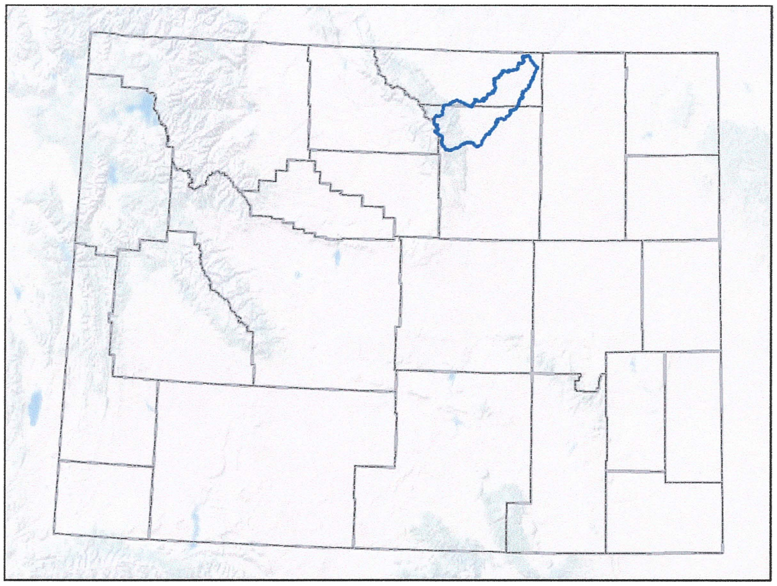
Appendices

Clear Creek Watershed, Level I Study



Prepared for:

Wyoming Water Development Commission
Cheyenne, Wyoming

Prepared by:

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In Association with:

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Watts and Associates, Inc. – Laramie, Wyoming

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WYOMING

March 2011

APPENDICES TABLE OF CONTENTS

Appendix 3A
Digital Library

BLM
APPROVED RESOURCE MANAGEMENT PLAN 2001rmp_update.pdf
Buffalo Field Office Resource Management Plan.pdf
Buffalo Resource Management Revision Project 00FinalScoping 2009.pdf
Summary of the Analysis of the Management Situation Buffalo Resource Management Plan Revision 2009 SummaryAMS.pdf

Johnson County
JOHNSON COUNTY land use plan-mar05.pdf
Keeping Ahead of Through Integrated Pest Management Leafy Spurge.pdf
Lake DeSmet Conservation District (LDCD) Portion of Clear Creek RWA_LDCD_Final.pdf

Sheridan County
Sheridan County Land Use sheridan_cty_appendices_nomaps_jan09.pdf
Sheridan County Land Use sheridan_cty_plan_ch1-3_jan09.pdf
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Sheridan County Land Use sheridan_cty_plan_ch7-13_jan09.pdf
Sheridan County Land Use PlanSC_1B_toc.pdf

USFS
clear crazy NF Powder Geographic Assessment.pdf
piney rock geographic area assessment.pdf
BHNF FEIS Revised Land and Resource Management Plan
BHNF Revised Land and Resource Management Plan
Clear_Creek_Watershed_AMPs: USFS
-amp_clearck_112299.rtf
-amp_grmmdnsrdgh_112999.rtf
-amp_muddy_121399.rtf
2009_0302_Little_Piney_AMP_FINAL.doc
2009_0302_Willow_Pk_AMP_FINAL.doc
2009_0413_Piney_AMP_FINAL.doc

WDEQ
WATERSHED-BASED WYPDES PERMITTING 2004WY-AUGUST2006.pdf

WGF
Response of Prairie Stream Riparian Buffers to Livestock Exclusion
WGF_RiparianBuffer_Rept_Final_Revised_012408%20Buffalo%20FO.pdf

WWDC
cbng.pdf
Powder Tongue River Basin Plan Final Report finalrept_lores.pdf

Appendix 3B
Grazing Allotments

BLM Allotments

Number	Allotment Number	Allotment Name	AUMs	Area	
				In Clear Creek Watershed (ac)	Total (ac)
9	2058	OLSEN DRAW	592	23,773	25,397
43	2093	CLEAR CREEK	39	10,129	14,852
12	2257	JIM CROW CREEK	113	362	21,924
16	2270	DIXIE REECE	30	2,337	2,337
11	2276	SE OF BUFFALO CRE	152	34,778	43,770
45	2284	V BAR F	364	2,859	3,220
34	2288	BELUS	30	1,334	1,341
24	2289	CAMPBELL DRAW	56	3,818	5,357
8	2298	SQUAW CREEK	289	5,876	5,876
7	2299	CABIN CREEK	309	4,940	7,111
53	2300	SMITH	23	865	865
26	2302	WHITMEYER CREEK	6	4,463	4,463
32	2328	BANNER	24	24,174	28,221
56	2333	THOM BROTHERS	4	4,893	4,893
3	2338	MOUNTAIN EAST	26	2,923	3,335
21	2340	N. LEITER	40	719	719
31	2343	LONG DRAW	99	7,495	7,506
18	2353	SCOTT DRAW	32	2,825	2,825
46	2354	MURRAY DRAW	8	2,333	2,333
10	2356	WATT RANCH	6	585	585
52	2363	NORTH RIDGE	57	1,480	1,480
49	2368	MARK GORDON	132	6,069	8,857
40	2369	SENFF DITCH	13	1,464	1,464
4	2378	76 CREEK	33	1,727	1,845
54	2417	TRAIL SIDE	14	433	433
41	2433	ARPAN BUTTE	137	3,290	10,142
51	2440	HEALY	35	1,867	3,108
2	2447	K RANCH	187	5,010	10,841
15	2455	WHITMEYER	21	12,887	13,259
27	2457	OK CREEK	216	3,346	24,278
14	12038	KLINE DRAW	43	13	744
23	12040	RBL	43	3,581	3,581
29	12045	FOREST TRACT	16	1,384	2,722
13	12065	CLEAR CREEK GRAZI	92	4,999	6,658
37	12070	FOWLER DRAW	18	2,380	2,380
42	12098	RATTLESNAKE SPRIN	46	7,967	9,374
33	12136	HARPER GEORGE MAR	30	93	422
17	12154	HAMPSHIRE	129	1,904	3,285
35	12155	ROBINSON PLACE	68	1,679	7,619
5	12162	FENCE CREEK	655	2,623	5,168
19	12164	PRONG SPOTTED HOR	271	928	4,518
39	12172	QUINN, JOHN, BONN	7	2,116	2,116
47	12173	ANTELOPE BASIN	47	59	1,033
6	12174	GREEN DRAW	29	1,197	1,207
1	12178	KENDRICK	874	929	75,351
48	12188	LAWRENCE LAND CO	19	7,960	7,960
36	12229	PINEY CREEK	7	2,617	2,617
25	12230	BLACK STUMP DRAW	50	8,070	8,070
28	22008	NUMBER TWO DRAW	170	14,886	15,115
38	22017	BELUS RANCH	51	16,586	16,586
55	22029	MOSIER GULCH	41	591	591
22	22109	FOSTER, RALPH T.	147	6,112	6,112
30	22110	SAHARA DRAW	20	3,845	3,845
20	22203	S. LEITER	146	8,896	9,100
50	32018	BULL CREEK	40	10,186	11,057
44	32019	BETZ ALVIN F	21	1,192	2,911

USFS Allotments

Unit No.	Unit Name	Unit Type	TRAIL_TRUC	LIVESTOCK	STATUS	Area	
						In Clear Creek Watershed (ac)	Total (ac)
GR411	Solitude GRA	3	TRAIL	Grazing	OTHER	59.8	4,391.1
104	Grommund Creek C&H	1	TRAIL	Cow / Horse	ACTIVE	8,043.3	8,297.9
556	McLain Lake S&G	1	TRAIL	Sheep / Goat	VACANT	8.5	7,852.4
405	Paintrock Basin C&H&S&G	1	TRAIL	C&H&S&G	ACTIVE	154.3	43,421.1
105	Muddy Creek C&H	1	TRAIL	Cow / Horse	ACTIVE	3,879.4	31,413.4
GR630	Highland Park Recreation GRA	3		Grazing	OTHER	3,968.1	5,707.1
611	Willow Park C&H	1		Cow / Horse	ACTIVE	10,700.0	10,700.0
559	Babywagon S&G	1	TRAIL	Sheep / Goat	ACTIVE	2.5	3,703.3
157	Elk Lake S&G	1	TRAIL	Sheep / Goat	VACANT	6,150.0	6,150.0
152	Crazy Woman S&G	1	TRAIL	Sheep / Goat	VACANT	25.9	4,024.0
156	Cloud Peak S&G	1		Sheep / Goat	VACANT	5,498.1	5,498.1
GR629	Frying Pan Lake Recreation GRA	3		Grazing	OTHER	6,543.5	6,543.5
107	Rock Creek C&H	1		Cow / Horse	ACTIVE	28,798.8	28,798.8
108	Sourdough C&H	1	TRAIL	Cow / Horse	ACTIVE	10,919.9	11,212.0
557	Misty Moon S&G	1	TRAIL	Sheep / Goat	VACANT	141.4	5,892.6
103	Clear Creek C&H	1	TRAIL	Cow / Horse	ACTIVE	16,480.8	16,480.8
GR633	Kearney Lake Recreation GRA	3		Grazing	OTHER	2,974.3	2,974.3
605	Little Piney C&H	1		Cow / Horse	ACTIVE	9,352.0	9,352.0
607	Piney C&H	1		Cow / Horse	ACTIVE	12,472.8	12,549.7
GR634	Spear Lake Recreation GRA	3		Grazing	OTHER	6,001.8	6,038.7
603	Little Goose C&H	1		Cow / Horse	ACTIVE	1,134.4	29,014.5

Appendix 3C
Ecological Site Descriptions

Ecological Site Description

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION (Old Format Report)

ECOLOGICAL SITE CHARACTERISTICS

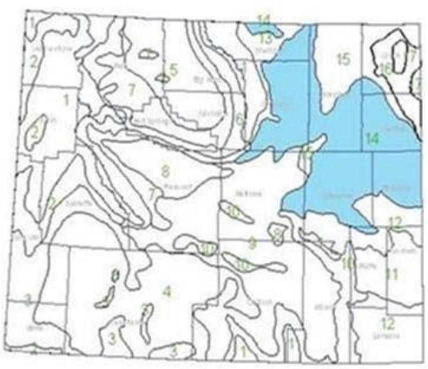
Site Type: Rangeland

Site Name: Shallow Loamy (SwLy) 10-14” Northern Plains Precipitation Zone

Site ID: R058BY162WY

Major Land Resource Area: 058B-Northern Rolling High Plains, Southern Part

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic Features

This site occurs on steep slopes and ridge tops, but may occur on all slopes.

Land Form:
(1) Hill
(2) Ridge
(3) Escarpment

	Minimum	Maximum
Elevation (feet):	3800	5100
Slope (percent):	0	60
Water Table Depth (inches):		
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		

Depth (inches):		
Frequency:	None	None
Duration:	None	None
Runoff Class:	Negligible	High
Aspect:	No Influence on this site	

Climatic Features

Annual precipitation ranges from 10-14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more drought years than those with more than normal precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.

Wind speed averages about 8 mph, ranging from 10 mph during the spring to 7 mph during late summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 75 mph.

Growth of native cool season plants begins about April 1 and continues to about July 1. Native warm season plants begin growth about May 15 and continue to about August 15. Green up of cool season plants may occur in September and October of most years.

The following information is from the “Clearmont 5 SW” climate station:
Frost-free period (32 F): 76 - 132 days; (5 yrs. out of 10, these days will occur between May 30 – September 11)
Freeze-free period 28 F): 110 - 145 days; (5 yrs. out of 10, these days will occur between May 16 – September 21)
Mean annual precipitation: 12.4 inches
Mean annual air temperature: 43.2 F (28.4 F Avg. Min. – 57.9 F Avg. Max.)
For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. Other climate station(s) representative of this precipitation zone include: “Dull Center”.

	Minimum	Maximum
Frost-free period (days):	76	132
Freeze-free period (days):	110	145
Mean annual precipitation (inches):	10.0	14.0

Monthly precipitation (inches) and temperature (°F):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precip. Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Precip. Max.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Temp. Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Temp. Max.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Climate Stations:

Influencing Water Features

Stream Type: None

Wetland Description:	System	Subsystem	Class

Representative Soil Features

The soils of this site are shallow (less than 20”to bedrock) well-drained soils formed in alluvium over residuum or residuum. These soils have moderate permeability and may occur on all slopes. The bedrock may be any kind which is virtually impenetrable to plant roots, except igneous. The surface soil will have one or more of the following textures: very fine sandy loam, loam, silt loam, sandy clay loam, silty clay loam, and clay loam. Thin ineffectual layers of other textures are disregarded. Layers of the soil most influential to the plant community vary from 3 to 6 inches thick.

Major Soil Series correlated to this site includes: Shingle, Worf,

Other Soil Series in MLRA 58B correlated to this site include: Cragola, Nihill

Parent Materials:
Kind:
Origin:

Surface Texture: (1) Loam
(2) Sandy loam
(3) Clay loam

Subsurface Texture Group: Loamy

	Minimum	Maximum
Surface Fragments <=3" (% Cover):	0	10
Surface Fragments > 3" (% Cover):	0	20
Subsurface Fragments <=3" (% Volume):	0	15
Subsurface Fragments > 3" (% Volume):	0	0

Drainage Class: Well drained To Well drained

Permeability Class: Moderate To Moderately rapid

	Minimum	Maximum
Depth (inches):	10	20
Electrical Conductivity (mmhos/cm):	0	4
Sodium Absorption Ratio:	0	5
Calcium Carbonate Equivalent (percent):	0	5

Soil Reaction (1:1 Water):	6.6	8.4
Soil Reaction (0.01M CaCl2):		
Available Water Capacity (inches):	1.1	4.2

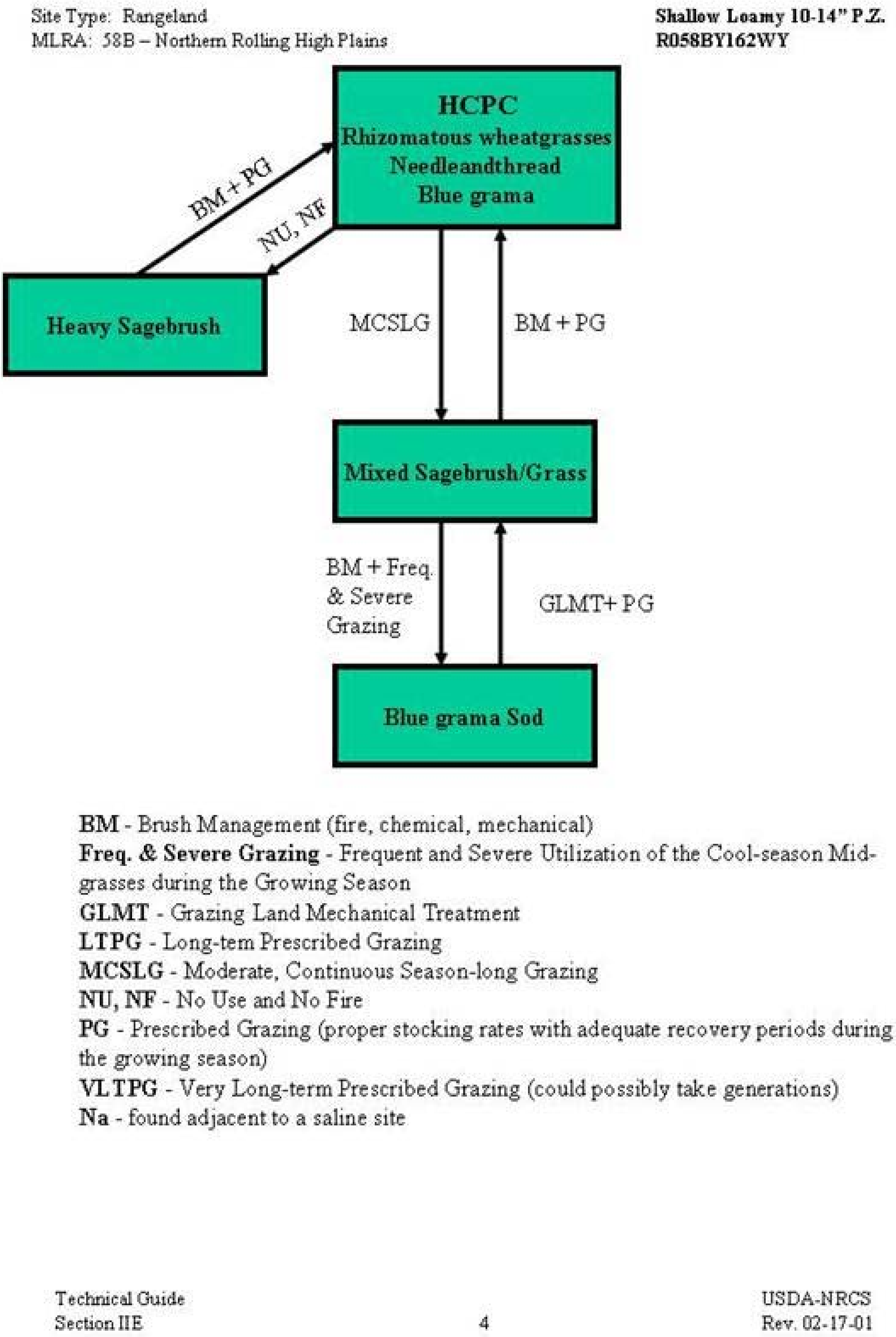
Plant Communities

Ecological Dynamics of the Site

As this site deteriorates, species such as blue grama and big sagebrush will increase. Cool season grasses such as bluebunch wheatgrass and rhizomatous wheatgrasses will decrease in frequency and production.

The Historic Climax Plant Community (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

The following is a State and Transition Model Diagram that illustrates the common plant communities (states) that can occur on the site and the transitions between these communities. The ecological processes will be discussed in more detail in the plant community narratives following the diagram.



Site Type: Rangeland
MLRA: 58B – Northern Rolling High Plains

Shallow Loamy 10-14" P.Z.
R058BY162WY

BM - Brush Management (fire, chemical, mechanical)
Freq. & Severe Grazing - Frequent and Severe Utilization of the Cool-season Mid-grasses during the Growing Season
GLMT - Grazing Land Mechanical Treatment
LTPG - Long-tem Prescribed Grazing
MCSLG - Moderate, Continuous Season-long Grazing
NU, NF - No Use and No Fire
PG - Prescribed Grazing (proper stocking rates with adequate recovery periods during the growing season)
VLTPG - Very Long-term Prescribed Grazing (could possibly take generations)
Na - found adjacent to a saline site

Rhizomatous wheatgrasses/Needleandthread/Blue Grama Plant Community

The interpretive plant community for this site is the Historic Climax Plant Community. This state evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. Potential vegetation is about 75% grasses or grass-like plants, 15% forbs, and 10% woody plants. The state is dominated by cool season midgrasses. The major grasses include western wheatgrass, bluebunch wheatgrass, needleandthread, and little bluestem. Other grasses occurring on the state include Cusick's and Sandberg bluegrass, blue grama, and prairie junegrass. Big sagebrush is a conspicuous element of this state, occurring in a mosaic pattern, and makes up 5 to 10% of the annual production. Big sagebrush may become dominant on some areas with absence of fire. Natural fire occurred frequently in this community and prevented big sagebrush from being the dominant landscape. Wildfires are actively controlled in recent times so chemical control using herbicides has replaced the historic role of fire on this state. Recently controlled burning has regained some popularity.

The total annual production (air-dry weight) of this state is about 900 pounds per acre, but it can range from about 450 lbs./acre in unfavorable years to about 1200 lbs./acre in above average years.

The state is extremely stable and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Transitions or pathways leading to other plant communities are as follows:

- Protection from grazing and fire will convert this plant community to the Heavy Sagebrush Vegetation State.

- Moderate, continuous season-long grazing will convert the plant community to the Mixed Sagebrush/Grass Vegetation State.

- Frequent and severe grazing and brush management will convert the plant community to the Blue Grama Vegetation State.

Rhizomatous wheatgrasses/Needleandthread/Blue Grama Plant CommunityPlant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
1				68	180
		streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	68	180
		western wheatgrass	*Pascopyrum smithii*	68	180
2				225	600
		bluebunch wheatgrass	*Pseudoroegneria spicata*	225	600
3				23	60
		green needlegrass	*Nassella viridula*	23	60
4				45	120

		needle and thread, needleandthread	*Hesperostipa comata*	45	120
5				45	120
		little bluestem	*Schizachyrium scoparium*	45	120
6				23	60
		Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	23	60
7				45	120
		blue grama	*Bouteloua gracilis*	45	120
8				45	120
		hairy grama	*Bouteloua hirsuta*	45	120
9				45	120
		threadleaf sedge	*Carex filifolia*	45	120
10				113	300
		Indian ricegrass	*Achnatherum hymenoides*	23	60
		Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	23	60
		sideoats grama	*Bouteloua curtipendula*	23	60
		needleleaf sedge	*Carex duriuscula*	23	60
		plains reedgrass	*Calamagrostis montanensis*	23	60
		prairie Junegrass	*Koeleria macrantha*	23	60
		plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	23	60
		Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	23	60

Forb

				Annual Production in Pounds Per Acre	
Group	Group Name	Common Name	Scientific Name	Low	High
11				45	120
		yarrow	*Achillea*	23	60
		textile onion	*Allium textile*	23	60
		rosy pussytoes, rose pussytoes	*Antennaria rosea*	23	60
		aster	*Aster*	23	60
		milkvetch	*Astragalus*	23	60
		tapertip hawksbeard	*Crepis acuminata*	23	60
		white prairie clover	*Dalea candida*	23	60
		violet prairie clover, purple prairie clover	*Dalea purpurea*	23	60
		sulphur-flower buckwheat	*Eriogonum umbellatum*	23	60
		scarlet beeblossom, scarlet gaura	*Gaura coccinea*	23	60
		stemless mock goldenweed	*Haplopappus acaulis(syn)*	23	60
		desertparsley, biscuitroot	*Lomatium*	23	60
		bluebells	*Mertensia*	23	60
		large Indian breadroot,	*Pediomelum esculentum*	23	60

		breadroot scurfpea			
		upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	23	60
		American vetch	*Vicia americana*	23	60

Shrub/Vine

				Annual Production in Pounds Per Acre	
Group	Group Name	Common Name	Scientific Name	Low	High
12				23	60
		winterfat	*Krascheninnikovia lanata*	23	60
13				45	120
		silver sagebrush	*Artemisia cana ssp. cana*	23	60
		big sagebrush	*Artemisia tridentata*	23	60
		rubber rabbitbrush	*Ericameria nauseosa*	23	60
		skunkbush sumac	*Rhus trilobata*	23	60

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Heavy Sagebrush Plant Community

This plant community is the result of protection from grazing and fire. Big sagebrush dominates this plant community with canopy cover often exceeding 50%. The understory of grass includes rhizomatous wheatgrasses, bluebunch wheatgrass, Sandberg bluegrass, and prairie junegrass. With complete protection from grazing and fire, the state will become dominated by big sagebrush. The big sagebrush canopy protects the cool season grasses, but this protection makes them unavailable for grazing. Big sagebrush is long-lived and will persist for a long period.

This plant community can provide valuable winter feed for both livestock (especially sheep) and wildlife (such as mule deer and antelope).

The total annual production (air-dry weight) of this state is about 675 pounds per acre, but it can range from about 450 lbs./acre in unfavorable years to about 900 lbs./acre in above average years.

The soil resources of this state are protected from erosion. The watershed is functioning. The biotic community is intact except that grass production is lowered.

Transitional pathways leading to other plant communities are as follows:

- Brush control followed by deferment for 1 to 2 years and prescribed grazing management thereafter will return this state to near Historic Climax Plant Community. Care should be taken when planning brush control to exclude critical winter ranges.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Mixed Sagebrush/Grass Plant Community

Historically, this plant community evolved under grazing by bison and a low fire frequency. Currently, it is found under moderate, season-long grazing by livestock in the absence of fire or brush control. Wyoming big sagebrush is a significant component of this plant community. Cool-season grasses make up the majority of the understory with the balance made up of short warm-season grasses, annual cool-season grass, and miscellaneous forbs.

Dominant grasses include bluebunch wheatgrass, rhizomatous wheatgrasses, and blue grama. Grasses of secondary importance include little bluestem, prairie junegrass, and Sandberg bluegrass. Forbs, commonly found in this plant community, include Louisiana sagewort (cudweed), plains wallflower, hairy goldaster, slimflower scurfpea, and scarlet globemallow. Big sagebrush canopy ranges from 20% to 30%. Fringed sagewort is commonly found. Plains pricklypear and winterfat can also occur.
When compared to the Historical Climax Plant Community, big sagebrush and blue grama have increased. Bluebunch wheatgrass has decreased, often occurring only where protected from grazing by the sagebrush canopy. Production of cool-season grasses has also been reduced. Cheatgrass (downy brome) has invaded the state. The overstory of big sagebrush and understory of grass and forbs provide a diverse plant community that will support domestic livestock and wildlife such as mule deer and antelope.

The total annual production (air-dry weight) of this state is about 725 pounds per acre, but it can range from about 450 lbs./acre in unfavorable years to about 1000 lbs./acre in above average years.

The state is stable and protected from excessive erosion. The biotic integrity of this plant community is usually intact. However, it can be at risk depending on how far a shift has occurred in plant composition toward blue grama, sagebrush, and/or cheatgrass. The watershed is usually functioning. However, it can become at risk when canopy cover of sagebrush, blue grama sod, and/or bare ground increases.

Transitional pathways leading to other plant communities are as follows:

- Brush management followed by 1 or 2 years deferment and prescribed grazing use will return this state to near Historic Climax Plant Community.

- Frequent and severe grazing and brush management will convert this stat

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites

Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Blue Grama Sod Plant Community

This plant community is the result of long-term, heavy, continuous, season-long grazing. A dense sod of blue grama and threadleaf sedge dominates and covers up to 90% of the soil surface. When the historic climax community is replaced by warm season dominated communities, grass production is reduced.

The total annual production (air-dry weight) of this state is about 600 pounds per acre, but it can range from about 400 lbs./acre in unfavorable years to about 800 lbs./acre in above average years.

The sod formed by these grasses is resistant to water infiltration. While this sod protects the state, off-site areas are affected by excessive runoff that may cause gully erosion. This sod is resistant to change and may require practices such as grazing land mechanical treatment to return to a cool season grass community. Transitional pathways leading to other plant communities are as follows:

Transitional pathways leading to other plant communities are as follows:

- Grazing Land Mechanical Treatment (chiseling, etc.) followed by prescribed grazing will return this plant community to near Historic Climax Plant Community.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Ecological Site Interpretations

Animal Community:
Animal Community – Wildlife Interpretations
Historic Climax Plant Community: The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing/foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here.

Heavy Sagebrush: This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15% protein and 40-60% digestibility during that time. This community can provide nesting and brood rearing habitat for sage grouse.

Mixed Sagebrush/Grass: The combination of an overstory of sagebrush and an understory of grasses and forbs provide a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer and antelope may use this state for foraging and cover year-round, as would cottontail and jack rabbits. It provides important winter, nesting, brood-rearing, and foraging habitat for sage grouse. Brewer’s sparrows’ nest in big sagebrush plants, and hosts of other nesting birds utilize stands in the 20-30% cover range.

Blue Grama Sod: These communities provide limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover and if the Historic Climax Plant Community or the Mixed Sagebrush/Grass Plant Community is limiting. Generally, these are not target plant communities for wildlife habitat management.

Animal Community – Grazing Interpretations

The following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using this information along with animal preference data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies can result in an increased carrying capacity. If distribution problems occur, stocking rates must be reduced to maintain plant health and vigor.

Plant Community Production Carrying Capacity*
(lb./ac) (AUM/ac)
Historic Climax Plant Community 450-1200 .2
Heavy Sagebrush 450-900 .17
Mixed Sagebrush/Grass 450-1000 .17
Blue Grama Sod 400-800 .1

* - Continuous, season-long grazing by cattle under average growing conditions.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for cattle, sheep, or horses. During the dormant period, the forage for livestock use needs to be supplemented with protein because the quality does not meet minimum livestock requirements.

Plant Preference by Animal Kind:

Animal Kind: AllAntelope

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Indian ricegrass	*Achnatherum hymenoides*	Leaves	N	N	N	P	P	P	N	N	N	D	D	D
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

big bluestem	*Andropogon gerardii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand bluestem	*Andropogon hallii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
silver sagebrush	*Artemisia cana*	Leaves	P	P	P	P	P	P	P	P	P	P	P	P
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
twogrooved milkvetch	*Astragalus bisulcatus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	P	P	P	P	P	P	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sideoats grama	*Bouteloua curtipendula*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue grama	*Bouteloua gracilis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Leaves	P	P	P	P	P	P	P	P	P	P	P	P
inland sedge	*Carex interior*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sandreed	*Calamovilfa longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains reedgrass	*Calamagrostis montanensis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Nebraska sedge	*Carex nebrascensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
alkali sacaton	*Sporobolus airoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand dropseed	*Sporobolus cryptandrus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
alkali cordgrass	*Spartina gracilis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broadleaf cattail	*Typha latifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

Animal Kind: allCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand bluestem	*Andropogon hallii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sideoats grama	*Bouteloua curtipendula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie sandreed	*Calamovilfa longifolia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D

Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
alkali sacaton	*Sporobolus airoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
alkali cordgrass	*Spartina gracilis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
broadleaf cattail	*Typha latifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Fruits/Seeds	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllDeer

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand bluestem	*Andropogon hallii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Wyoming big sagebrush	*Artemisia tridentata ssp. wyomingensis*	Entire plant	P	P	P	P	P	P	D	D	D	D	D	D
twogrooved milkvetch	*Astragalus bisulcatus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sideoats grama	*Bouteloua curtipendula*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sandreed	*Calamovilfa longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Nebraska sedge	*Carex nebrascensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
silverberry	*Elaeagnus commutata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

basin wildrye	*Leymus cinereus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
prairie coneflower	*Ratibida*	Entire plant	D	D	D	P	P	P	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
alkali sacaton	*Sporobolus airoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand dropseed	*Sporobolus cryptandrus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
alkali cordgrass	*Spartina gracilis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broadleaf cattail	*Typha latifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand bluestem	*Andropogon hallii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
silver sagebrush	*Artemisia cana ssp. cana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	D	D	D	U	U	U	U	U	U	D	D	D
sideoats grama	*Bouteloua curtipendula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie sandreed	*Calamovilfa longifolia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertparsley, biscuitroot	*Lomatium*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
willow	*Salix*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
greasewood	*Sarcobatus vermiculatus*	Leaves	U	U	U	U	U	U	U	U	U	U	U	U

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
alkali sacaton	*Sporobolus airoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
alkali cordgrass	*Spartina gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
broadleaf cattail	*Typha latifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllSheep

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand bluestem	*Andropogon hallii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
silver sagebrush	*Artemisia cana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Wyoming big sagebrush	*Artemisia tridentata ssp. wyomingensis*	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
twogrooved milkvetch	*Astragalus bisulcatus*	Entire plant	N	N	N	T	T	T	T	T	T	T	T	T
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

prairie sandreed	*Calamovilfa longifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broom snakeweed	*Gutierrezia sarothrae*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot														

scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue-eyed grass	*Sisyrinchium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broadleaf cattail	*Typha latifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Legend: P = Preferred D = Desirable U = Undesirable N = Not consumed E = Emergency T = Toxic
X = Used, but degree of utilization unknown

Hydrology Functions:

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B and C, with localized areas in hydrologic group D. Infiltration ranges from moderate to moderately rapid. Runoff potential for this site varies from moderate to high depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong sod and dominate the site. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses such as bluebunch wheatgrass. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1-2% of the soil surface.

Recreational Uses:
This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood Products:
No appreciable wood products are present on the site.

Other Products:
None noted.

Other Information:

Supporting Information

Associated Sites:

Site Name	Site ID	Site Narrative
Shallow Clayey (SwCy) 10-14” Northern Plains Precipitation Zone	R058BY158WY	

Similar Sites:

Site Name	Site ID	Site Narrative
Shallow Loamy (SwLy) 15-17” Northern Plains Precipitation Zone	R058BY262WY	Shallow Loamy 15-17” Northern Plains P.Z. has higher production.

State Correlation:
This site has been correlated with the following states:
MT

Inventory Data References:
Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel was also used. Those involved in developing this site include: Glen Mitchell, Range Management Specialist, NRCS; Chuck Ring, Range Management Specialist, NRCS; and Everet Bainter, Range Management Specialist. Other sources used as references include: USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

Inventory Data References
Data Source Number of Records Sample Period State County
SCS-RANGE-417 12 1971-1994 WY Campbell & others
Ocular estimates 5 1990-1999 WY Campbell & others

Type Locality:

Relationship to Other Established Classifications:

Other References:

Site Description Approval:

Author	Date	Approval	Date
G. Mitchell	10/31/2002	E. Bainter	3/7/2008

Reference Sheet

Author(s)/participant(s):

Contact for lead author:

Date:4/1/2005 **MLRA:**058B **Ecological Site:**Shallow Loamy (SwLy) 10-14” Northern Plains Precipitation ZoneR058BY162WY This *must* be verified based on soils and climate (see Ecological Site Description). Current plant community cannot be used to identify the ecological site.

Composition (indicators 10 and 12) based on: XAnnual Production, Foliar Cover, Biomass

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Indicators. For each indicator, describe the potential for the site. Where possible, (1) use numbers, (2) include expected range of values for above- and below-average years for **each** community and natural disturbance regimes within the reference state, when appropriate and (3) cite data. Continue descriptions on separate sheet.

1. **Number and extent of rills:** Rills should not be present.
2. **Presence of water flow patterns:** Barely observable.
3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent.
4. **Bare ground from Ecological Site Description or other studies (rock, litter, standing dead, lichen, moss, plant canopy are not bare ground):** Bare ground is 40-60% occurring in small areas throughout site.
5. **Number of gullies and erosion associated with gullies:** Active gullies should be restricted to areas of concentrated water flow patterns on steeper slopes.
6. **Extent of wind scoured, blowouts and/or depositional areas:** Small scoured sites may be observed.
7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement is little to none based on topography and water flow patterns.
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most**

sites will show a range of values): Plant cover and litter is at 50% or greater of soil surface and maintains soil surface integrity. Soil Stability class is anticipated to be 4 or greater.

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9. **Soil surface structure and SOM content (include type and strength of structure, and A-horizon color and thickness):** Use Soil Series description for depth and color of A-horizon.

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10. **Effect on plant community composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Grass canopy and basal cover should reduce raindrop impact and slow overland flow providing increased time for infiltration to occur. Infiltration is moderate.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer or soil surface crusting should be present.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground weight using symbols: >>, >, = to indicate much greater than, greater than, and equal to) with dominants and sub-dominants and "others" on separate lines:**
 Dominant: Mid stature Cool Season Grasses > Short Grasses/Grasslikes > Mid Stature Warm Season Grasses > Shrubs > Forbs
 Sub-dominant:
 Other:
 Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very Low

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14. **Average percent litter cover (%) and depth (inches):** Average litter cover is 15-25% with depths of 0.25 to 0.5 inches

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15. **Expected annual production (this is TOTAL above-ground production, not just forage production):** 900 lbs/ac

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16. **Potential invasive (including noxious) species (native and non-native). List Species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicator, we are describing what in NOT expected in the reference state for the ecological site:** Blue grama, Threadleaf sedge, Prickly Pear, Broom Snakeweed, and Species found on Noxious Weed List.

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17. **Perennial plant reproductive capability:** All species are capable of reproducing.

Reference Sheet Approval:

Approval	Date
E. Bainter	3/7/2008

United States Department of Agriculture
NRCS Natural Resources Conservation Service

Ecological Site Description

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION (Old Format Report)

ECOLOGICAL SITE CHARACTERISTICS

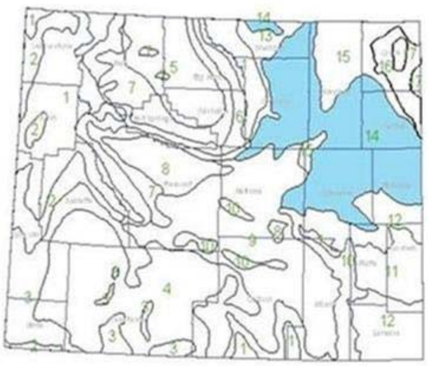
Site Type: Rangeland

Site Name: Loamy (Ly) 10-14” Northern Plains Precipitation Zone

Site ID: R058BY122WY

Major Land Resource Area: 058B-Northern Rolling High Plains, Southern Part

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic Features

This site occurs on gently undulating rolling land.

Land Form: (1) Hill
(2) Alluvial fan
(3) Ridge

	Minimum	Maximum
Elevation (feet):	3800	5100
Slope (percent):	0	30
Water Table Depth (inches):		
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		

Depth (inches):	0	0
Frequency:	None	None
Duration:	None	None
Runoff Class:	Negligible	High
Aspect:	No Influence on this site	

Climatic Features

Annual precipitation ranges from 10-14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more drought years than those with more than normal precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.

Wind speed averages about 8 mph, ranging from 10 mph during the spring to 7 mph during late summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 75 mph.

Growth of native cool season plants begins about April 1 and continues to about July 1. Native warm season plants begin growth about May 15 and continue to about August 15. Green up of cool season plants may occur in September and October of most years.

The following information is from the “Clearmont 5 SW” climate station:
Frost-free period (32 F): 76 - 132 days; (5 yrs. out of 10, these days will occur between May 30 – September 11)
Freeze-free period 28 F): 110 - 145 days; (5 yrs. out of 10, these days will occur between May 16 – September 21)
Mean annual precipitation: 12.4 inches
Mean annual air temperature: 43.2 F (28.4 F Avg. Min. – 57.9 F Avg. Max.)
For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. Other climate station(s) representative of this precipitation zone include: “Dull Center”

	Minimum	Maximum
Frost-free period (days):	76	132
Freeze-free period (days):	110	145
Mean annual precipitation (inches):	10.0	14.0

Monthly precipitation (inches) and temperature (°F):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precip. Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Precip. Max.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Temp. Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Temp. Max.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Climate Stations:

Influencing Water Features

Stream Type: None

Wetland Description:	System	Subsystem	Class

Representative Soil Features

The soils of this site are deep to moderately deep (greater than 20" to bedrock), well drained & moderately permeable. Layers of the soil most influential to the plant community varies from 3 to 6 inches thick. These layers consist of the A horizon with very fine sandy loam, loam, or silt loam texture and may also include the upper few inches of the B horizon with sandy clay loam, silty clay loam or clay loam texture.
Major Soil Series correlated to this site includes: Bidman, Cambria, Cushman, Forkwood, Kishona, Parmleed, Theedle and Zigweid.

Other Soil Series correlated to this site in MLRA 58B include: Absted, Arvada, Ascalon, Big Horn, Bowbac, Briggsdale, Cambria Variant, Cedak Dry, Clarkelen, Connerton, Docpar, El Rancho, Emigha, Emigrant, Forkwood Variant, Fort Collins, Garrett, Glendo, Harlan, Harlan Dry, Haverdad, Hiland, Jonpol, Kadoka, Keota, Keyner, Kim, Kirtley, Larim, Larimer, Lawver, Lohsman, Maysdorf, Neville, Noden, Nuncho, Platmak, Platmak Dry, Pugsley, Recluse, Recluse Dry, Redbow, Reddale, Renohill, Roughlock, Senlar, Spearman, Stoneham, Teckla, Thirtynine, Ulm, Ulm Dry, Wages, Wolf, Wolf Variant, Wolf Dry, and Wyotite.

Parent Materials:
Kind:
Origin:

Surface Texture: (1) Loam
(2) GravellySandy loam
(3) CobblyVery fine sandy loam

Subsurface Texture Group: Loamy

	Minimum	Maximum
Surface Fragments <=3" (% Cover):	0	0
Surface Fragments > 3" (% Cover):	0	10
Subsurface Fragments <=3" (% Volume):	0	15
Subsurface Fragments > 3" (% Volume):	0	10

Drainage Class: Moderately well drained To Well drained
Permeability Class: Moderately slow To Moderate

	Minimum	Maximum
Depth (inches):	20	60

Electrical Conductivity (mmhos/cm):	0	4
Sodium Absorption Ratio:	0	5
Calcium Carbonate Equivalent (percent):	0	10
Soil Reaction (1:1 Water):	6.6	8.4
Soil Reaction (0.01M CaCl2):		
Available Water Capacity (inches):	3.0	6.3

Plant Communities

Ecological Dynamics of the Site

As this site deteriorates because of a combination of frequent and severe grazing, species such as blue grama and big sagebrush will increase. Cool-season grasses such as green needlegrass, needleandthread, and rhizomatous wheatgrasses will decrease in frequency and production.

Big sagebrush may become dominant on some areas with an absence of fire. Wildfires are actively controlled in recent times so chemical control using herbicides has replaced the historic role of fire on this site. Recently, prescribed burning has regained some popularity.

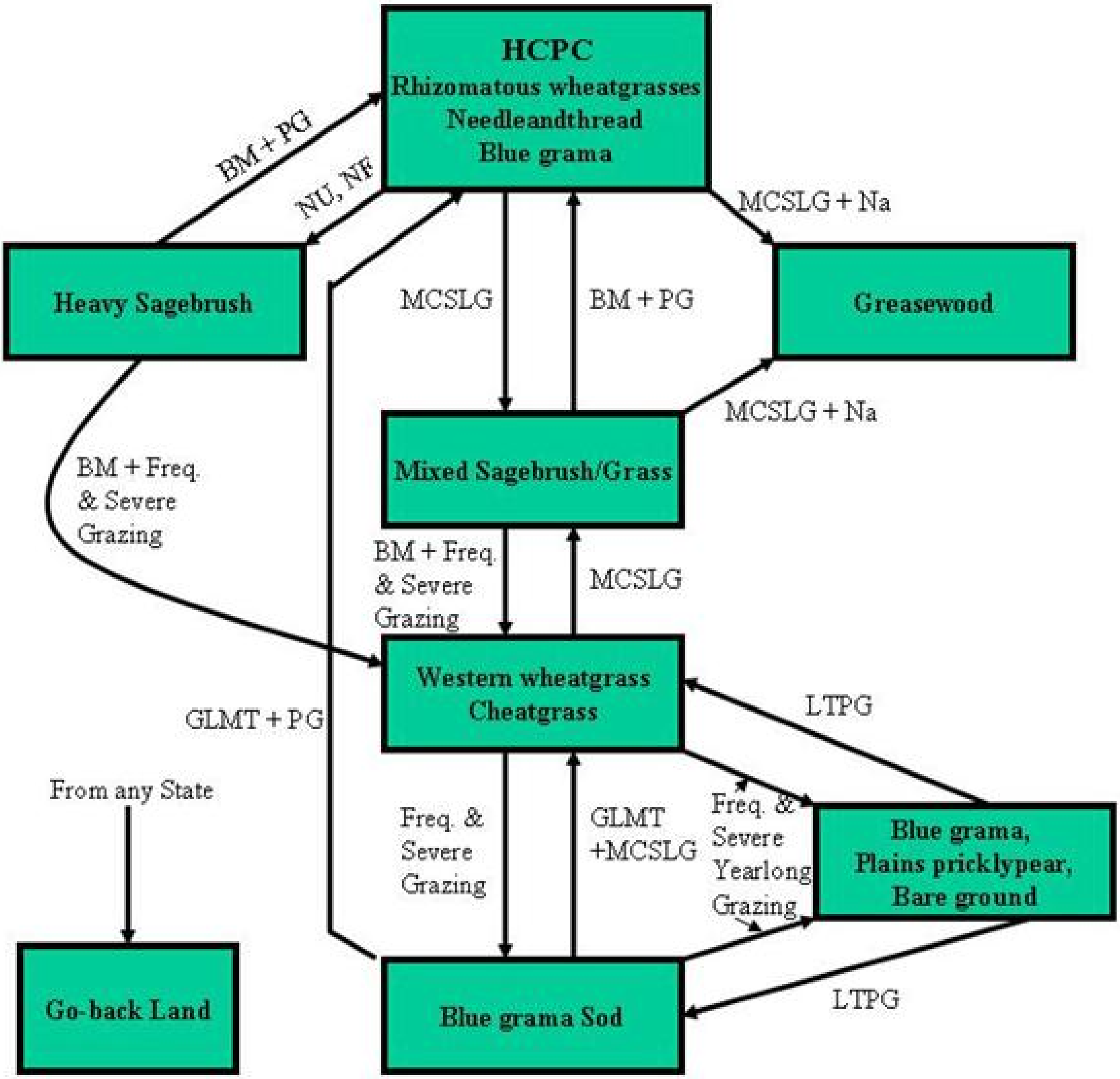
Due to the amount and pattern of the precipitation, the big sagebrush component typically is not resilient once it has been removed if a healthy and vigorous stand of grass exists and is maintained. The exception to this is where the herbaceous component is severely degraded at the time of treatment, growing conditions are unfavorable after treatment, and/or recovery periods are inadequate.

The Historic Climax Plant Community (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

The following is a State and Transition Model Diagram that illustrates the common plant communities (states) that can occur on the site and the transitions between these communities. The ecological processes will be discussed in more detail in the plant community narratives following the diagram.

Site Type: Rangeland
MLRA: 58B – Northern Rolling High Plains

Loamy 10-14" P.Z.
R058BY122WY



BM - Brush Management (fire, chemical, mechanical)
Freq. & Severe Grazing - Frequent and Severe Utilization of the Cool-season Mid-grasses during the Growing Season
GLMT - Grazing Land Mechanical Treatment
LTPG - Long-tem Prescribed Grazing
MCSLG - Moderate, Continuous Season-long Grazing
NU, NF - No Use and No Fire
PG - Prescribed Grazing (proper stocking rates with adequate recovery periods during the growing season)
VLTPG - Very Long-term Prescribed Grazing (could possibly take generations)
Na - found adjacent to a saline site

Rhizomatous wheatgrasses/Needleandthread/Blue Grama Plant Community

This plant community is the interpretive plant community for this site and is considered to be the Historic Climax Plant Community (HCPC). This plant community evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. This plant community can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. The potential vegetation is about 75% grasses or grass-like plants, 15% forbs, and 10% woody plants. This state is dominated by cool season mid-grasses.

The major grasses include western wheatgrass, needleandthread, and green needlegrass. Other grasses occurring in this state include Cusick's and Sandberg's bluegrass, bluebunch wheatgrass, and blue grama. A variety of forbs and half-shrubs also occur, as shown in the preceding table. Big sagebrush is a conspicuous element of this state, occurs in a mosaic pattern, and makes up 5 to 10% of the annual production. Plant diversity is high.

The total annual production (air-dry weight) of this state is about 1,200 lbs./acre, but it can range from about 700 lbs./acre in unfavorable years to about 1,500 lbs./acre in above average years.

This plant community is extremely stable and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Transitions or pathways leading to other plant communities are as follows:

- No use and no fire for 20 years or more will convert this plant community to the Heavy Sagebrush Plant Community.

- Moderate, continuous season-long grazing will convert the plant community to the Mixed Sagebrush/Grass Plant Community.

- Moderate continuous season-long grazing, where greasewood occurs adjacent to the site, will convert the plant community to the Greasewood Plant Community.

- When cropped annually and then abandoned without reseeding, the site is converted to the Go-back Land Plant Community.

Rhizomatous wheatgrasses/Needleandthread/Blue Grama Plant CommunityPlant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
1				175	375
		streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	175	375
		western wheatgrass	*Pascopyrum smithii*	175	375
2				105	225
		green needlegrass	*Nassella viridula*	105	225
3				175	375

		needle and thread, needleandthread	*Hesperostipa comata*	175	375
4				70	150
		Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	70	150
5				105	225
		blue grama	*Bouteloua gracilis*	105	225
6				175	375
		Indian ricegrass	*Achnatherum hymenoides*	35	75
		hairy grama	*Bouteloua hirsuta*	35	75
		needleleaf sedge	*Carex duriuscula*	35	75
		threadleaf sedge	*Carex filifolia*	35	75
		plains reedgrass	*Calamagrostis montanensis*	35	75
		prairie Junegrass	*Koeleria macrantha*	35	75
		Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	35	75
		bluebunch wheatgrass	*Pseudoroegneria spicata*	35	75

Forb

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	 High
7				105	225
		yarrow	*Achillea*	35	75
		textile onion	*Allium textile*	35	75
		rosy pussytoes, rose pussytoes	*Antennaria rosea*	35	75
		aster	*Aster*	35	75
		milkvetch	*Astragalus*	35	75
		tapertip hawksbeard	*Crepis acuminata*	35	75
		white prairie clover	*Dalea candida*	35	75
		violet prairie clover, purple prairie clover	*Dalea purpurea*	35	75
		sulphur-flower buckwheat	*Eriogonum umbellatum*	35	75
		scarlet beeblossom, scarlet gaura	*Gaura coccinea*	35	75
		stemless mock goldenweed	*Haplopappus acaulis(syn)*	35	75
		desertparsley, biscuitroot	*Lomatium*	35	75
		bluebells	*Mertensia*	35	75
		large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	35	75
		upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	35	75
		American vetch	*Vicia americana*	35	75

Shrub/Vine

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	 High
8				70	150
		big sagebrush	*Artemisia tridentata*	70	150

9			35	75
	winterfat	*Krascheninnikovia lanata*	35	75

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Mixed Sagebrush/Grass Plant Community

Historically, this plant community evolved under grazing by bison and a low fire frequency. Currently, it is found under moderate, season-long grazing by livestock in the absence of fire or brush management. Wyoming big sagebrush is a significant component of this plant community. Cool-season grasses make up the majority of the understory with the balance made up of short warm-season grasses, annual cool-season grasses, and miscellaneous forbs.

Dominant grasses include needleandthread, western wheatgrass, and green needlegrass. Grasses of secondary importance include blue grama, prairie junegrass, and Sandberg bluegrass. Forbs commonly found in this plant community include plains wallflower, hairy goldaster, slimflower scurfpea, and scarlet globemallow. Sagebrush canopy ranges from 20% to 30%. Fringed sagewort is commonly found. Plains pricklypear can also occur.

When compared to the Historic Climax Plant Community, sagebrush and blue grama have increased. Production of cool-season grasses, particularly green needlegrass, has been reduced. The sagebrush canopy protects the cool-season mid-grasses, but this protection makes them unavailable for grazing. Cheatgrass (downy brome) has invaded the site. The overstory of sagebrush and understory of grass and forbs provide a diverse plant community that will support domestic livestock and wildlife such as mule deer and antelope.

The total annual production (air-dry weight) of this state is about 900 pounds per acre, but it can range from about 700 lbs./acre in unfavorable years to about 1,200 lbs./acre in above average years.

This plant community is resistant to change. A significant reduction of big sagebrush can only be accomplished through fire or brush management. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Transitions or pathways leading to other plant communities are as follows:

- Brush management (chemical, fire, or mechanical), followed by prescribed grazing, will convert this plant community to the Rhizomatous wheatgrasses, Needleandthread, Blue grama Plant Community. The probability of this occurring is high. When prescribed fire is used, sufficient fine fuels will need to be present. This may require deferment from grazing prior to treatment. Post management is critical to ensure success. This can range from two or more years of rest to partial growing season deferment, depending on the condition of the understory at the time of treatment and the growing conditions following treatment. In the case of an intense wildfire that occurs when desirable plants are not completely dormant, the length of time required to reach the Rhizomatous wheatgrasses, Needleandthread, Blue grama Plant Community may be increased.

- Brush management, followed by frequent and severe grazing, will convert the plant community to the Western Wheatgrass/Cheatgrass Plant Community. The probability of this occurring is high. If bare areas exist after treatment, along with no recovery periods from grazing, cheatgrass will invade and plants not as resistant to grazing as western wheatgrass will be reduced.

- Moderate continuous season-long grazing, where greasewood occurs adjacent to this state, will convert the plant community to the Greasewood Plant Community.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Heavy Sagebrush Plant Community

This plant community is the result of long-term protection from grazing and fire. Sagebrush eventually dominates this plant community with canopy cover often exceeding 60%. At first, excessive litter builds up, shading out some of the grasses and forbs. Other plants become decadent with low vigor. Bunch grasses often develop dead centers. Eventually, the interspaces between plants increase in size leaving more soil surface exposed. Organic matter oxidizes in the air rather than being incorporated into the soil.

The dominant plants tend to be somewhat similar to those found in the Historic Climax Plant Community. Weedy species, cool-season grasses, and sedges have increased. Blue grama has decreased. Rodent activity has resulted in an increase in soil disturbance. Cactus and sageworts often increase. Noxious weeds such as Dalmatian toadflax, leafy spurge, or Canada thistle may invade the site if a seed source is present. Plant diversity is moderate to high.

The total annual production (air-dry weight) of this state is about 800 pounds per acre, but it can range from about 600 lbs./acre in unfavorable years to about 1,000 lbs./acre in above average years.

This plant community is not resistant to change and is more vulnerable to severe disturbance than the HCPC. The introduction of grazing or fire quickly changes the plant community.

Soil erosion is accelerated because of increased bare ground. Water flow patterns and pedestaling are obvious. Infiltration is reduced and runoff is increased.

Transitions or pathways leading to other plant communities are as follows:

- Brush management, followed by prescribed grazing, will return this plant community to at or near the Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community.

• Brush management, followed by frequent and severe grazing, will convert the plant community to the Western Wheatgrass/Cheatgrass Plant Community. The probability of this occurring is high because of the amount of bare ground exposed to cheatgrass invasion.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Western Wheatgrass/Cheatgrass Plant Community

This plant community is created when the Mixed Sagebrush/Grass Plant Community or the Heavy Sagebrush Plant Community is subjected to fire or brush management not followed by prescribed grazing. Rhizomatous wheatgrasses and annuals will eventually dominate the site.

Compared to the HCPC, cheatgrass has invaded with western wheatgrass and thickspike wheatgrass maintaining at a similar or slightly higher level. Virtually all other cool-season mid-grasses are severely decreased. Blue grama is the same or slightly less than found in the HCPC. Plant diversity is low.

The total annual production (air-dry weight) of this state is about 600 pounds per acre, but it can range from about 450 lbs./acre in unfavorable years to about 750 lbs./acre in above average years.

This plant community is relatively stable with the rhizomatous wheatgrasses being somewhat resistant to overgrazing and the cheatgrass effectively competing against the establishment of perennial cool-season grasses.

An increase in bare ground reduces water infiltration and increases soil erosion. The watershed is usually functioning. The biotic integrity is reduced by the lack of diversity in the plant community.

Transitions or pathways leading to other plant communities are as follows:
• Moderate continuous season-long grazing will eventually return this plant community to the Mixed Sagebrush/Grass Plant Community.

• Frequent and severe grazing will convert this plant community to Blue Grama Sod Plant Community.

• Frequent and severe yearlong grazing will convert this plant community to Blue grama, Plains Pricklypear, Bare Ground Plant Community.

• Long-term, prescribed grazing will eventually return this plant community to at or near the Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Blue Grama Sod Plant Community

This plant community is the result of frequent and severe grazing during the growing season of the cool-season mid-grasses. A dense sod of blue grama dominates it. Pricklypear cactus can become dense enough so that livestock cannot graze forage growing within the cactus clumps.

When compared to the Historic Climax Plant Community, blue grama and threadleaf sedge have increased. All cool-season mid-grasses and forbs have been greatly reduced. Plant diversity is extremely low.

The total annual production (air-dry weight) of this state is about 600 pounds per acre, but it can range from about 450 lbs./acre in unfavorable years to about 750 lbs./acre in above average years.

This sod bound plant community is very resistant to water infiltration. While this sod protects the site itself, off-site areas are affected by excessive runoff that can cause gully erosion. This sod is very resistant to change and may require a grazing land mechanical treatment, such as chiseling, to return the cool-season grass component.

Transitions or pathways leading to other plant communities are as follows:

- Grazing land mechanical treatment (chiseling, etc.) and pricklypear cactus control (if needed), followed by prescribed grazing, will return this plant community to near Historic Climax Plant Community condition.

- Grazing land mechanical treatment, followed by moderate continuous season-long grazing, will convert this plant community to the Western Wheatgrass/Cheatgrass Plant Community.

- Frequent and severe yearlong grazing will eventually convert this state to the Blue Grama, Plains Pricklypear, Bare Ground Plant Community.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Greasewood Plant Community

This plant community can occur where states are subjected to continuous season-long grazing at moderate stocking rates and where greasewood occurs adjacent to the site. It is dominated by an overstory of greasewood and possibly big sagebrush. Rhizomatous wheatgrasses, cheatgrass, and inland saltgrass make up the understory. Salts in the surface will increase due to the shedding of the salt-filled leaves of the greasewood. Plant diversity is high.

The total annual production (air-dry weight) of this state is about 700 pounds per acre, but it can range from about 525 lbs./acre in unfavorable years to about 875 lbs./acre in above average years.

This plant community is resistant to change. A significant reduction of greasewood can only be accomplished through repeated brush control treatments. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

The site is protected from erosion as long as ground cover is maintained. The biotic integrity of this state is somewhat intact because of the woody overstory and perennial grass understory. The watershed is functioning as long as a grass cover is maintained.

- Recovery to near Historic Climax Plant Community condition is difficult due to the resistance of greasewood to herbicides and accumulated effects of salts on the soil.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Blue Grama Sod/Plains Pricklypear/Bare Ground Plant Community

This plant community is the result of frequent and severe yearlong grazing over the long-term. Perennial plants are decreased. Cheatgrass, annual weeds, and bare ground are increased. Plains pricklypear may have increased, rendering much of the forage unusable by livestock.

This plant community is highly variable depending on the severity, frequency, and duration of the grazing and also the condition of the plant community when this level of grazing began. Virtually all plants not resistant to overgrazing may have been eliminated. Dominant plants may include blue grama, threeawns, annuals, and, to a lesser degree, rhizomatous wheatgrasses. Perennial plant diversity is low.

The total annual production (air-dry weight) of this state is about 500 pounds per acre, but it can range from about 375 lbs./acre in unfavorable years to about 625 lbs./acre in above average years.

This state is unhealthy and subject to increased erosion. Runoff is high on this state due to the sod nature of blue grama and bare ground.

Transitions or pathways leading to other plant communities are as follows:

- Long-term prescribed grazing will convert this plant community initially to the Blue Grama Sod Plant Community, when this state is dominated by blue grama sod at the time of treatment.

- Long-term prescribed grazing will convert this plant community to the Western Wheatgrass /Cheatgrass Plant Community, when this state has large amounts of cheatgrass, annual weeds, and bare ground at the time of treatment. Control of plains pricklypear cactus may be necessary.

Reseeding areas with native plant species and proper grazing management may be necessary to accelerate recovery where few desirable plants remain.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Go-back Land

This plant community occurs on land that has been cropped annually in the past and then abandoned without reseeding. Natural succession has resulted in a plant community dominated by varying combinations of red threeawn, cheatgrass, blue grama, Sandberg bluegrass, and some rhizomatous wheatgrasses. Forage production is low and grasses such as red threeawn and cheatgrass are not used efficiently by livestock.

The total annual production (air-dry weight) of this state is about 600 pounds per acre, but it can range from about 500 lbs./acre in unfavorable years to about 900 lbs./acre in above average years.

The potential for accelerated erosion can be highly variable depending on amount of bare ground present. Biological diversity is low.

Transitions or pathways leading to other plant communities are as follows:

- Prescribed grazing may be used to increase desirable native cool-season grass production. It is usually difficult to return to near Historic Climax Plant Community condition in a timely manner because of past soil loss.

- Grazing land mechanical treatment (i.e., chiseling) may improve forage production where significant rhizomatous wheatgrass is present to respond.

Where there is a lack of perennial grasses, reseeding to tame or native species may be necessary to return these lands to production in the form of pastureland. These pastures are normally seeded to crested wheatgrass, pubescent wheatgrass, or Russian wildrye. They require considerable investment to establish and have a variable life expectancy. They do produce up to 50% more than native range, but their value as forage is somewhat limited due to the single species usually seeded. In some cases, the single species or certain groups of species (e.g., wheatgrasses) may be more vulnerable to infestation by associated insects and/or diseases (e.g., black grass bugs).

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Ecological Site Interpretations

Animal Community:
Animal Community – Wildlife Interpretations
Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community (HCPC): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing/foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here.

Mixed Sagebrush/Grass Plant Community: The combination of an overstory of sagebrush and an understory of grasses and forbs provide a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer and antelope may use this state for foraging and cover year-round, as would cottontail and jack rabbits. It provides important winter, nesting, brood-rearing, and foraging habitat for sage grouse. Brewer's sparrows' nest in big sagebrush plants, and hosts of other nesting birds utilize stands in the 20-30% cover range.

Heavy Sagebrush Plant Community: This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15% protein and 40-60% digestibility during that time. This community provides excellent escape and thermal cover for large ungulates, as well as nesting and brood rearing habitat for sage grouse.

Western Wheatgrass/Cheatgrass Plant Community: This plant community may be useful for the same large grazers that would use the Historic Climax Plant Community. However, the plant community composition is less diverse, and thus, less apt to meet the seasonal needs of these animals. It may provide some foraging opportunities for sage grouse when it occurs proximal to woody cover. Good grasshopper habitat equals good foraging for birds.

Blue Grama Sod and Go-back Land Plant Communities: These communities provide limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover and if the Historic Climax Plant Community or the Western Wheatgrass/Cheatgrass Plant Community is limiting. Generally, these are not target plant communities for wildlife habitat management.

Greasewood Plant Community: This plant community exhibits a low level of plant species diversity due to the accumulation of salts in the soil. It may provide some thermal and escape cover for deer and antelope if no other woody community is nearby, but in most cases it is not a desirable plant community to select as a wildlife habitat management objective.

Blue Grama, Plains Pricklypear, Bare Ground Plant Community: Benefits to other wildlife are largely due to the subterranean structure created by the prairie dogs, not the sparse vegetation found on this plant community.

Introduced Pasture: These communities are highly variable depending on the species planted. Refer to Forage Suitability Groups for more information.

Animal Community – Grazing Interpretations

The following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using this information along with animal preference data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies can result in an increased carrying capacity. If distribution problems occur, stocking rates must be reduced to maintain plant health and vigor.

Plant Community	Production (lb./ac)	Carrying Capacity* (AUM/ac)
Rhizomatous WG, Needleandthread, Blue Grama	700-1500	.4
Heavy Sagebrush	800-1400	.3
Blue Grama Sod	400-1000	.2
Mixed Sagebrush/Grass	700-1200	.33
Western Wheatgrass/Cheatgrass	600-1200	.2
Blue grama, Plains Pricklypear, Bare ground	300-800	.1
Greasewood	525-875	.3
Go-back Land	500-900	.2

* - Continuous, season-long grazing by cattle under average growing conditions.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for cattle, sheep, or horses. During the dormant period, the forage for livestock use needs to be supplemented with protein because the quality does not meet minimum livestock requirements.

Plant Preference by Animal Kind:

Animal Kind: AllAntelope

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Indian ricegrass	*Achnatherum hymenoides*	Leaves	N	N	N	P	P	P	N	N	N	D	D	D
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand bluestem	*Andropogon hallii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
silver sagebrush	*Artemisia cana*	Leaves	P	P	P	P	P	P	P	P	P	P	P	P
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
twogrooved milkvetch	*Astragalus bisulcatus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	P	P	P	P	P	P	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sideoats grama	*Bouteloua curtipendula*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue grama	*Bouteloua gracilis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Leaves	P	P	P	P	P	P	P	P	P	P	P	P
inland sedge	*Carex interior*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sandreed	*Calamovilfa longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains reedgrass	*Calamagrostis montanensis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Nebraska sedge	*Carex nebrascensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

little bluestem	*Schizachyrium scoparium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
alkali sacaton	*Sporobolus airoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand dropseed	*Sporobolus cryptandrus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
alkali cordgrass	*Spartina gracilis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broadleaf cattail	*Typha latifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

Animal Kind: allCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand bluestem	*Andropogon hallii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sideoats grama	*Bouteloua curtipendula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie sandreed	*Calamovilfa longifolia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass,														

Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
alkali sacaton	*Sporobolus airoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
alkali cordgrass	*Spartina gracilis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
broadleaf cattail	*Typha latifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Fruits/Seeds	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllDeer

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand bluestem	*Andropogon hallii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red														

threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Wyoming big sagebrush	*Artemisia tridentata ssp. wyomingensis*	Entire plant	P	P	P	P	P	P	D	D	D	D	D	D
twogrooved milkvetch	*Astragalus bisulcatus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sideoats grama	*Bouteloua curtipendula*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sandreed	*Calamovilfa longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Nebraska sedge	*Carex nebrascensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
silverberry	*Elaeagnus commutata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
prairie coneflower	*Ratibida*	Entire plant	D	D	D	P	P	P	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
alkali sacaton	*Sporobolus airoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand dropseed	*Sporobolus cryptandrus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
alkali cordgrass	*Spartina gracilis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broadleaf cattail	*Typha latifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca,														

small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand bluestem	*Andropogon hallii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
silver sagebrush	*Artemisia cana ssp. cana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	D	D	D	U	U	U	U	U	U	D	D	D
sideoats grama	*Bouteloua curtipendula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie sandreed	*Calamovilfa longifolia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail, bottlebrush														

squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertparsley, biscuitroot	*Lomatium*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

willow	*Salix*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
greasewood	*Sarcobatus vermiculatus*	Leaves	U	U	U	U	U	U	U	U	U	U	U	U

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
alkali sacaton	*Sporobolus airoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
alkali cordgrass	*Spartina gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
broadleaf cattail	*Typha latifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllSheep

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand bluestem	*Andropogon hallii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
silver sagebrush	*Artemisia cana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Wyoming big sagebrush	*Artemisia tridentata ssp. wyomingensis*	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
twogrooved milkvetch	*Astragalus bisulcatus*	Entire plant	N	N	N	T	T	T	T	T	T	T	T	T
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie sandreed	*Calamovilfa longifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broom snakeweed	*Gutierrezia sarothrae*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue-eyed grass	*Sisyrinchium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broadleaf cattail	*Typha latifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Legend: P = Preferred D = Desirable U = Undesirable N = Not consumed E = Emergency T = Toxic
X = Used, but degree of utilization unknown

Hydrology Functions:

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B and C, with localized areas in hydrologic group D. Infiltration ranges from moderately slow to moderate. Runoff potential for this site varies from low to moderate depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong sod and dominate the site. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1-2% of the soil surface.

Recreational Uses:

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood Products:

No appreciable wood products are present on the site.

Other Products:

None noted.

Other Information:

Supporting Information

Associated Sites:

Site Name	Site ID	Site Narrative
Clayey (Cy) 10-14” Northern Plains Precipitation Zone	R058BY104WY	Clayey
Lowland (LL) 10-14” Northern Plains Precipitation Zone	R058BY128WY	Lowland
Overflow (Ov) 10-14” Northern Plains Precipitation Zone	R058BY130WY	Overflow
Sandy (Sy) 10-14” Northern Plains Precipitation Zone	R058BY150WY	Sandy
Shallow Loamy (SwLy) 10-14” Northern Plains Precipitation Zone	R058BY162WY	Shallow Loamy

Similar Sites:

Site Name	Site ID	Site Narrative
Loamy (Ly) 15-17” Northern Plains Precipitation Zone	R058BY222WY	Loamy 15-17” Northern Plains P.Z. has higher production.

State Correlation:

This site has been correlated with the following states:
MT

Inventory Data References:

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel was also used. Those involved in developing this site include: Glen Mitchell, Range Management Specialist, NRCS; Chuck Ring, Range Management Specialist, NRCS; and Everet Bainter, Range Management Specialist. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

Inventory Data References
Data Source Number of Records Sample Period State County
SCS-RANGE-417 12 1971-1994 WY Campbell & others
Ocular estimates 5 1990-1999 WY Campbell & others

Type Locality:

Relationship to Other Established Classifications:

Other References:
Field Offices
Buffalo, Douglas, Gillette, Lusk, Newcastle, Sheridan

Site Description Approval:

Author	Date	Approval	Date
G. Mitchell	4/25/2000	E. Bainter	3/7/2008

Reference Sheet

Author(s)/participant(s):

Contact for lead author:

Date:4/1/2005 **MLRA:**058B **Ecological Site:**Loamy (Ly) 10-14” Northern Plains Precipitation ZoneR058BY122WY This *must* be verified based on soils and climate (see Ecological Site Description). Current plant community cannot be used to identify the ecological site.

Composition (indicators 10 and 12) based on: XAnnual Production, Foliar Cover, Biomass

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Indicators. For each indicator, describe the potential for the site. Where possible, (1) use numbers, (2) include expected range of values for above- and below-average years for **each** community and natural disturbance regimes within the reference state, when appropriate and (3) cite data. Continue descriptions on separate sheet.

1. **Number and extent of rills:** Rills should not be present.
2. **Presence of water flow patterns:** Barely observable.

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3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, standing dead, lichen, moss, plant canopy are not bare ground):** Bare ground is 20-30% occurring in small areas throughout site.

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Plant cover and litter is at 70% or greater of soil surface and maintains soil surface integrity. Soil Stability class is anticipated to be 5 or greater.

---

9. **Soil surface structure and SOM content (include type and strength of structure, and A-horizon color and thickness):** Use Soil Series description for depth and color of A-horizon.

---

10. **Effect on plant community composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Grass canopy and basal cover should reduce raindrop impact and slow overland flow providing increased time for infiltration to occur. Healthy deep rooted native grasses enhance infiltration and reduce runoff. Infiltration is Moderate.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer or soil surface crusting should be present.

---

12. **Functional/Structural Groups (list in order of descending dominance by above-ground weight using symbols: >>, >, = to indicate much greater than, greater than, and equal to) with dominants and sub-dominants and "others" on separate lines:**
    Dominant: Cool Season Bunch grasses > Cool Season Rhizomatous grasses > Short stature grasses/grasslikes > Forbs = Shrubs
    Sub-dominant:
    Other:
    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very Low.

---

14. **Average percent litter cover (%) and depth (inches):** Average litter cover is 25-35%

with depths of 0.25 to 1.0 inches.

15. **Expected annual production (this is TOTAL above-ground production, not just forage production):** 1200 lbs/ac

16. **Potential invasive (including noxious) species (native and non-native). List Species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicator, we are describing what in NOT expected in the reference state for the ecological site:** Blue grama, Threadleaf sedge, Fringed sagewort, Prickly Pear, Big sagebrush, Broom Snakeweed, and Species found on Noxious Weed List

17. **Perennial plant reproductive capability:** All species are capable of reproducing.

Reference Sheet Approval:

Approval	Date
E. Bainter	3/7/2008

Ecological Site Description

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION (Old Format Report)

ECOLOGICAL SITE CHARACTERISTICS

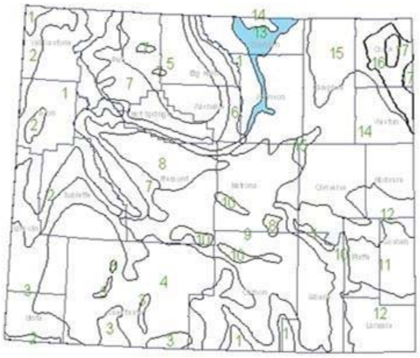
Site Type: Rangeland

Site Name: Loamy (Ly) 15-19” Northern Plains Precipitation Zone

Site ID: R043BY422WY

Major Land Resource Area: 043B-Central Rocky Mountains

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic Features

This site occurs on gently undulating rolling land.

Land Form: (1) Hill
(2) Alluvial fan
(3) Ridge

	Minimum	Maximum
Elevation (feet):	3700	7500
Slope (percent):	0	30
Water Table Depth (inches):		
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		

Depth (inches):	0	0
Frequency:	None	None
Duration:	None	None
Runoff Class:	Negligible	High
Aspect:	No Influence on this site	

Climatic Features

Annual precipitation ranges from 15" to 19" per year. May is generally the wettest month. July, August and September are somewhat drier with daily amounts rarely exceeding one inch. Snowfall is quite heavy in the mountainous area. Annual snowfall averages close to 70 inches.

Sunshine is abundant in the latter part of the summer, the greatest amount being in July and August. Sunshine possibility during these two months averages 70 to 75% possibility with only a 65% possibility for June and September. Winter averages about 40% sunshine.

Because of the varied topography, the wind will vary considerably for different parts of the area. The wind is usually much lighter at the lower elevations and in the valleys as compared with the higher terrain. The average winter wind velocity is 8.5 mph, while the summer wind velocity averages 7.5 mph. Winds during storms and on ridges may exceed 45 mph.

Temperatures show a wide range between summer and winter, and between daily maximums and minimums. Summer nights are cool and temperatures drop into the forties at most places before sunrise. Summer daytime temperatures are usually in the seventies and occasionally reach eighty, but rarely reach the mid nineties. Winters are cold with daily lows below freezing most of the time. January has the coldest temperatures with a range of near 10 deg. F at night to the mid thirties in the afternoon. Temperatures of well below zero to –30 deg. F are not uncommon in the winter months.

The growing season for the cool season plants will generally start about April 15 to May 1 and continue to about October 10.

The following information is from the “Sheridan Airport” climate station:
Frost-free period (32 °F): 95-156 days; (5 yrs. out of 10, these days will occur between May 20 – September 20)
Freeze-free period 28 °F): 116-187 days; (5 yrs. out of 10, these days will occur between May 3 – October 2)
Mean annual precipitation: 14.7 inches
Mean annual air temperature: 45.0 °F (31.2 °F Avg. Min. – 58.8 °F Avg. Max.)

For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. Other climate station(s) representative of this precipitation zone include: “Parkman 5 WNW”

	Minimum	Maximum
Frost-free period (days):	95	156
Freeze-free period (days):	116	187
Mean annual precipitation (inches):	15.0	19.0

Monthly precipitation (inches) and temperature (°F):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precip. Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Precip. Max.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Temp. Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Temp. Max.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Climate Stations:

Influencing Water Features

Stream type: None

Wetland Description:	System	Subsystem	Class

Representative Soil Features

The soils of this site are deep to moderately deep (greater than 20" to bedrock), well-drained & moderately permeable. The surface soil will vary from 3" to 6" in thickness depending on the texture and permeability of the subsoil. The surface soil will be one or more of the following textures: very fine sandy loam, loam, silt loam and the friable portions of sandy clay loam, silty clay loam and clay loam. Loess material with little or no development is excluded from this site.

Parent Materials:
Kind:
Origin:

Surface Texture: (1) Loam
(2) Sandy loam
(3) Very fine sandy loam

Subsurface Texture Group: Loamy

	Minimum	Maximum
Surface Fragments <=3" (% Cover):	0	0
Surface Fragments > 3" (% Cover):	0	10
Subsurface Fragments <=3" (% Volume):	0	15
Subsurface Fragments > 3" (% Volume):	0	10

Drainage Class: Moderately well drained To Well drained

Permeability Class: Moderately slow To Moderate

	Minimum	Maximum
Depth (inches):	20	60
Electrical Conductivity (mmhos/cm):	0	4
Sodium Absorption Ratio:	0	5

Calcium Carbonate Equivalent (percent):	0	10
Soil Reaction (1:1 Water):	6.6	8.4
Soil Reaction (0.01M CaCl2):		
Available Water Capacity (inches):	3.0	6.3

Plant Communities

Ecological Dynamics of the Site

As this site deteriorates from improper grazing management, species such as blue grama, and big sagebrush will increase. Species such as cheatgrass will invade. Cool season grasses such as green needlegrass and western wheatgrass will decrease in frequency and production.

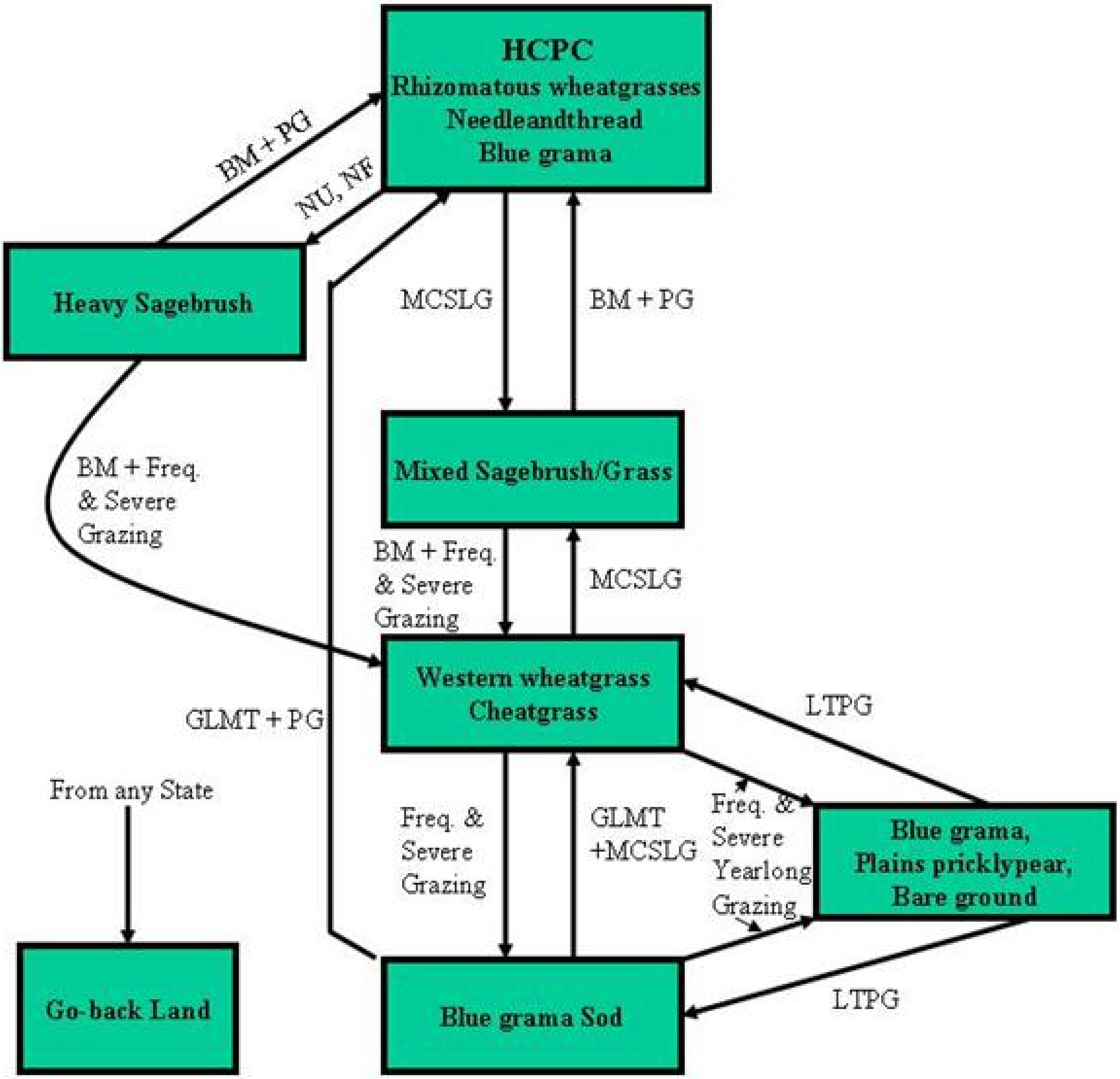
Big sagebrush may become dominant on some areas with an absence of fire. Wildfires are actively controlled in recent times so chemical control using herbicides has replaced the historic role of fire on this site. Recently, prescribed burning has regained some popularity.

The Historic Climax Plant Community (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

The following is a State and Transition Model Diagram that illustrates the common plant communities (states) that can occur on the site and the transitions between these communities. The ecological processes will be discussed in more detail in the plant community narratives following the diagram.

Site Type: Rangeland
MLRA: 43BY – Central Rocky Mountains

Loamy 15-19"NP P.Z.
R043BY422WY



BM - Brush Management (fire, chemical, mechanical)
Freq. & Severe Grazing - Frequent and Severe Utilization of the Cool-season Mid-grasses during the Growing Season
GLMT - Grazing Land Mechanical Treatment
LTPG - Long-tem Prescribed Grazing
MCSLG - Moderate, Continuous Season-long Grazing
NU, NF - No Use and No Fire
PG - Prescribed Grazing (proper stocking rates with adequate recovery periods during the growing season)
VLTPG - Very Long-term Prescribed Grazing (could possibly take generations)
Na - found adjacent to a saline site

Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community

The interpretive plant community for this site is the Historic Climax Plant Community. This site evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. Potential vegetation is about 75% grasses or grass-like plants, 15% forbs, and 10% woody plants. The site is dominated by cool season midgrasses. The major grasses include rhizomatous wheatgrass, Idaho fescue, needleandthread, and green needlegrass. Other grasses occurring on the site include Cusick, Canby, and Sandberg bluegrass, bluebunch wheatgrass, sideoats grama, and blue grama. Big sagebrush is a conspicuous element of this site, occurs in a mosaic pattern, and makes up 5 to 10% of the annual production. Big sagebrush may become dominant on some areas with the absence of fire. Natural fire occurred frequently in this community and prevented sagebrush from being the dominant landscape. Wildfires are actively controlled in recent times so chemical control using herbicides has replaced the historic role of fire on this site. Recently controlled burning has regained some popularity.

Annual production on this site ranges from 1500 to 3000 pounds depending on climatic conditions.

This plant community is extremely stable and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Transitions or pathways leading to other plant communities are as follows:

• No use and no fire for 20 years or more will convert this plant community to the Heavy Sagebrush Plant Community.

• Moderate, continuous season-long grazing will convert the plant community to the Mixed Sagebrush/Grass Plant Community.

• When cropped annually and then abandoned without reseeding, the state is converted to the Go-back Land Plant Community.

Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant CommunityPlant Species Composition:

Grass/Grasslike

Group	Group Name	Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
1				220	550
		Idaho fescue	*Festuca idahoensis*	220	550
2				220	550
		spike fescue, kingspike fescue	*Leucopoa kingii*	220	550
3				220	550
		green needlegrass	*Nassella viridula*	220	550
4				220	440
		western wheatgrass	*Pascopyrum smithii*	220	440
5				110	220

		needle and thread, needleandthread	*Hesperostipa comata*	110	220
6				110	220
		prairie Junegrass	*Koeleria macrantha*	110	220
7				110	220
		Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	110	220
8				110	220
		bluebunch wheatgrass	*Pseudoroegneria spicata*	110	220
9				110	330
		Grass, perennial, other perennial grass		0	110
		Indian ricegrass	*Achnatherum hymenoides*	0	110
		blue grama	*Bouteloua gracilis*	0	110
		nodding brome	*Bromus anomalus*	0	110
		Pumpelly's brome	*Bromus inermis ssp. pumpellianus var. pumpellianus*	0	110
		mountain brome	*Bromus marginatus*	0	110
		needleleaf sedge	*Carex duriuscula*	0	110
		threadleaf sedge	*Carex filifolia*	0	110
		plains reedgrass	*Calamagrostis montanensis*	0	110
		onespike danthonia, onespike oatgrass	*Danthonia unispicata*	0	110
		Montana wheatgrass	*Elymus albicans*	0	110
		basin wildrye	*Leymus cinereus*	0	110
		Sandberg bluegrass	*Poa ampla(syn)*	0	110
		Sandberg bluegrass	*Poa canbyi(syn)*	0	110
		Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	0	110
		spike trisetum	*Trisetum spicatum*	0	110

Forb

				Annual Production in Pounds Per Acre	
Group	Group Name	Common Name	Scientific Name	Low	High
10 -null				110	330
		Forb, perennial, other perennial forb		0	110
		yarrow	*Achillea*	0	110
		rosy pussytoes, rose pussytoes	*Antennaria rosea*	0	110
		tarragon, green sagewort	*Artemisia dracunculus*	0	110
		prairie sagewort, fringed sagewort	*Artemisia frigida*	0	110
		white sagebrush, cudweed sagewort	*Artemisia ludoviciana*	0	110
		field chickweed	*Cerastium arvense*	0	110
		prairie clover	*Dalea*	0	110
		fleabane	*Erigeron*	0	110
		buckwheat	*Eriogonum*	0	110
		aster	*Eucephalus*	0	110

		hairy false goldenaster, hairy goldenaster	*Heterotheca villosa*	0	110
		desertparsley, biscuitroot	*Lomatium*	0	110
		lupine	*Lupinus*	0	110
		bluebells	*Mertensia*	0	110
		silverleaf Indian breadroot	*Pediomelum argophyllum*	0	110
		beardtongue, penstemon	*Penstemon*	0	110
		phlox	*Phlox*	0	110
		upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	0	110
		American vetch	*Vicia americana*	0	110
		deathcamas	*Zigadenus*	0	110

Shrub/Vine

				Annual Production in Pounds Per Acre	
Group	Group Name	Common Name	Scientific Name	Low	High
11				0	110
		big sagebrush	*Artemisia tridentata*	0	110
12				0	44
		rubber rabbitbrush	*Ericameria nauseosa*	0	44
13				0	110
		silver sagebrush	*Artemisia cana*	0	110
14				0	110
		Woods' rose	*Rosa woodsii var. woodsii*	0	110
15				0	110
		Shrub (>.5m)		0	110

Plant Growth Curve:
Growth Curve Number:WY1301
Growth Curve Name: 15-19NP Upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	45	35	10	0	5	0	0	0

Mixed Sagebrush/Grass Plant Community

Historically, this plant community evolved under grazing by bison and a low fire frequency. Currently, it is found under moderate, season-long grazing by livestock in the absence of fire or brush control. Big sagebrush is a significant component of this plant community. Cool-season grasses make up the majority of the understory with the balance made up of short warm-season grasses, annual cool-season grass, and miscellaneous forbs.

Dominant grasses include needleandthread, rhizomatous wheatgrass, Idaho fescue, and green needlegrass. Grasses of secondary importance include blue grama, prairie junegrass, Canby bluegrass and Sandberg bluegrass. Forbs commonly found in this plant community, include Louisiana sagewort (cudweed), plains wallflower, hairy goldaster, slimflower scurfpea, and scarlet globemallow. Sagebrush canopy ranges from 20% to 30%. Fringed sagewort and plains pricklypear can also occur.

This state produces between 900 and 2500 pounds annually, depending on the growing conditions.

When compared to the Historical Climax Plant Community, sagebrush and blue grama have increased. Green needlegrass has decreased, often occurring only where protected from grazing by the sagebrush canopy. Production of cool-season grasses has also been reduced. Cheatgrass (downy brome) has invaded the site. The overstory of sagebrush and understory of grass and forbs provide a diverse plant community which will support domestic livestock and wildlife such as mule deer and antelope. The site is stable and protected from excessive erosion. The biotic integrity of this plant community is usually intact. However, it can be at risk depending on how far a shift has occurred in plant composition toward blue grama, sagebrush, and/or cheatgrass. The watershed is usually functioning. However, it can become at risk when canopy cover of sagebrush, blue grama sod, and/or bare ground increases.

This plant community is resistant to change. A significant reduction of big sagebrush can only be accomplished through fire or brush management. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Transitions or pathways leading to other plant communities are as follows:

- Brush management (chemical, fire, or mechanical), followed by prescribed grazing, will convert this plant community to the Rhizomatous wheatgrasses, Needleandthread, Blue grama Plant Community. The probability of this occurring is high. When prescribed fire is used, sufficient fine fuels will need to be present. This may require deferment from grazing prior to treatment. Post management is critical to ensure success. This can range from two or more years of rest to partial growing season deferment, depending on the condition of the understory at the time of treatment and the growing conditions following treatment. In the case of an intense wildfire that occurs when desirable plants are not completely dormant, the length of time required to reach the Rhizomatous wheatgrasses, Needleandthread, Blue grama Plant Community may be increased.

- Brush management, followed by frequent and severe grazing, will convert the plant community to the Western Wheatgrass/Cheatgrass Plant Community. The probability of this occurring is high. If bare areas exist after treatment, along with no recovery periods from grazing, cheatgrass will invade and plants not as resistant to grazing as western wheatgrass will be reduced.

Plant Growth Curve:
Growth Curve Number:WY1301
Growth Curve Name: 15-19NP Upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	45	35	10	0	5	0	0	0

Heavy Sagebrush Plant Community

This plant community is the result of protection from grazing and fire. Sagebrush dominates this plant community with canopy cover often exceeding 60%. The understory of grass includes western wheatgrass, green needlegrass, needleandthread, Idaho fescue, Sandberg bluegrass, and prairie junegrass. With complete protection from grazing and fire, the site will become dominated by big sagebrush. The cool season grasses are protected by the sagebrush canopy, but this protection makes them unavailable for grazing. Big sagebrush is long-lived and will persist for a long period.

Production on this state ranges from 900 to 2400 pounds, depending on climatic conditions.

This plant community is not resistant to change and is more vulnerable to severe disturbance than the HCPC. The introduction of grazing or fire quickly changes the plant community.

Soil erosion is accelerated because of increased bare ground. Water flow patterns and pedestaling are obvious. Infiltration is reduced and runoff is increased.

Transitions or pathways leading to other plant communities are as follows:

- Brush management, followed by prescribed grazing, will return this plant community to at or near the Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community.

- Brush management, followed by frequent and severe grazing, will convert the plant community to the Western Wheatgrass/Cheatgrass Plant Community. The probability of this occurring is high because of the amount of bare ground exposed to cheatgrass invasion.

Plant Growth Curve:
Growth Curve Number:WY1301
Growth Curve Name: 15-19NP Upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	45	35	10	0	5	0	0	0

Western Wheatgrass/Cheatgrass Plant Community

This plant community is created when the Mixed Sagebrush/Grass Vegetation State or the Heavy Sagebrush Vegetation State is subjected to fire or brush control, followed by improper grazing management. Rhizomatous wheatgrasses are the main perennial grass. Cheatgrass has increased, severely decreasing the production of desirable cool-season grasses.

Annual production ranges from 800 to 1500 pounds, depending on climatic conditions.

This plant community is relatively stable with the rhizomatous wheatgrasses being somewhat resistant to overgrazing and the cheatgrass effectively competing against the establishment of perennial cool-season grasses.

An increase in bare ground reduces water infiltration and increases soil erosion. The watershed is usually functioning. The biotic integrity is reduced by the lack of diversity in the plant community.

Transitions or pathways leading to other plant communities are as follows:

- Moderate continuous season-long grazing will eventually return this plant community to the Mixed Sagebrush/Grass Plant Community.

- Frequent and severe grazing during the growing season of cool season grasses will change this state to the Blue grama sod Plant Community.

- Frequent and severe yearlong grazing will convert this plant community to Blue grama, Plains Pricklypear, Bare Ground Plant Community.

- Long-term, prescribed grazing will eventually return this plant community to at or near the Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community.

Plant Growth Curve:
Growth Curve Number:WY1301
Growth Curve Name: 15-19NP Upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	45	35	10	0	5	0	0	0

Blue Grama Sod Plant Community

This plant community is the result of frequent and severe grazing during the growing season of the cool-season mid-grasses. A dense sod of blue grama dominates it. Pricklypear cactus can become dense enough so that livestock cannot graze forage growing within the cactus clumps.

When compared to the Historic Climax Plant Community, blue grama and threadleaf sedge have increased. All cool-season mid-grasses and forbs have been greatly reduced. Plant diversity is extremely low.

The total annual production (air-dry weight) of this state is about 600 pounds per acre, but it can range from about 450 lbs./acre in unfavorable years to about 750 lbs./acre in above average years.

This sod bound plant community is very resistant to water infiltration. While this sod protects the site itself, off-site areas are affected by excessive runoff that can cause gully erosion. This sod is very resistant to change and may require a grazing land mechanical treatment, such as chiseling, to return the cool-season grass component.

Transitions or pathways leading to other plant communities are as follows:

- Grazing land mechanical treatment (chiseling, etc.) and pricklypear cactus control (if needed), followed by prescribed grazing, will return this plant community to near Historic Climax Plant Community condition.

- Grazing land mechanical treatment, followed by moderate continuous season-long grazing, will convert this plant community to the Western Wheatgrass/Cheatgrass Plant Community.

- Frequent and severe yearlong grazing will eventually convert this state to the Blue Grama, Plains Pricklypear, Bare Ground Plant Community.

Plant Growth Curve:
Growth Curve Number:WY1301
Growth Curve Name: 15-19NP Upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	45	35	10	0	5	0	0	0

Blue Grama/ Plains Pricklypear/ Bare Ground Plant Community

This plant community is often the result of invasion of prairie dogs. Prairie dogs are persistent once they become established. Large variations in prairie dog population occur due to occurrences such as outbreaks of plague. Even when prairie dog populations are reduced, they tend to recover rapidly. Perennial plants are decreased. Cheatgrass, annual weeds, and bare ground are increased. Plains pricklypear may have increased, rendering much of the forage unusable by livestock.

Annual production ranges from 400 to 1000 pounds.

This state is unhealthy and subject to increased erosion. Runoff is high on this state due to the sod nature of blue grama and bare ground.

Transitions or pathways leading to other plant communities are as follows:

- Long-term prescribed grazing will convert this plant community initially to the Blue Grama Sod Plant Community, when this state is dominated by blue grama sod at the time of treatment.

- Long-term prescribed grazing will convert this plant community to the Western Wheatgrass /Cheatgrass Plant Community, when this state has large amounts of cheatgrass, annual weeds, and bare ground at the time of treatment. Control of plains pricklypear cactus may be necessary.

Plant Growth Curve:
Growth Curve Number:WY1301
Growth Curve Name: 15-19NP Upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	45	35	10	0	5	0	0	0

Go-back Land Plant Community

This plant community occurs on land that has been cropped annually in the past and then abandoned without reseeding. Natural succession has resulted in a plant community dominated by varying combinations of red threeawn, cheatgrass, blue grama, Sandberg bluegrass, and some rhizomatous wheatgrass. Forage production is low since grasses such as red threeawn and cheatgrass are not used efficiently by livestock.

Annual production ranges from 800 to 1500 pounds

The potential for accelerated erosion can be highly variable depending on amount of bare ground present. Biological diversity is low.

Transitions or pathways leading to other plant communities are as follows:

- Prescribed grazing may be used to increase desirable native cool-season grass production. It is usually difficult to return to near Historic Climax Plant Community condition in a timely manner because of past soil loss.

- Grazing land mechanical treatment (i.e., chiseling) may improve forage production where significant rhizomatous wheatgrass is present to respond.

Where there is a lack of perennial grasses, reseeding to tame or native species may be necessary to return these lands to production in the form of pastureland. These pastures are normally seeded to crested wheatgrass, pubescent wheatgrass, or Russian wildrye. They require considerable investment to establish and have a variable life expectancy. They do produce up to 50% more than native range, but their value as forage is somewhat limited due to the single species usually seeded. In some cases, the single species or certain groups of species (e.g., wheatgrasses) may be more vulnerable to infestation by associated insects and/or diseases (e.g., black grass bugs).

Plant Growth Curve:
Growth Curve Number:WY1301
Growth Curve Name: 15-19NP Upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	45	35	10	0	5	0	0	0

Ecological Site Interpretations

Animal Community:
Animal Community – Wildlife Interpretations
Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community (HCPC): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing/foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here.

Mixed Sagebrush/Grass Plant Community: The combination of an overstory of sagebrush and an understory of grasses and forbs provide a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer and antelope may use this state for foraging and cover year-round, as would cottontail and jack rabbits. It provides important winter, nesting, brood-rearing, and foraging habitat for sage grouse. Brewer's sparrows' nest in big sagebrush plants, and hosts of other nesting birds utilize stands in the 20-30% cover range.

Heavy Sagebrush Plant Community: This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15% protein and 40-60% digestibility during that time. This community provides excellent escape and thermal cover for large ungulates, as well as nesting and brood rearing habitat for sage grouse.

Western Wheatgrass/Cheatgrass Plant Community: This plant community may be useful for the same large grazers that would use the Historic Climax Plant Community. However, the plant community composition is less diverse, and thus, less apt to meet the seasonal needs of these animals. It may provide some foraging opportunities for sage grouse when it occurs proximal to woody cover. Good grasshopper habitat equals good foraging for birds.

Blue Grama Sod and Go-back Land Plant Communities: These communities provide limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover and if the Historic Climax Plant Community or the Western Wheatgrass/Cheatgrass Plant Community is limiting. Generally, these are not target plant communities for wildlife habitat management.

Blue Grama, Plains Pricklypear, Bare Ground Plant Community: Benefits to other wildlife are largely due to the subterranean structure created by the prairie dogs, not the sparse vegetation found on this plant community.

Introduced Pasture: These communities are highly variable depending on the species planted. Refer to Forage Suitability Groups for more information.

Animal Community – Grazing Interpretations

The following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using this information along with animal preference data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies can result in an increased carrying capacity. If distribution problems occur, stocking rates must be reduced to maintain plant health and vigor.

Plant Community Production Carrying Capacity*
(lb./ac) (AUM/ac)
Rhizomatous WG, Needleandthread, Blue Grama 1500-3000 .6
Heavy Sagebrush 900-2400 .35

Mixed Sagebrush/Grass 900-2500 .5
Western Wheatgrass/Cheatgrass 800-1500 .35
Blue grama, Plains Pricklypear, Bare ground 400-1000 .25
Blue grama sod 450-750 .20
Go-back Land 800-1500 .35

* - Continuous, season-long grazing by cattle under average growing conditions.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for cattle, sheep, or horses. During the dormant period, the forage for livestock use needs to be supplemented with protein because the quality does not meet minimum livestock requirements.

Plant Preference by Animal Kind:

Animal Kind: ALLAntelope

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Letterman's needlegrass	*Achnatherum lettermanii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
common yarrow, western yarrow, yarrow	*Achillea millefolium*	Entire plant	N	N	N	U	U	U	U	U	U	N	N	N
boxelder	*Acer negundo*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
blunt chaff flower	*Achyranthes nelsonii(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Richardson's needlegrass	*Achnatherum richardsonii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
pale agoseris, pale mountain dandelion	*Agoseris glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand bluestem	*Andropogon hallii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
pussytoes	*Antennaria*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
field sagewort	*Artemisia campestris*	Entire plant	N	N	N	U	U	U	U	U	U	N	N	N
silver sagebrush	*Artemisia cana ssp. cana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sandwort	*Arenaria*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
white sagebrush, cudweed sagewort	*Artemisia ludoviciana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
black sagebrush	*Artemisia nova*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
threetip sagebrush	*Artemisia tripartita*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
balsamroot	*Balsamorhiza*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertbroom	*Baccharis sarothroides*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Porter brome	*Bromus anomalus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Pumpelly's brome	*Bromus inermis ssp. pumpellianus var. pumpellianus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain brome	*Bromus marginatus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
buglossoides	*Buglossoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
water sedge	*Carex aquatilis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
wheat sedge	*Carex atherodes*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
reedgrass	*Calamagrostis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Nebraska sedge	*Carex nebrascensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
dunhead sedge, dunehead sedge	*Carex phaeocephala*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
northern reedgrass	*Calamagrostis stricta ssp. inexpansa*	Entire plant	U	U	U	D	D	D	U	U	U	U	U	U
field chickweed	*Cerastium arvense*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain mahogany	*Cercocarpus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
western white clematis	*Clematis ligusticifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bastard toadflax	*Comandra*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
pale bastard toadflax	*Comandra umbellata ssp. pallida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tapertip hawksbeard	*Crepis acuminata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hawthorn	*Crataegus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie clover	*Dalea*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
onespike danthonia, onespike oatgrass	*Danthonia unispicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
larkspur	*Delphinium*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
Montana wheatgrass	*Elymus albicans*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
California waterwort	*Elatine californica*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
blue wildrye	*Elymus glaucus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus ssp. trachycaulus*	Entire plant	U	U	U	D	D	D	U	U	U	U	U	U
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sanddune wallflower, western wallflower	*Erysimum capitatum var. capitatum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fleabane	*Erigeron*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
buckwheat	*Eriogonum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Idaho fescue	*Festuca idahoensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
green ash	*Fraxinus pennsylvanica*	Entire plant	U	U	U	D	D	D	D	D	D	U	U	U
sticky purple geranium, sticky geranium	*Geranium viscosissimum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fowl mannagrass	*Glyceria elata(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread	*Hesperostipa comata ssp. comata*	Entire plant	U	U	U	P	P	P	U	U	U	U	U	U
hairy false goldenaster, hairy goldenaster	*Heterotheca villosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
waterleaf	*Hydrophyllum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
common juniper	*Juniperus communis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	D	D	D	U	U	U	U	U	U	D	D	D
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike fescue, kingspike fescue	*Leucopoa kingii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
flax	*Linum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
dotted blazing star, dotted gayfeather	*Liatris punctata*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
desertparsley, biscuitroot	*Lomatium*	Entire plant	U	U	U	D	D	D	D	D	D	U	U	U
lupine	*Lupinus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mint	*Mentha*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain muhly	*Muhlenbergia montana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
locoweed	*Oxytropis*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
nailwort	*Paronychia*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
silverleaf Indian breadroot	*Pediomelum argophyllum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
beardtongue, penstemon	*Penstemon*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
alpine timothy	*Phleum alpinum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
phlox	*Phlox*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
Sandberg bluegrass	*Poa ampla(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American bistort	*Polygonum bistortoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
fowl bluegrass	*Poa palustris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American plum	*Prunus americana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
chokecherry	*Prunus virginiana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
currant	*Ribes*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
dock	*Rumex*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
willow	*Salix*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
little bluestem	*Schizachyrium scoparium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
stonecrop	*Sedum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
ragwort	*Senecio*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N

blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
goldenrod	*Solidago*	Entire plant	N	N	N	U	U	U	N	N	N	N	N	N
sand dropseed	*Sporobolus cryptandrus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie cordgrass	*Spartina pectinata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Stenotus acaulis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
common tansy	*Tanacetum vulgare*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain goldenbanner	*Thermopsis montana var. montana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
spike trisetum	*Trisetum spicatum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet	*Viola*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
meadow deathcamas	*Zigadenus venenosus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T

Animal Kind: ALLCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Letterman's needlegrass	*Achnatherum lettermanii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
common yarrow, western yarrow, yarrow	*Achillea millefolium*	Entire plant	N	N	N	U	U	U	U	U	U	N	N	N
boxelder	*Acer negundo*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
blunt chaff flower	*Achyranthes nelsonii(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Richardson's needlegrass	*Achnatherum richardsonii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
pale agoseris, pale mountain dandelion	*Agoseris glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand bluestem	*Andropogon hallii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
pussytoes	*Antennaria*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
field sagewort	*Artemisia campestris*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
silver sagebrush	*Artemisia cana ssp. cana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sandwort	*Arenaria*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
white sagebrush, cudweed sagewort	*Artemisia ludoviciana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
black sagebrush	*Artemisia nova*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threetip sagebrush	*Artemisia tripartita*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
balsamroot	*Balsamorhiza*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertbroom	*Baccharis sarothroides*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
sideoats grama	*Bouteloua curtipendula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Porter brome	*Bromus anomalus(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Pumpelly's brome	*Bromus inermis ssp. pumpellianus var. pumpellianus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
mountain brome	*Bromus marginatus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

buglossoides	*Buglossoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
water sedge	*Carex aquatilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
wheat sedge	*Carex atherodes*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
reedgrass	*Calamagrostis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
dunhead sedge, dunehead sedge	*Carex phaeocephala*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
northern reedgrass	*Calamagrostis stricta ssp. inexpansa*	Entire plant	U	U	U	P	P	P	D	D	D	U	U	U
field chickweed	*Cerastium arvense*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain mahogany	*Cercocarpus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
western white clematis	*Clematis ligusticifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bastard toadflax	*Comandra*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
pale bastard toadflax	*Comandra umbellata ssp. pallida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tapertip hawksbeard	*Crepis acuminata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
hawthorn	*Crataegus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie clover	*Dalea*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
onespike danthonia, onespike oatgrass	*Danthonia unispicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
larkspur	*Delphinium*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
Montana wheatgrass	*Elymus albicans*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
California waterwort	*Elatine californica*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue wildrye	*Elymus glaucus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus ssp. trachycaulus*	Entire plant	D	D	D	P	P	P	D	D	D	D	D	D
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sanddune wallflower, western wallflower	*Erysimum capitatum var. capitatum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fleabane	*Erigeron*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
buckwheat	*Eriogonum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Idaho fescue	*Festuca idahoensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
green ash	*Fraxinus pennsylvanica*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sticky purple geranium, sticky geranium	*Geranium viscosissimum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
fowl mannagrass	*Glyceria elata(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
needle and thread	*Hesperostipa comata ssp. comata*	Entire plant	D	D	D	P	P	P	D	D	D	D	D	D
hairy false														

goldenaster, hairy goldenaster	*Heterotheca villosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
waterleaf	*Hydrophyllum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
common juniper	*Juniperus communis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
spike fescue, kingspike fescue	*Leucopoa kingii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
flax	*Linum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
dotted blazing star, dotted gayfeather	*Liatris punctata*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
desertparsley, biscuitroot	*Lomatium*	Entire plant	U	U	U	D	D	D	U	U	U	U	U	U
lupine	*Lupinus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mint	*Mentha*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mountain muhly	*Muhlenbergia montana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
locoweed	*Oxytropis*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
nailwort	*Paronychia*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
silverleaf Indian breadroot	*Pediomelum argophyllum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
beardtongue, penstemon	*Penstemon*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
alpine timothy	*Phleum alpinum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
phlox	*Phlox*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	T	T	T	T	T	T	U	U	U
Sandberg bluegrass	*Poa ampla(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
American bistort	*Polygonum bistortoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
fowl bluegrass	*Poa palustris*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American plum	*Prunus americana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
chokecherry	*Prunus virginiana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
currant	*Ribes*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
dock	*Rumex*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
stonecrop	*Sedum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
ragwort	*Senecio*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
goldenrod	*Solidago*	Entire plant	N	N	N	U	U	U	N	N	N	N	N	N
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie cordgrass	*Spartina pectinata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
stemless mock goldenweed	*Stenotus acaulis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
common tansy	*Tanacetum vulgare*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain goldenbanner	*Thermopsis montana var. montana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
spike trisetum	*Trisetum spicatum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet	*Viola*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
meadow deathcamas	*Zigadenus venenosus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T

Animal Kind: ALLDeer

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Letterman's needlegrass	*Achnatherum lettermanii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
common yarrow, western yarrow, yarrow	*Achillea millefolium*	Entire plant	N	N	N	U	U	U	U	U	U	N	N	N
boxelder	*Acer negundo*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
blunt chaff flower	*Achyranthes nelsonii(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Richardson's needlegrass	*Achnatherum richardsonii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
pale agoseris, pale mountain dandelion	*Agoseris glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand bluestem	*Andropogon hallii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
pussytoes	*Antennaria*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
field sagewort	*Artemisia campestris*	Entire plant	N	N	N	U	U	U	U	U	U	N	N	N
silver sagebrush	*Artemisia cana ssp. cana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sandwort	*Arenaria*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
white sagebrush, cudweed sagewort	*Artemisia ludoviciana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
black sagebrush	*Artemisia nova*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
threetip sagebrush	*Artemisia tripartita*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
balsamroot	*Balsamorhiza*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertbroom	*Baccharis sarothroides*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
sideoats grama	*Bouteloua curtipendula*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Porter brome	*Bromus anomalus(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Pumpelly's brome	*Bromus inermis ssp. pumpellianus var. pumpellianus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mountain brome	*Bromus marginatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buglossoides	*Buglossoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
water sedge	*Carex aquatilis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
wheat sedge	*Carex atherodes*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
reedgrass	*Calamagrostis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Nebraska sedge	*Carex nebrascensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
dunhead sedge, dunehead sedge	*Carex phaeocephala*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
northern reedgrass	*Calamagrostis stricta ssp. inexpansa*	Entire plant	U	U	U	D	D	D	U	U	U	U	U	U
field chickweed	*Cerastium arvense*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain mahogany	*Cercocarpus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
western white clematis	*Clematis ligusticifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bastard toadflax	*Comandra*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
pale bastard toadflax	*Comandra umbellata ssp. pallida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tapertip hawksbeard	*Crepis acuminata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hawthorn	*Crataegus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie clover	*Dalea*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
onespike danthonia, onespike oatgrass	*Danthonia unispicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
larkspur	*Delphinium*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
Montana wheatgrass	*Elymus albicans*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
California waterwort	*Elatine californica*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
blue wildrye	*Elymus glaucus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus ssp. trachycaulus*	Entire plant	U	U	U	D	D	D	U	U	U	U	U	U
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sanddune wallflower, western wallflower	*Erysimum capitatum var. capitatum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fleabane	*Erigeron*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
buckwheat	*Eriogonum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Idaho fescue	*Festuca idahoensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
green ash	*Fraxinus pennsylvanica*	Entire plant	U	U	U	D	D	D	D	D	D	U	U	U
sticky purple geranium, sticky														

geranium	*Geranium viscosissimum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
fowl mannagrass	*Glyceria elata(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread	*Hesperostipa comata ssp. comata*	Entire plant	U	U	U	P	P	P	U	U	U	U	U	U
hairy false goldenaster, hairy goldenaster	*Heterotheca villosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
waterleaf	*Hydrophyllum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
common juniper	*Juniperus communis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike fescue, kingspike fescue	*Leucopoa kingii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
flax	*Linum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
dotted blazing star, dotted gayfeather	*Liatris punctata*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
desertparsley, biscuitroot	*Lomatium*	Entire plant	U	U	U	D	D	D	D	D	D	U	U	U
lupine	*Lupinus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mint	*Mentha*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain muhly	*Muhlenbergia montana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
locoweed	*Oxytropis*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
nailwort	*Paronychia*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
silverleaf Indian breadroot	*Pediomelum argophyllum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
beardtongue, penstemon	*Penstemon*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
alpine timothy	*Phleum alpinum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
phlox	*Phlox*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
Sandberg bluegrass	*Poa ampla(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American bistort	*Polygonum bistortoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
fowl bluegrass	*Poa palustris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American plum	*Prunus americana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
chokecherry	*Prunus virginiana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

currant	*Ribes*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
dock	*Rumex*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
little bluestem	*Schizachyrium scoparium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
stonecrop	*Sedum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
ragwort	*Senecio*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
goldenrod	*Solidago*	Entire plant	N	N	N	U	U	U	N	N	N	N	N	N
sand dropseed	*Sporobolus cryptandrus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie cordgrass	*Spartina pectinata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Stenotus acaulis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
common tansy	*Tanacetum vulgare*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain goldenbanner	*Thermopsis montana var. montana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
spike trisetum	*Trisetum spicatum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet	*Viola*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
meadow deathcamas	*Zigadenus venenosus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T

Animal Kind: ALLHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Letterman's needlegrass	*Achnatherum lettermanii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
common yarrow, western yarrow, yarrow	*Achillea millefolium*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
boxelder	*Acer negundo*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
blunt chaff flower	*Achyranthes nelsonii(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Richardson's needlegrass	*Achnatherum richardsonii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
pale agoseris, pale mountain dandelion	*Agoseris glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand bluestem	*Andropogon hallii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
pussytoes	*Antennaria*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
field sagewort	*Artemisia campestris*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
silver sagebrush	*Artemisia cana ssp. cana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sandwort	*Arenaria*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
white sagebrush, cudweed sagewort	*Artemisia ludoviciana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
black sagebrush	*Artemisia nova*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threetip sagebrush	*Artemisia tripartita*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

balsamroot	*Balsamorhiza*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertbroom	*Baccharis sarothroides*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
sideoats grama	*Bouteloua curtipendula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Porter brome	*Bromus anomalus(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Pumpelly's brome	*Bromus inermis ssp. pumpellianus var. pumpellianus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mountain brome	*Bromus marginatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buglossoides	*Buglossoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
water sedge	*Carex aquatilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
wheat sedge	*Carex atherodes*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
reedgrass	*Calamagrostis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
dunhead sedge, dunehead sedge	*Carex phaeocephala*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
northern reedgrass	*Calamagrostis stricta ssp. inexpansa*	Entire plant	U	U	U	P	P	P	D	D	D	U	U	U
field chickweed	*Cerastium arvense*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain mahogany	*Cercocarpus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
western white clematis	*Clematis ligusticifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bastard toadflax	*Comandra*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
pale bastard toadflax	*Comandra umbellata ssp. pallida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tapertip hawksbeard	*Crepis acuminata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
hawthorn	*Crataegus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie clover	*Dalea*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
onespike danthonia, onespike oatgrass	*Danthonia unispicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
larkspur	*Delphinium*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
Montana wheatgrass	*Elymus albicans*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
California waterwort	*Elatine californica*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue wildrye	*Elymus glaucus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus ssp. trachycaulus*	Entire plant	D	D	D	P	P	P	D	D	D	D	D	D
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sanddune wallflower, western wallflower	*Erysimum capitatum var. capitatum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fleabane	*Erigeron*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
buckwheat	*Eriogonum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

Idaho fescue	*Festuca idahoensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
green ash	*Fraxinus pennsylvanica*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sticky purple geranium, sticky geranium	*Geranium viscosissimum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fowl mannagrass	*Glyceria elata(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
needle and thread	*Hesperostipa comata ssp. comata*	Entire plant	D	D	D	P	P	P	D	D	D	D	D	D
hairy false goldenaster, hairy goldenaster	*Heterotheca villosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
waterleaf	*Hydrophyllum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
common juniper	*Juniperus communis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
spike fescue, kingspike fescue	*Leucopoa kingii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
flax	*Linum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
dotted blazing star, dotted gayfeather	*Liatris punctata*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
desertparsley, biscuitroot	*Lomatium*	Entire plant	U	U	U	D	D	D	U	U	U	U	U	U
lupine	*Lupinus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mint	*Mentha*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mountain muhly	*Muhlenbergia montana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
locoweed	*Oxytropis*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
nailwort	*Paronychia*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
silverleaf Indian breadroot	*Pediomelum argophyllum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
beardtongue, penstemon	*Penstemon*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
alpine timothy	*Phleum alpinum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
phlox	*Phlox*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
Sandberg bluegrass	*Poa ampla(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
American bistort	*Polygonum bistortoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
fowl bluegrass	*Poa palustris*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American plum	*Prunus americana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
chokecherry	*Prunus virginiana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
currant	*Ribes*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
dock	*Rumex*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
willow	*Salix*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
stonecrop	*Sedum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
ragwort	*Senecio*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
goldenrod	*Solidago*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie cordgrass	*Spartina pectinata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
stemless mock goldenweed	*Stenotus acaulis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
common tansy	*Tanacetum vulgare*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain goldenbanner	*Thermopsis montana var. montana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
spike trisetum	*Trisetum spicatum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet	*Viola*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
meadow deathcamas	*Zigadenus venenosus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T

Animal Kind: ALLSheep

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Letterman's needlegrass	*Achnatherum lettermanii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
common yarrow, western yarrow, yarrow	*Achillea millefolium*	Entire plant	N	N	N	U	U	U	U	U	U	N	N	N
boxelder	*Acer negundo*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
blunt chaff flower	*Achyranthes nelsonii(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Richardson's needlegrass	*Achnatherum richardsonii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
pale agoseris, pale mountain dandelion	*Agoseris glauca*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand bluestem	*Andropogon hallii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
pussytoes	*Antennaria*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
field sagewort	*Artemisia campestris*	Entire plant	N	N	N	U	U	U	U	U	U	N	N	N
silver sagebrush	*Artemisia cana ssp. cana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sandwort	*Arenaria*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
white sagebrush, cudweed sagewort	*Artemisia ludoviciana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
black sagebrush	*Artemisia nova*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
threetip sagebrush	*Artemisia tripartita*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
balsamroot	*Balsamorhiza*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertbroom	*Baccharis sarothroides*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
sideoats grama	*Bouteloua curtipendula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Porter brome	*Bromus anomalus(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Pumpelly's brome	*Bromus inermis ssp. pumpellianus var. pumpellianus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
mountain brome	*Bromus marginatus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
buglossoides	*Buglossoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
water sedge	*Carex aquatilis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
wheat sedge	*Carex atherodes*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
reedgrass	*Calamagrostis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
dunhead sedge, dunehead sedge	*Carex phaeocephala*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
northern reedgrass	*Calamagrostis stricta ssp. inexpansa*	Entire plant	U	U	U	D	D	D	U	U	U	U	U	U
field chickweed	*Cerastium arvense*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain mahogany	*Cercocarpus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
western white clematis	*Clematis ligusticifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bastard toadflax	*Comandra*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
pale bastard toadflax	*Comandra umbellata ssp. pallida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tapertip hawksbeard	*Crepis acuminata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
hawthorn	*Crataegus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie clover	*Dalea*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
onespike danthonia, onespike oatgrass	*Danthonia unispicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
larkspur	*Delphinium*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
Montana wheatgrass	*Elymus albicans*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
California waterwort	*Elatine californica*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue wildrye	*Elymus glaucus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus ssp. trachycaulus*	Entire plant	U	U	U	P	P	P	D	D	D	D	D	D
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sanddune wallflower, western wallflower	*Erysimum capitatum var. capitatum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

fleabane	*Erigeron*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
buckwheat	*Eriogonum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Idaho fescue	*Festuca idahoensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
green ash	*Fraxinus pennsylvanica*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sticky purple geranium, sticky geranium	*Geranium viscosissimum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
fowl mannagrass	*Glyceria elata(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread	*Hesperostipa comata ssp. comata*	Entire plant	U	U	U	P	P	P	D	D	D	U	U	U
hairy false goldenaster, hairy goldenaster	*Heterotheca villosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
waterleaf	*Hydrophyllum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
common juniper	*Juniperus communis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
spike fescue, kingspike fescue	*Leucopoa kingii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
flax	*Linum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
dotted blazing star, dotted gayfeather	*Liatris punctata*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
desertparsley, biscuitroot	*Lomatium*	Entire plant	U	U	U	D	D	D	D	D	D	U	U	U
lupine	*Lupinus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mint	*Mentha*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bluebells	*Mertensia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mountain muhly	*Muhlenbergia montana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
locoweed	*Oxytropis*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
nailwort	*Paronychia*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
silverleaf Indian breadroot	*Pediomelum argophyllum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
beardtongue, penstemon	*Penstemon*	Entire plant	U	U	U	P	P	P	P	P	P	U	U	U
alpine timothy	*Phleum alpinum*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
phlox	*Phlox*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
Sandberg bluegrass	*Poa ampla(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
American bistort	*Polygonum bistortoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
fowl bluegrass	*Poa palustris*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

American plum	*Prunus americana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
chokecherry	*Prunus virginiana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
currant	*Ribes*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
dock	*Rumex*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
stonecrop	*Sedum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
ragwort	*Senecio*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
blue-eyed grass	*Sisyrinchium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
goldenrod	*Solidago*	Entire plant	N	N	N	U	U	U	N	N	N	N	N	N
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie cordgrass	*Spartina pectinata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
stemless mock goldenweed	*Stenotus acaulis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
common tansy	*Tanacetum vulgare*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mountain goldenbanner	*Thermopsis montana var. montana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
spike trisetum	*Trisetum spicatum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet	*Viola*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
meadow deathcamas	*Zigadenus venenosus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T

Legend: P = Preferred D = Desirable U = Undesirable N = Not consumed E = Emergency T = Toxic
X = Used, but degree of utilization unknown

Hydrology Functions:

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B and C, with localized areas in hydrologic group D. Infiltration ranges from moderately slow to moderate. Runoff potential for this site varies from low to moderate depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong sod and dominate the site. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1-2% of the soil surface.

Recreational Uses:

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood Products:

No appreciable wood products are present on the site.

Other Products:

None noted.

Other Information:

Supporting Information

Associated Sites:

Site Name	Site ID	Site Narrative
Clayey (Cy) 15-19” Northern Plains Precipitation Zone	R043BY404WY	
Lowland (LL) 15-19” Northern Plains Precipitation Zone	R043BY428WY	
Overflow (Ov) 15-19” Northern Plains Precipitation Zone	R043BY430WY	
Sandy (Sy) 15-19” Northern Plains Precipitation Zone	R043BY450WY	
Shallow Loamy (SwLy) 15-19” Northern Plains Precipitation Zone	R043BY462WY	

Similar Sites:

Site Name	Site ID	Site Narrative
Loamy (Ly) 10-14” Northern Plains Precipitation Zone	R058BY122WY	Loamy 10-14” Northern Plains P.Z., has lower production.

State Correlation:

This site has been correlated with the following states:
WY

Inventory Data References:

Inventory Data References (narrative)

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel was also used. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

Inventory Data References
Data Source Number of Records Sample Period State County
SCS-RANGE-417 1971-1994 WY
Ocular estimates 5 1990-1999 WY

Type Locality:

Relationship to Other Established Classifications:

Other References:

Site Description Approval:

Author	Date	Approval	Date
G. Mitchell	9/1/2004	E. Bainter	3/17/2008

Reference Sheet

Author(s)/participant(s):

Contact for lead author:

Date:4/1/2005 **MLRA:**043B **Ecological Site:**Loamy (Ly) 15-19” Northern Plains Precipitation ZoneR043BY422WY This *must* be verified based on soils and climate (see Ecological Site Description). Current plant community cannot be used to identify the ecological site.

Composition (indicators 10 and 12) based on: XAnnual Production, Foliar Cover, Biomass

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Indicators. For each indicator, describe the potential for the site. Where possible, (1) use numbers, (2) include expected range of values for above- and below-average years for **each** community and natural disturbance regimes within the reference state, when appropriate and (3) cite data. Continue descriptions on separate sheet.

1. **Number and extent of rills:** Rills should not be present
2. **Presence of water flow patterns:** Barely observable
3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent
4. **Bare ground from Ecological Site Description or other studies (rock, litter, standing dead, lichen, moss, plant canopy are not bare ground):** Bare ground is 15-25% occurring in small areas throughout site
5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present
6. **Extent of wind scoured, blowouts and/or depositional areas:** None
7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Plant cover and litter is at 75% or greater of soil surface and maintains soil surface integrity. Soil Stability class is anticipated to be 5 or greater.

9. **Soil surface structure and SOM content (include type and strength of structure, and A-horizon color and thickness):** Use Soil Series description for depth and color of A-horizon

10. **Effect on plant community composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Grass canopy and basal cover should reduce raindrop impact and slow overland flow providing increased time for infiltration to occur. Healthy deep rooted native grasses enhance infiltration and reduce runoff. Infiltration is Moderate.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer or soil surface crusting should be present.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground weight using symbols: >>, >, = to indicate much greater than, greater than, and equal to) with dominants and sub-dominants and "others" on separate lines:**
    Dominant:
    Sub-dominant:
    Other:
    Additional: Mid-stature Bunch grasses >> Mid-stature Rhizomatous grasses > Shrubs > Short stature grasses/grasslikes > Forbs

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very Low

14. **Average percent litter cover (30-40 %) and depth (0.25 to 1.0 inches):** Average litter cover is 30-40% with depths of 0.25 to 1.0 inches

15. **Expected annual production (this is TOTAL above-ground production, not just forage production):** 2200 lbs/ac

16. **Potential invasive (including noxious) species (native and non-native). List Species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicator, we are describing what in NOT expected in the reference state for the ecological site:** Blue grama, Big sagebrush, Prickly Pear, Cheatgrass, and Species found on Noxious Weed List

17. Perennial plant reproductive capability: All species are capable of reproducing

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Reference Sheet Approval:

Approval	Date
E. Bainter	3/17/2008

United States Department of Agriculture
NRCS Natural Resources Conservation Service

Ecological Site Description

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION (Old Format Report)

ECOLOGICAL SITE CHARACTERISTICS

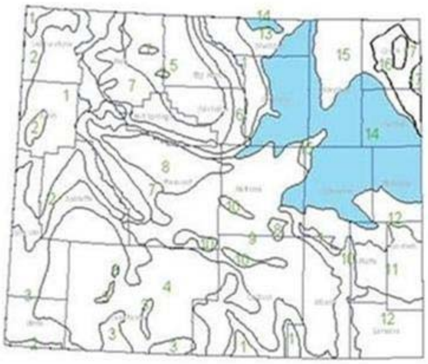
Site Type: Rangeland

Site Name: Loamy (Ly) 10-14” Northern Plains Precipitation Zone

Site ID: R058BY122WY

Major Land Resource Area: 058B-Northern Rolling High Plains, Southern Part

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic Features

This site occurs on gently undulating rolling land.

Land Form: (1) Hill
(2) Alluvial fan
(3) Ridge

	Minimum	Maximum
Elevation (feet):	3800	5100
Slope (percent):	0	30
Water Table Depth (inches):		
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		

Depth (inches):	0	0
Frequency:	None	None
Duration:	None	None
Runoff Class:	Negligible	High
Aspect:	No Influence on this site	

Climatic Features

Annual precipitation ranges from 10-14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more drought years than those with more than normal precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.

Wind speed averages about 8 mph, ranging from 10 mph during the spring to 7 mph during late summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 75 mph.

Growth of native cool season plants begins about April 1 and continues to about July 1. Native warm season plants begin growth about May 15 and continue to about August 15. Green up of cool season plants may occur in September and October of most years.

The following information is from the “Clearmont 5 SW” climate station:
Frost-free period (32 F): 76 - 132 days; (5 yrs. out of 10, these days will occur between May 30 – September 11)
Freeze-free period 28 F): 110 - 145 days; (5 yrs. out of 10, these days will occur between May 16 – September 21)
Mean annual precipitation: 12.4 inches
Mean annual air temperature: 43.2 F (28.4 F Avg. Min. – 57.9 F Avg. Max.)
For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. Other climate station(s) representative of this precipitation zone include: “Dull Center”

	Minimum	Maximum
Frost-free period (days):	76	132
Freeze-free period (days):	110	145
Mean annual precipitation (inches):	10.0	14.0

Monthly precipitation (inches) and temperature (°F):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precip. Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Precip. Max.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Temp. Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Temp. Max.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Climate Stations:

Influencing Water Features

Stream Type: None

Wetland Description:	System	Subsystem	Class

Representative Soil Features

The soils of this site are deep to moderately deep (greater than 20" to bedrock), well drained & moderately permeable. Layers of the soil most influential to the plant community varies from 3 to 6 inches thick. These layers consist of the A horizon with very fine sandy loam, loam, or silt loam texture and may also include the upper few inches of the B horizon with sandy clay loam, silty clay loam or clay loam texture.
Major Soil Series correlated to this site includes: Bidman, Cambria, Cushman, Forkwood, Kishona, Parmleed, Theedle and Zigweid.

Other Soil Series correlated to this site in MLRA 58B include: Absted, Arvada, Ascalon, Big Horn, Bowbac, Briggsdale, Cambria Variant, Cedak Dry, Clarkelen, Connerton, Docpar, El Rancho, Emigha, Emigrant, Forkwood Variant, Fort Collins, Garrett, Glendo, Harlan, Harlan Dry, Haverdad, Hiland, Jonpol, Kadoka, Keota, Keyner, Kim, Kirtley, Larim, Larimer, Lawver, Lohsman, Maysdorf, Neville, Noden, Nuncho, Platmak, Platmak Dry, Pugsley, Recluse, Recluse Dry, Redbow, Reddale, Renohill, Roughlock, Senlar, Spearman, Stoneham, Teckla, Thirtynine, Ulm, Ulm Dry, Wages, Wolf, Wolf Variant, Wolf Dry, and Wyotite.

Parent Materials:
Kind:
Origin:

Surface Texture: (1) Loam
(2) GravellySandy loam
(3) CobblyVery fine sandy loam

Subsurface Texture Group: Loamy

	Minimum	Maximum
Surface Fragments <=3" (% Cover):	0	0
Surface Fragments > 3" (% Cover):	0	10
Subsurface Fragments <=3" (% Volume):	0	15
Subsurface Fragments > 3" (% Volume):	0	10

Drainage Class: Moderately well drained To Well drained

Permeability Class: Moderately slow To Moderate

	Minimum	Maximum
Depth (inches):	20	60

Electrical Conductivity (mmhos/cm):	0	4
Sodium Absorption Ratio:	0	5
Calcium Carbonate Equivalent (percent):	0	10
Soil Reaction (1:1 Water):	6.6	8.4
Soil Reaction (0.01M CaCl2):		
Available Water Capacity (inches):	3.0	6.3

Plant Communities

Ecological Dynamics of the Site

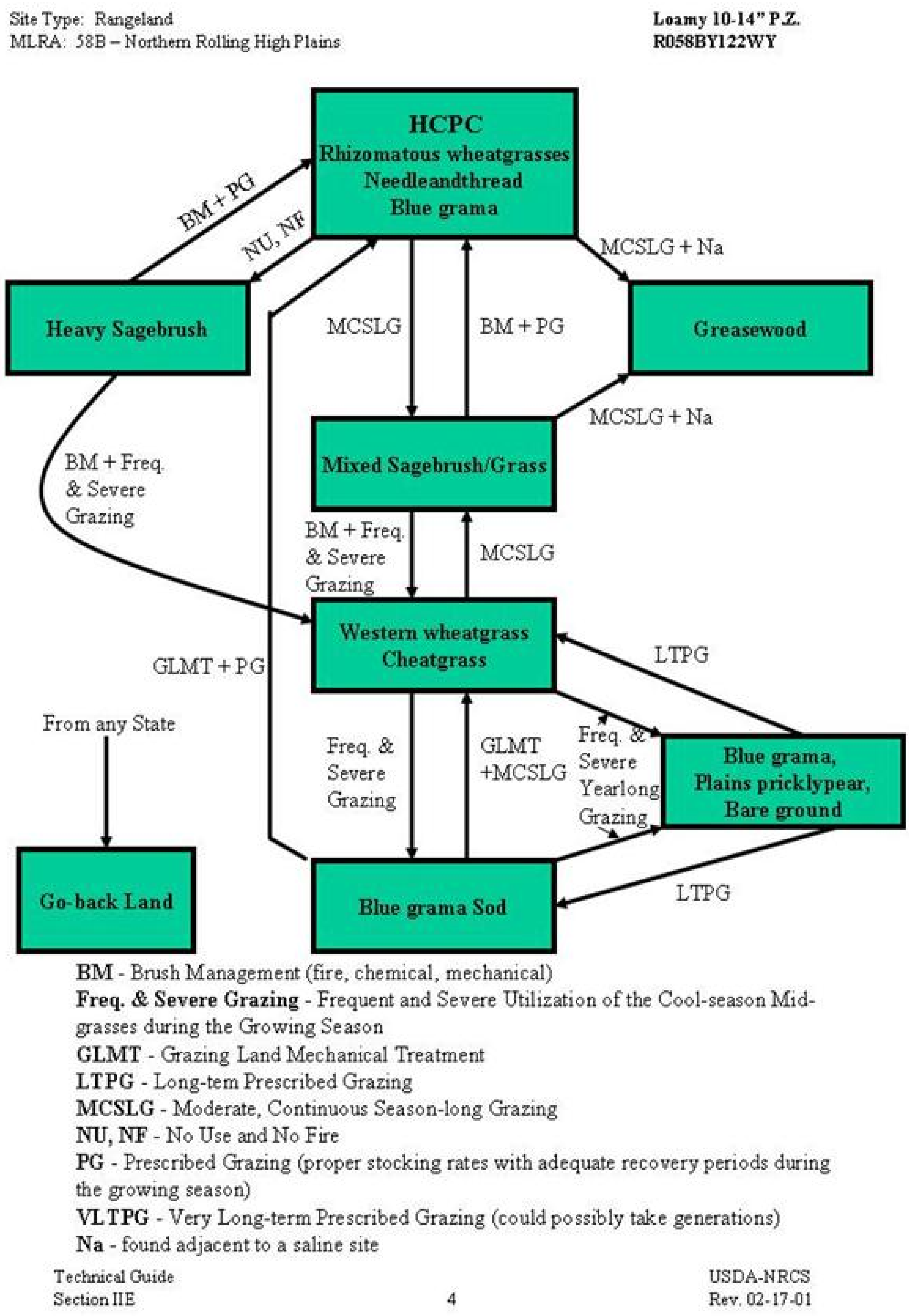
As this site deteriorates because of a combination of frequent and severe grazing, species such as blue grama and big sagebrush will increase. Cool-season grasses such as green needlegrass, needleandthread, and rhizomatous wheatgrasses will decrease in frequency and production.

Big sagebrush may become dominant on some areas with an absence of fire. Wildfires are actively controlled in recent times so chemical control using herbicides has replaced the historic role of fire on this site. Recently, prescribed burning has regained some popularity.

Due to the amount and pattern of the precipitation, the big sagebrush component typically is not resilient once it has been removed if a healthy and vigorous stand of grass exists and is maintained. The exception to this is where the herbaceous component is severely degraded at the time of treatment, growing conditions are unfavorable after treatment, and/or recovery periods are inadequate.

The Historic Climax Plant Community (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

The following is a State and Transition Model Diagram that illustrates the common plant communities (states) that can occur on the site and the transitions between these communities. The ecological processes will be discussed in more detail in the plant community narratives following the diagram.



Site Type: Rangeland
MLRA: 58B – Northern Rolling High Plains

Loamy 10-14" P.Z.
R058BY122WY

BM - Brush Management (fire, chemical, mechanical)
Freq. & Severe Grazing - Frequent and Severe Utilization of the Cool-season Mid-grasses during the Growing Season
GLMT - Grazing Land Mechanical Treatment
LTPG - Long-tem Prescribed Grazing
MCSLG - Moderate, Continuous Season-long Grazing
NU, NF - No Use and No Fire
PG - Prescribed Grazing (proper stocking rates with adequate recovery periods during the growing season)
VLTPG - Very Long-term Prescribed Grazing (could possibly take generations)
Na - found adjacent to a saline site

Rhizomatous wheatgrasses/Needleandthread/Blue Grama Plant Community

This plant community is the interpretive plant community for this site and is considered to be the Historic Climax Plant Community (HCPC). This plant community evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. This plant community can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. The potential vegetation is about 75% grasses or grass-like plants, 15% forbs, and 10% woody plants. This state is dominated by cool season mid-grasses.

The major grasses include western wheatgrass, needleandthread, and green needlegrass. Other grasses occurring in this state include Cusick’s and Sandberg’s bluegrass, bluebunch wheatgrass, and blue grama. A variety of forbs and half-shrubs also occur, as shown in the preceding table. Big sagebrush is a conspicuous element of this state, occurs in a mosaic pattern, and makes up 5 to 10% of the annual production. Plant diversity is high.

The total annual production (air-dry weight) of this state is about 1,200 lbs./acre, but it can range from about 700 lbs./acre in unfavorable years to about 1,500 lbs./acre in above average years.

This plant community is extremely stable and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Transitions or pathways leading to other plant communities are as follows:

- No use and no fire for 20 years or more will convert this plant community to the Heavy Sagebrush Plant Community.

- Moderate, continuous season-long grazing will convert the plant community to the Mixed Sagebrush/Grass Plant Community.

- Moderate continuous season-long grazing, where greasewood occurs adjacent to the site, will convert the plant community to the Greasewood Plant Community.

- When cropped annually and then abandoned without reseeding, the site is converted to the Go-back Land Plant Community.

Rhizomatous wheatgrasses/Needleandthread/Blue Grama Plant CommunityPlant Species Composition:

Grass/Grasslike

				Annual Production in Pounds Per Acre	
Group	Group Name	Common Name	Scientific Name	Low	High
1				175	375
		streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	175	375
		western wheatgrass	*Pascopyrum smithii*	175	375
2				105	225
		green needlegrass	*Nassella viridula*	105	225
3				175	375

		needle and thread, needleandthread	*Hesperostipa comata*	175	375
4				70	150
		Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	70	150
5				105	225
		blue grama	*Bouteloua gracilis*	105	225
6				175	375
		Indian ricegrass	*Achnatherum hymenoides*	35	75
		hairy grama	*Bouteloua hirsuta*	35	75
		needleleaf sedge	*Carex duriuscula*	35	75
		threadleaf sedge	*Carex filifolia*	35	75
		plains reedgrass	*Calamagrostis montanensis*	35	75
		prairie Junegrass	*Koeleria macrantha*	35	75
		Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	35	75
		bluebunch wheatgrass	*Pseudoroegneria spicata*	35	75

Forb

				Annual Production in Pounds Per Acre	
Group	Group Name	Common Name	Scientific Name	Low	High
7				105	225
		yarrow	*Achillea*	35	75
		textile onion	*Allium textile*	35	75
		rosy pussytoes, rose pussytoes	*Antennaria rosea*	35	75
		aster	*Aster*	35	75
		milkvetch	*Astragalus*	35	75
		tapertip hawksbeard	*Crepis acuminata*	35	75
		white prairie clover	*Dalea candida*	35	75
		violet prairie clover, purple prairie clover	*Dalea purpurea*	35	75
		sulphur-flower buckwheat	*Eriogonum umbellatum*	35	75
		scarlet beeblossom, scarlet gaura	*Gaura coccinea*	35	75
		stemless mock goldenweed	*Haplopappus acaulis(syn)*	35	75
		desertparsley, biscuitroot	*Lomatium*	35	75
		bluebells	*Mertensia*	35	75
		large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	35	75
		upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	35	75
		American vetch	*Vicia americana*	35	75

Shrub/Vine

				Annual Production in Pounds Per Acre	
Group	Group Name	Common Name	Scientific Name	Low	High
8				70	150
		big sagebrush	*Artemisia tridentata*	70	150

9			35	75
	winterfat	*Krascheninnikovia lanata*	35	75

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Mixed Sagebrush/Grass Plant Community

Historically, this plant community evolved under grazing by bison and a low fire frequency. Currently, it is found under moderate, season-long grazing by livestock in the absence of fire or brush management. Wyoming big sagebrush is a significant component of this plant community. Cool-season grasses make up the majority of the understory with the balance made up of short warm-season grasses, annual cool-season grasses, and miscellaneous forbs.

Dominant grasses include needleandthread, western wheatgrass, and green needlegrass. Grasses of secondary importance include blue grama, prairie junegrass, and Sandberg bluegrass. Forbs commonly found in this plant community include plains wallflower, hairy goldaster, slimflower scurfpea, and scarlet globemallow. Sagebrush canopy ranges from 20% to 30%. Fringed sagewort is commonly found. Plains pricklypear can also occur.

When compared to the Historic Climax Plant Community, sagebrush and blue grama have increased. Production of cool-season grasses, particularly green needlegrass, has been reduced. The sagebrush canopy protects the cool-season mid-grasses, but this protection makes them unavailable for grazing. Cheatgrass (downy brome) has invaded the site. The overstory of sagebrush and understory of grass and forbs provide a diverse plant community that will support domestic livestock and wildlife such as mule deer and antelope.

The total annual production (air-dry weight) of this state is about 900 pounds per acre, but it can range from about 700 lbs./acre in unfavorable years to about 1,200 lbs./acre in above average years.

This plant community is resistant to change. A significant reduction of big sagebrush can only be accomplished through fire or brush management. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Transitions or pathways leading to other plant communities are as follows:

• Brush management (chemical, fire, or mechanical), followed by prescribed grazing, will convert this plant community to the Rhizomatous wheatgrasses, Needleandthread, Blue grama Plant Community. The probability of this occurring is high. When prescribed fire is used, sufficient fine fuels will need to be present. This may require deferment from grazing prior to treatment. Post management is critical to ensure success. This can range from two or more years of rest to partial growing season deferment, depending on the condition of the understory at the time of treatment and the growing conditions following treatment. In the case of an intense wildfire that occurs when desirable plants are not completely dormant, the length of time required to reach the Rhizomatous wheatgrasses, Needleandthread, Blue grama Plant Community may be increased.

- Brush management, followed by frequent and severe grazing, will convert the plant community to the Western Wheatgrass/Cheatgrass Plant Community. The probability of this occurring is high. If bare areas exist after treatment, along with no recovery periods from grazing, cheatgrass will invade and plants not as resistant to grazing as western wheatgrass will be reduced.

- Moderate continuous season-long grazing, where greasewood occurs adjacent to this state, will convert the plant community to the Greasewood Plant Community.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Heavy Sagebrush Plant Community

This plant community is the result of long-term protection from grazing and fire. Sagebrush eventually dominates this plant community with canopy cover often exceeding 60%. At first, excessive litter builds up, shading out some of the grasses and forbs. Other plants become decadent with low vigor. Bunch grasses often develop dead centers. Eventually, the interspaces between plants increase in size leaving more soil surface exposed. Organic matter oxidizes in the air rather than being incorporated into the soil.

The dominant plants tend to be somewhat similar to those found in the Historic Climax Plant Community. Weedy species, cool-season grasses, and sedges have increased. Blue grama has decreased. Rodent activity has resulted in an increase in soil disturbance. Cactus and sageworts often increase. Noxious weeds such as Dalmatian toadflax, leafy spurge, or Canada thistle may invade the site if a seed source is present. Plant diversity is moderate to high.

The total annual production (air-dry weight) of this state is about 800 pounds per acre, but it can range from about 600 lbs./acre in unfavorable years to about 1,000 lbs./acre in above average years.

This plant community is not resistant to change and is more vulnerable to severe disturbance than the HCPC. The introduction of grazing or fire quickly changes the plant community.

Soil erosion is accelerated because of increased bare ground. Water flow patterns and pedestaling are obvious. Infiltration is reduced and runoff is increased.

Transitions or pathways leading to other plant communities are as follows:

- Brush management, followed by prescribed grazing, will return this plant community to at or near the Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community.

• Brush management, followed by frequent and severe grazing, will convert the plant community to the Western Wheatgrass/Cheatgrass Plant Community. The probability of this occurring is high because of the amount of bare ground exposed to cheatgrass invasion.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Western Wheatgrass/Cheatgrass Plant Community

This plant community is created when the Mixed Sagebrush/Grass Plant Community or the Heavy Sagebrush Plant Community is subjected to fire or brush management not followed by prescribed grazing. Rhizomatous wheatgrasses and annuals will eventually dominate the site.

Compared to the HCPC, cheatgrass has invaded with western wheatgrass and thickspike wheatgrass maintaining at a similar or slightly higher level. Virtually all other cool-season mid-grasses are severely decreased. Blue grama is the same or slightly less than found in the HCPC. Plant diversity is low.

The total annual production (air-dry weight) of this state is about 600 pounds per acre, but it can range from about 450 lbs./acre in unfavorable years to about 750 lbs./acre in above average years.

This plant community is relatively stable with the rhizomatous wheatgrasses being somewhat resistant to overgrazing and the cheatgrass effectively competing against the establishment of perennial cool-season grasses.

An increase in bare ground reduces water infiltration and increases soil erosion. The watershed is usually functioning. The biotic integrity is reduced by the lack of diversity in the plant community.

Transitions or pathways leading to other plant communities are as follows:
• Moderate continuous season-long grazing will eventually return this plant community to the Mixed Sagebrush/Grass Plant Community.

• Frequent and severe grazing will convert this plant community to Blue Grama Sod Plant Community.

• Frequent and severe yearlong grazing will convert this plant community to Blue grama, Plains Pricklypear, Bare Ground Plant Community.

• Long-term, prescribed grazing will eventually return this plant community to at or near the Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Blue Grama Sod Plant Community

This plant community is the result of frequent and severe grazing during the growing season of the cool-season mid-grasses. A dense sod of blue grama dominates it. Pricklypear cactus can become dense enough so that livestock cannot graze forage growing within the cactus clumps.

When compared to the Historic Climax Plant Community, blue grama and threadleaf sedge have increased. All cool-season mid-grasses and forbs have been greatly reduced. Plant diversity is extremely low.

The total annual production (air-dry weight) of this state is about 600 pounds per acre, but it can range from about 450 lbs./acre in unfavorable years to about 750 lbs./acre in above average years.

This sod bound plant community is very resistant to water infiltration. While this sod protects the site itself, off-site areas are affected by excessive runoff that can cause gully erosion. This sod is very resistant to change and may require a grazing land mechanical treatment, such as chiseling, to return the cool-season grass component.

Transitions or pathways leading to other plant communities are as follows:

- Grazing land mechanical treatment (chiseling, etc.) and pricklypear cactus control (if needed), followed by prescribed grazing, will return this plant community to near Historic Climax Plant Community condition.

- Grazing land mechanical treatment, followed by moderate continuous season-long grazing, will convert this plant community to the Western Wheatgrass/Cheatgrass Plant Community.

- Frequent and severe yearlong grazing will eventually convert this state to the Blue Grama, Plains Pricklypear, Bare Ground Plant Community.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Greasewood Plant Community

This plant community can occur where states are subjected to continuous season-long grazing at moderate stocking rates and where greasewood occurs adjacent to the site. It is dominated by an overstory of greasewood and possibly big sagebrush. Rhizomatous wheatgrasses, cheatgrass, and inland saltgrass make up the understory. Salts in the surface will increase due to the shedding of the salt-filled leaves of the greasewood. Plant diversity is high.

The total annual production (air-dry weight) of this state is about 700 pounds per acre, but it can range from about 525 lbs./acre in unfavorable years to about 875 lbs./acre in above average years.

This plant community is resistant to change. A significant reduction of greasewood can only be accomplished through repeated brush control treatments. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

The site is protected from erosion as long as ground cover is maintained. The biotic integrity of this state is somewhat intact because of the woody overstory and perennial grass understory. The watershed is functioning as long as a grass cover is maintained.

- Recovery to near Historic Climax Plant Community condition is difficult due to the resistance of greasewood to herbicides and accumulated effects of salts on the soil.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Blue Grama Sod/Plains Pricklypear/Bare Ground Plant Community

This plant community is the result of frequent and severe yearlong grazing over the long-term. Perennial plants are decreased. Cheatgrass, annual weeds, and bare ground are increased. Plains pricklypear may have increased, rendering much of the forage unusable by livestock.

This plant community is highly variable depending on the severity, frequency, and duration of the grazing and also the condition of the plant community when this level of grazing began. Virtually all plants not resistant to overgrazing may have been eliminated. Dominant plants may include blue grama, threeawns, annuals, and, to a lesser degree, rhizomatous wheatgrasses. Perennial plant diversity is low.

The total annual production (air-dry weight) of this state is about 500 pounds per acre, but it can range from about 375 lbs./acre in unfavorable years to about 625 lbs./acre in above average years.

This state is unhealthy and subject to increased erosion. Runoff is high on this state due to the sod nature of blue grama and bare ground.

Transitions or pathways leading to other plant communities are as follows:

• Long-term prescribed grazing will convert this plant community initially to the Blue Grama Sod Plant Community, when this state is dominated by blue grama sod at the time of treatment.

• Long-term prescribed grazing will convert this plant community to the Western Wheatgrass /Cheatgrass Plant Community, when this state has large amounts of cheatgrass, annual weeds, and bare ground at the time of treatment. Control of plains pricklypear cactus may be necessary.

Reseeding areas with native plant species and proper grazing management may be necessary to accelerate recovery where few desirable plants remain.

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Go-back Land

This plant community occurs on land that has been cropped annually in the past and then abandoned without reseeding. Natural succession has resulted in a plant community dominated by varying combinations of red threeawn, cheatgrass, blue grama, Sandberg bluegrass, and some rhizomatous wheatgrasses. Forage production is low and grasses such as red threeawn and cheatgrass are not used efficiently by livestock.

The total annual production (air-dry weight) of this state is about 600 pounds per acre, but it can range from about 500 lbs./acre in unfavorable years to about 900 lbs./acre in above average years.

The potential for accelerated erosion can be highly variable depending on amount of bare ground present. Biological diversity is low.

Transitions or pathways leading to other plant communities are as follows:

• Prescribed grazing may be used to increase desirable native cool-season grass production. It is usually difficult to return to near Historic Climax Plant Community condition in a timely manner because of past soil loss.

• Grazing land mechanical treatment (i.e., chiseling) may improve forage production where significant rhizomatous wheatgrass is present to respond.

Where there is a lack of perennial grasses, reseeding to tame or native species may be necessary to return these lands to production in the form of pastureland. These pastures are normally seeded to crested wheatgrass, pubescent wheatgrass, or Russian wildrye. They require considerable investment to establish and have a variable life expectancy. They do produce up to 50% more than native range, but their value as forage is somewhat limited due to the single species usually seeded. In some cases, the single species or certain groups of species (e.g., wheatgrasses) may be more vulnerable to infestation by associated insects and/or diseases (e.g., black grass bugs).

Plant Growth Curve:
Growth Curve Number:WY1401
Growth Curve Name: 10-14NP upland sites
Growth Curve Description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	30	35	10	5	5	5	0	0

Ecological Site Interpretations

Animal Community:
Animal Community – Wildlife Interpretations
Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community (HCPC): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing/foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here.

Mixed Sagebrush/Grass Plant Community: The combination of an overstory of sagebrush and an understory of grasses and forbs provide a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer and antelope may use this state for foraging and cover year-round, as would cottontail and jack rabbits. It provides important winter, nesting, brood-rearing, and foraging habitat for sage grouse. Brewer's sparrows' nest in big sagebrush plants, and hosts of other nesting birds utilize stands in the 20-30% cover range.

Heavy Sagebrush Plant Community: This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15% protein and 40-60% digestibility during that time. This community provides excellent escape and thermal cover for large ungulates, as well as nesting and brood rearing habitat for sage grouse.

Western Wheatgrass/Cheatgrass Plant Community: This plant community may be useful for the same large grazers that would use the Historic Climax Plant Community. However, the plant community composition is less diverse, and thus, less apt to meet the seasonal needs of these animals. It may provide some foraging opportunities for sage grouse when it occurs proximal to woody cover. Good grasshopper habitat equals good foraging for birds.

Blue Grama Sod and Go-back Land Plant Communities: These communities provide limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover and if the Historic Climax Plant Community or the Western Wheatgrass/Cheatgrass Plant Community is limiting. Generally, these are not target plant communities for wildlife habitat management.

Greasewood Plant Community: This plant community exhibits a low level of plant species diversity due to the accumulation of salts in the soil. It may provide some thermal and escape cover for deer and antelope if no other woody community is nearby, but in most cases it is not a desirable plant community to select as a wildlife habitat management objective.

Blue Grama, Plains Pricklypear, Bare Ground Plant Community: Benefits to other wildlife are largely due to the subterranean structure created by the prairie dogs, not the sparse vegetation found on this plant community.

Introduced Pasture: These communities are highly variable depending on the species planted. Refer to Forage Suitability Groups for more information.

Animal Community – Grazing Interpretations

The following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using this information along with animal preference data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies can result in an increased carrying capacity. If distribution problems occur, stocking rates must be reduced to maintain plant health and vigor.

Plant Community	Production (lb./ac)	Carrying Capacity* (AUM/ac)
Rhizomatous WG, Needleandthread, Blue Grama	700-1500	.4
Heavy Sagebrush	800-1400	.3
Blue Grama Sod	400-1000	.2
Mixed Sagebrush/Grass	700-1200	.33
Western Wheatgrass/Cheatgrass	600-1200	.2
Blue grama, Plains Pricklypear, Bare ground	300-800	.1
Greasewood	525-875	.3
Go-back Land	500-900	.2

* - Continuous, season-long grazing by cattle under average growing conditions.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for cattle, sheep, or horses. During the dormant period, the forage for livestock use needs to be supplemented with protein because the quality does not meet minimum livestock requirements.

Plant Preference by Animal Kind:

Animal Kind: AllAntelope

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Indian ricegrass	*Achnatherum hymenoides*	Leaves	N	N	N	P	P	P	N	N	N	D	D	D
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand bluestem	*Andropogon hallii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
silver sagebrush	*Artemisia cana*	Leaves	P	P	P	P	P	P	P	P	P	P	P	P
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
twogrooved milkvetch	*Astragalus bisulcatus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	P	P	P	P	P	P	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sideoats grama	*Bouteloua curtipendula*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue grama	*Bouteloua gracilis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Leaves	P	P	P	P	P	P	P	P	P	P	P	P
inland sedge	*Carex interior*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sandreed	*Calamovilfa longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains reedgrass	*Calamagrostis montanensis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Nebraska sedge	*Carex nebrascensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

little bluestem	*Schizachyrium scoparium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
alkali sacaton	*Sporobolus airoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand dropseed	*Sporobolus cryptandrus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
alkali cordgrass	*Spartina gracilis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broadleaf cattail	*Typha latifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

Animal Kind: allCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand bluestem	*Andropogon hallii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sideoats grama	*Bouteloua curtipendula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie sandreed	*Calamovilfa longifolia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass,														

Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
alkali sacaton	*Sporobolus airoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
alkali cordgrass	*Spartina gracilis*	Leaves	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllCattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
broadleaf cattail	*Typha latifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Fruits/Seeds	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllDeer

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand bluestem	*Andropogon hallii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

Fendler threeawn, red

threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Wyoming big sagebrush	*Artemisia tridentata ssp. wyomingensis*	Entire plant	P	P	P	P	P	P	D	D	D	D	D	D
twogrooved milkvetch	*Astragalus bisulcatus*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sideoats grama	*Bouteloua curtipendula*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sandreed	*Calamovilfa longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Nebraska sedge	*Carex nebrascensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
silverberry	*Elaeagnus commutata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
prairie coneflower	*Ratibida*	Entire plant	D	D	D	P	P	P	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
alkali sacaton	*Sporobolus airoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
sand dropseed	*Sporobolus cryptandrus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
alkali cordgrass	*Spartina gracilis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broadleaf cattail	*Typha latifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca,														

small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand bluestem	*Andropogon hallii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
silver sagebrush	*Artemisia cana ssp. cana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	U	U	U	N	N	N	N	N	N	U	U	U
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	D	D	D	U	U	U	U	U	U	D	D	D
sideoats grama	*Bouteloua curtipendula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie sandreed	*Calamovilfa longifolia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail, bottlebrush														

squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertparsley, biscuitroot	*Lomatium*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bluebells	*Mertensia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

willow	*Salix*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
greasewood	*Sarcobatus vermiculatus*	Leaves	U	U	U	U	U	U	U	U	U	U	U	U

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue-eyed grass	*Sisyrinchium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
alkali sacaton	*Sporobolus airoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: allHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
alkali cordgrass	*Spartina gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllHorses

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
broadleaf cattail	*Typha latifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal Kind: AllSheep

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
yarrow	*Achillea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
textile onion	*Allium textile*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
big bluestem	*Andropogon gerardii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand bluestem	*Andropogon hallii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
rosy pussytoes, rose pussytoes	*Antennaria rosea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
silver sagebrush	*Artemisia cana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
tarragon, green sagewort	*Artemisia dracunculus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie sagewort, fringed sagewort	*Artemisia frigida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
birdfoot sagebrush	*Artemisia pedatifida*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Fendler threeawn, red threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
big sagebrush	*Artemisia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Wyoming big sagebrush	*Artemisia tridentata ssp. wyomingensis*	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
twogrooved milkvetch	*Astragalus bisulcatus*	Entire plant	N	N	N	T	T	T	T	T	T	T	T	T
aster	*Aster*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
milkvetch	*Astragalus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gardner's saltbush	*Atriplex gardneri*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue grama	*Bouteloua gracilis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

hairy grama	*Bouteloua hirsuta*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buffalograss	*Buchloe dactyloides(syn)*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluejoint, bluejoint reedgrass	*Calamagrostis canadensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
needleleaf sedge	*Carex duriuscula*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
threadleaf sedge	*Carex filifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
inland sedge	*Carex interior*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
prairie sandreed	*Calamovilfa longifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
plains reedgrass	*Calamagrostis montanensis*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
spike sedge	*Carex nardina*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Nebraska sedge	*Carex nebrascensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
yellow rabbitbrush, green rabbitbrush, low rabbitbrush, Douglas rabbitbrush	*Chrysothamnus viscidiflorus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
water hemlock	*Cicuta*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
poison hemlock	*Conium maculatum*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
tapertip hawksbeard	*Crepis acuminata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
white prairie clover	*Dalea candida*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
violet prairie clover, purple prairie clover	*Dalea purpurea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
tufted hairgrass	*Deschampsia caespitosa(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
inland saltgrass	*Distichlis spicata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bearded wheatgrass	*Elymus caninus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Canada wildrye	*Elymus canadensis*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
silverberry	*Elaeagnus commutata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail, bottlebrush squirreltail	*Elymus elymoides ssp. elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
slender wheatgrass	*Elymus trachycaulus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
horsetail	*Equisetum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
sulphur-flower buckwheat	*Eriogonum umbellatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet beeblossom, scarlet gaura	*Gaura coccinea*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American licorice	*Glycyrrhiza lepidota*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broom snakeweed	*Gutierrezia sarothrae*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
stemless mock goldenweed	*Haplopappus acaulis(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread, needleandthread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
iris	*Iris*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Baltic rush	*Juncus balticus(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Rocky Mountain juniper	*Juniperus scopulorum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie Junegrass	*Koeleria macrantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
winterfat	*Krascheninnikovia lanata*	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
basin wildrye	*Leymus cinereus*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
desertparsley, biscuitroot	*Lomatium*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bluebells	*Mertensia*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P

plains muhly, stoneyhills muhly	*Muhlenbergia cuspidata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
mat muhly	*Muhlenbergia richardsonis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
green needlegrass	*Nassella viridula*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	*Pascopyrum smithii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
ponderosa pine	*Pinus ponderosa*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Sandberg bluegrass	*Poa canbyi(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides ssp. monilifera*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	*Poa secunda*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Sandberg bluegrass	*Poa secunda ssp. juncifolia(syn)*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Nuttall's alkaligrass	*Puccinellia nuttalliana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
upright prairie coneflower, prairie coneflower	*Ratibida columnifera*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
skunkbush sumac	*Rhus trilobata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Woods' rose	*Rosa woodsii var. woodsii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
willow	*Salix*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
greasewood	*Sarcobatus vermiculatus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
little bluestem	*Schizachyrium scoparium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
blue-eyed grass	*Sisyrinchium*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
sand dropseed	*Sporobolus cryptandrus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Pursh seepweed	*Suaeda calceoliformis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western snowberry	*Symphoricarpos occidentalis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
prairie thermopsis	*Thermopsis rhombifolia var. annulocarpa(syn)*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
arrowgrass	*Triglochin*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
narrowleaf cattail	*Typha angustifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broadleaf cattail	*Typha latifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
American vetch	*Vicia americana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
soapweed yucca, small soapweed	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Legend: P = Preferred D = Desirable U = Undesirable N = Not consumed E = Emergency T = Toxic
X = Used, but degree of utilization unknown

Hydrology Functions:

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B and C, with localized areas in hydrologic group D. Infiltration ranges from moderately slow to moderate. Runoff potential for this site varies from low to moderate depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong sod and dominate the site. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1-2% of the soil surface.

Recreational Uses:
This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood Products:
No appreciable wood products are present on the site.

Other Products:
None noted.

Other Information:

Supporting Information

Associated Sites:

Site Name	Site ID	Site Narrative
Clayey (Cy) 10-14” Northern Plains Precipitation Zone	R058BY104WY	Clayey
Lowland (LL) 10-14” Northern Plains Precipitation Zone	R058BY128WY	Lowland
Overflow (Ov) 10-14” Northern Plains Precipitation Zone	R058BY130WY	Overflow
Sandy (Sy) 10-14” Northern Plains Precipitation Zone	R058BY150WY	Sandy
Shallow Loamy (SwLy) 10-14” Northern Plains Precipitation Zone	R058BY162WY	Shallow Loamy

Similar Sites:

Site Name	Site ID	Site Narrative
Loamy (Ly) 15-17” Northern Plains Precipitation Zone	R058BY222WY	Loamy 15-17” Northern Plains P.Z. has higher production.

State Correlation:
This site has been correlated with the following states:
MT

Inventory Data References:
Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel was also used. Those involved in developing this site include: Glen Mitchell, Range Management Specialist, NRCS; Chuck Ring, Range Management Specialist, NRCS; and Everet Bainter, Range Management Specialist. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

Inventory Data References
Data Source Number of Records Sample Period State County
SCS-RANGE-417 12 1971-1994 WY Campbell & others
Ocular estimates 5 1990-1999 WY Campbell & others

Type Locality:

Relationship to Other Established Classifications:

Other References:
Field Offices
Buffalo, Douglas, Gillette, Lusk, Newcastle, Sheridan

Site Description Approval:

Author	Date	Approval	Date
G. Mitchell	4/25/2000	E. Bainter	3/7/2008

Reference Sheet

Author(s)/participant(s):

Contact for lead author:

Date:4/1/2005 **MLRA:**058B **Ecological Site:**Loamy (Ly) 10-14” Northern Plains Precipitation ZoneR058BY122WY This *must* be verified based on soils and climate (see Ecological Site Description). Current plant community cannot be used to identify the ecological site.

Composition (indicators 10 and 12) based on: XAnnual Production, Foliar Cover, Biomass

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Indicators. For each indicator, describe the potential for the site. Where possible, (1) use numbers, (2) include expected range of values for above- and below-average years for **each** community and natural disturbance regimes within the reference state, when appropriate and (3) cite data. Continue descriptions on separate sheet.

1. **Number and extent of rills:** Rills should not be present.
2. **Presence of water flow patterns:** Barely observable.

3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, standing dead, lichen, moss, plant canopy are not bare ground):** Bare ground is 20-30% occurring in small areas throughout site.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Plant cover and litter is at 70% or greater of soil surface and maintains soil surface integrity. Soil Stability class is anticipated to be 5 or greater.

9. **Soil surface structure and SOM content (include type and strength of structure, and A-horizon color and thickness):** Use Soil Series description for depth and color of A-horizon.

10. **Effect on plant community composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Grass canopy and basal cover should reduce raindrop impact and slow overland flow providing increased time for infiltration to occur. Healthy deep rooted native grasses enhance infiltration and reduce runoff. Infiltration is Moderate.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer or soil surface crusting should be present.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground weight using symbols: >>, >, = to indicate much greater than, greater than, and equal to) with dominants and sub-dominants and "others" on separate lines:**
    Dominant: Cool Season Bunch grasses > Cool Season Rhizomatous grasses > Short stature grasses/grasslikes > Forbs = Shrubs
    Sub-dominant:
    Other:
    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very Low.

14. **Average percent litter cover (%) and depth (inches):** Average litter cover is 25-35%

with depths of 0.25 to 1.0 inches.

15. **Expected annual production (this is TOTAL above-ground production, not just forage production):** 1200 lbs/ac

16. **Potential invasive (including noxious) species (native and non-native). List Species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicator, we are describing what in NOT expected in the reference state for the ecological site:** Blue grama, Threadleaf sedge, Fringed sagewort, Prickly Pear, Big sagebrush, Broom Snakeweed, and Species found on Noxious Weed List

17. **Perennial plant reproductive capability:** All species are capable of reproducing.

Reference Sheet Approval:

Approval	Date
E. Bainter	3/7/2008

Appendix 3D

Historic Sites

Buffalo Main Post Office

Buffalo, Wyoming

Date Added to Register

Wednesday, January 01, 2003

Smithsonian Number

48JO245

The Buffalo Main Post Office is included within a thematic study including twelve post offices owned and administered by the U.S. Postal Service (USPS) throughout the State of Wyoming.

Buffalo Main Post Office

Buffalo Main Street Historic District

Buffalo, Wyoming

Date Added to Register

Thursday, April 12, 1984

Smithsonian Number

48JO1079

Buffalo Main Street Historic District

The Buffalo Main Street Historic District contains historically significant buildings primarily dating from 1900 to 1932. This one and a half block district extends diagonally along Main Street at the heart of the larger commercial area. It is divided midway in the block between Fetterman Street and Fort Street on the north. Clear Creek, originally the impetus for locating Buffalo at this site runs under Main Street just south of this boundary. Angus Street serves as the southern boundary. Buffalo's buildings are typical of other commercial structures constructed in Wyoming and the West during the same period, and are representative of the cattle industry's recovery from weather, political battles of the 1880s and 1890s, and the trend for growth experienced at the turn of the century. Facade details represent a simple stylistic approach to commercial design. Most of the buildings are constructed of brick, a few are stone, and some have been stuccoed. The buildings in the Buffalo Main Street Historic District represent a prosperous commercial area supported by the agricultural base of the upper Powder River Basin in northern Wyoming.

Carnegie Public Library

Buffalo, Wyoming

Date Added to Register

Sunday, November 07, 1976

Smithsonian Number

48JO101

Carnegie Public Library

The Johnson County Library Building is situated on the northwest corner of the County Courthouse grounds. It was built in 1909 of native stone. It is a fine example of the Neoclassical style of architecture. On January 28, 1909, the local newspaper of Buffalo reported that Judge Parmalee had returned from visiting *libraries in Cheyenne and Laramie, Wyoming. He said that Andrew Carnegie had agreed to provide $12,500 for erection of a library building in Buffalo, if the County would furnish the site and $1,250 a year for maintenance. Citizens of Johnson County agreed, and a portion of the Courthouse grounds was donated by the County Commissioners upon which to build the library.*

Fort McKinney

West of Buffalo, Wyoming

Date Added to Register

Friday, July 30, 1976

Smithsonian Number

48JO104

Fort McKinney

The year 1876 saw intensive Indian campaigns extended by the army across the whole Northern Plains region. Troops came from posts in the Department of the Platte and swept most of the hostile Sioux and Cheyenne Indians out of present Wyoming, and participated in major engagements in southern Montana as well. By the time the campaigns drew to a seasonal halt in January of 1877, plans were under way for a series of military posts to provide bases from which the troops could prevent the Indians reoccupying their old hunting grounds. One of these posts was located on the west bank of Powder River, opposite the mouth of Dry Fork, and called at first, ''Cantonment Reno.'' Soon renamed ''Fort McKinney'' in honor of Lt. J. A. McKinney (killed in the battle with the Cheyenne on Red Fork of Powder River, November 25, 1876), this post was occupied through the spring of 1878. After considerable study, it was abandoned because of poor water, wood and forage supplies nearby, and the name transferred along with the troops to a new site on a broad terrace above Clear Fork of Powder River where that stream exits from the Big Horn Mountains. The new site was occupied and construction activities under way in July of 1878. The post at peak of development consisted of barracks for seven companies of troops, at least 14 structures for officer quarters, stables, warehouses, laundress quarters, a hospital, bakery, offices, and auxiliary structures.

Troops from Fort McKinney and neighboring posts were responsible for keeping the lately-hostile Sioux and Cheyenne from reverting to their old way of life in a vast region. They were supposed to keep the friendly Crows and Shoshoni from resuming their intermittent warfare with tribal enemies, and to prevent the Arapahoe from becoming embroiled with settlers and other tribes while officials pondered their disposition. They did this work well. They guarded communication lines that included the ''Rock Creek Stage Line'' which provided mail, passenger and express service from Rock Creek on the UPRR to Terry's Landing on the Yellowstone. They built and maintained the first telegraph line into the Powder River country.

HF Bar Ranch

Northwest of Buffalo, Wyoming

Date Added to Register

Wednesday, November 07, 1984

Smithsonian Number

48JO138

HF Bar Ranch

Located in north central Wyoming 20 miles northwest of Buffalo nestled into the foothills of the Big Horn Mountains, the HF Bar Ranch is a working cattle/dude ranch complex consisting of 36 buildings predominately of rustic frame and log construction built primarily between 1898 and 1921. Wyoming state senator and U. S. congressman, Frank Horton, with the financial backing and capital of his brother-in-law and sister-in-law, Chicago investment banker, Warren Gorrell and his wife Demia Gorrell, purchased the 1890s homestead in 1911. Warren and Demia Gorrell and their four children spent most of their summers at the HF Bar Ranch between 1911 and 1929. While the Gorrells continued to reside principally in Chicago, the Horton family lived year-round in Wyoming, as Frank Horton managed the day-to-day operations of the Ranch. Throughout this period, Warren and Demia Gorrell continued as the major stockholders, financial backers and supporters of the HF Bar. With the Stock Market Crash of 1929, Warren and Demia Gorrell sold their shares in the HF Bar Ranch, and associates of Frank Horton purchased them. The HF Bar Ranch is significant as an intact example of a working dude ranch in continuous use for nearly 100 years. It is one of the best remaining representatives of similar operations which flourished during peak years of the cattle ranching frontier, then turned to dude ranching in the face of economic difficulties. The ranch is associated with the state and locally significant tourist industry which brought wealthy easterners and Europeans to the West. Their influence subsequently enriched the social, intellectual, cultural and economic climate of the entire region.

Holland House
Buffalo, Wyoming

Date Added to Register
Thursday, November 04, 1993

Smithsonian Number
48JO1486

The Holland House, constructed in 1883 along the town's main street by successful rancher William H. Holland, was one of the first brick residences built in Buffalo, Wyoming and is a good example of a late Victorian vernacular brick house. The house is significant for its association with the settlement of the town of Buffalo and because of its association with the lives of the Holland family who were active participants in local government during both the nineteenth and twentieth centuries


Holland House

Johnson County Court House
Buffalo, Wyoming

Date Added to Register
Sunday, November 07, 1976

Smithsonian Number
48JO100

The Johnson County Court House, constructed in 1884, is a good example of the Italianate style of architecture. Many of the early photographs of Buffalo, Wyoming, show the Johnson County Court House, a beautiful two-story red brick building, towering over ox teams on a muddy Main Street.


Johnson County Court House

This is one of the oldest structures standing in the state of Wyoming, was the sixth county courthouse to be built, and is the second oldest courthouse in Wyoming retaining its original character and still used as originally designed.

Lake Desmet Segment - Bozeman Trail

Johnson County, Wyoming

Date Added to Register

Sunday, July 23, 1989

Smithsonian Number

48JO134

First ascending and then descending the hilly topography near Lake Desmet, a discernible set of trail ruts make up this segment of the Bozeman Trail. The downhill set of ruts, thought often faint, can be found on the down slope side of the hill overlooking Lake Desmet. This segment features parallel sets of ruts as well as a trough formed by the wagon traffic. The segment is 1.1 miles in length.

Methodist Episcopal Church

Buffalo, Wyoming

Date Added to Register

Monday, September 13, 1976

Smithsonian Number

48JO98

Methodist Episcopal Church

The cornerstone of the Methodist Episcopal Church, also known as the First United Methodist Church, was laid August 17, 1898, and placed within the stone were a Bible, a hymnal, a copy of the Church Discipline, several church papers, and some coins. The church was dedicated on May 28, 1899, having been built by Pastor E. J. Robinson and members of the congregation. The ornamental features and details of the exterior combine with an especially functional plan of the interior to provide beauty, comfort, and convenience for the worshipper. The interior of the church follows the Akron plan, which typifies many Methodist churches in the West. The emphasis in this plan, developed in Akron, Ohio, is on good acoustics, sight lines, and flexibility, along with the focus on the pulpit and communion table. The elevated platform for preaching is placed in the corner of the audience room, with the seating in circular pattern. The plan was originated and developed between 1879 and 1885 by George Washington Kramer, upon the suggestion of the father-in-law of Thomas A. Edison.

Peloux Bridge on Clear Creek

Johnson County, Wyoming

Date Added to Register

Friday, February 22, 1985

Smithsonian Number

48JO999

This bridge was certified as a historic location on Friday February 22, 1985. This location is a protected historic place because of historical significance relating to transportation.

St. Luke's Episcopal Church
Buffalo, Wyoming

Date Added to Register
Sunday, November 07, 1976

Smithsonian Number
48JO99

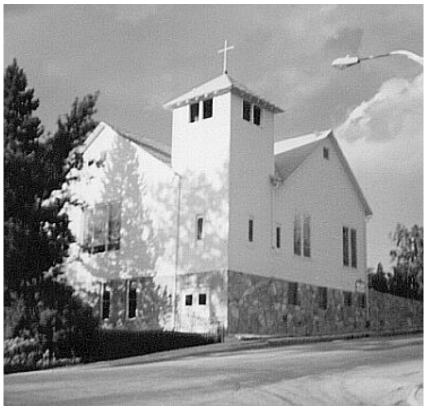
Luke's Episcopal Church

St. Luke's Episcopal Church was built in 1889 of red brick, in the Gothic Revival style of architecture. The church displays many noteworthy architectural features, and is considered one of the best examples of the Gothic Revival architectural style in the state of Wyoming. The interior plan, with a small narthex, long narrow nave, chancel elevated by two steps, sanctuary elevated by two more steps, typifies the plans of small Episcopal churches throughout the country. The cornerstone was laid in 1889 by the Masonic Lodge of Buffalo. The builder, Thomas Hutton, used red brick made by the Curran brothers in their brickyard on the west side of town.

Union Congregational Church
Buffalo, Wyoming

Date Added to Register
Thursday, February 07, 1985

Smithsonian Number
48JO915



Union Congregational Church

The Union Congregational Church, one of the first two churches established in northern Wyoming Territory and the first church in Buffalo, was incorporated in 1884, the same year the town of Buffalo was chartered. Situated on the top of a steep hill, the church was a plain, gable-roofed, rectangular, frame structure. The members of the church had constructed a building large enough to hold 200 people and to serve as a center for religious and social activities. Besides religious services, this structure housed dramatic production, concerts by local talent, old-fashioned spelling bees, and other gatherings. The present configuration of the church is the result of a remarkable plan formulated by the Reverend Charles Gray Miller and put into effect in 1911-1912 to enlarge the church. A basement was constructed on the lower slope of the hill to the west and the church was moved onto it. The parsonage, which was built in 1910, is just northwest of the church and on a level with the west side of the basement.

Big Red Ranch Complex
Ucross, Wyoming

Date Added to Register

Thursday, October 11, 1984

Smithsonian Number
48SH690


Big Red Ranch Complex

The Big Red Ranch was the headquarters of one of the largest cattle operations in Wyoming. It was a leader in agricultural development in the area beginning with the large open range cattle period, moving to sheep ranching and the development of irrigation projects, and concluding with the sugar beet industry. Big Red is significant as one of the few large corporation ranches able to survive the open range period through adaptive change and growth. Big Red owes its creation to the Pratt & Ferris Cattle Company which arrived in Wyoming in 1880. The ranch house was constructed in 1882. During the open range period it was unusual that any permanent structure would be erected, much less painted. The name ''Big Red'' stems from the fact that large buildings were erected at the site and painted red. Men of state and local significance were associated with the ranch including James H. Pratt, Levi and Joseph Leiter, William ''Billy'' Irvine, Frank Horton, and Willis Spear. No other property is in existence in the area that was associated with so many men of regional importance nor with the entire continuum of ranch and farm development in northern Wyoming.

Clearmont Jail
Clearmont, Wyoming

Date Added to Register
Monday, May 14, 1984

Smithsonian Number
48SH689


Clearmont Jail

Clearmont, founded in 1892 by the Burlington Missouri Railroad, is primarily an agricultural community located in the northeast portion of the state of Wyoming. Clearmont was incorporated in 1919. In the same year the developers of an agricultural business, Leiter Company, asked the Clearmont Town Council to authorize construction of a jail. Due to a growing population town officials became concerned about law enforcement. The Town Council funded the construction of the jail in 1922. The Clearmont Jail is a solid steel and concrete structure with walls five and one-half inches thick. The jail was used frequently through the 1950s. It was thought that the jail was an effective deterrent to crime because it did not have any modern facilities. Prisoners were taken to a cafe to eat, and back at the jail they were given a can to serve as a toilet. It was used for the last time in 1961.

Appendix 3E
Wetland Assessments

MDT Montana Wetland Assessment Form (revised 5/25/1999)

1. Project Name: Clear Creek Watershed Study **2. Project #:** NA **Control #:** NA

3. Evaluation Date: Mo. 6 Day 4 Yr. 10 **4. Evaluator(s):** E. Lack **5. Wetlands/Site #(s)** 1

6. Wetland Location(s): i. Legal: T 52 [✓ N] or S; R 83 E or [✓ W]; S 6 ; T ___ N or S; R ___ E or W; S ___ ;
ii. Approx. Stationing or Mileposts: NA

iii. Watershed: 10090206 **GPS Reference No. (if applies):** –
Other Location Information:

7. a. Evaluating Agency: WEST Inc.
b. Purpose of Evaluation:
1.____Wetlands potentially affected by MDT project
2.____Mitigation wetlands; pre-construction
3.____ Mitigation wetlands; post-construction
4. X Other

8. Wetland size: (total acres) 0.6 (visually estimated)
including pond ________ (measured, e.g. by GPS [if applies])

9. Assessment area: (AA, tot., ac., 0.6 (visually estimated)
see instructions on determining AA) ________ (measured, e.g. by GPS [if applies])

10. Classification of Wetland and Aquatic Habitats in AA (HGM according to Brinson, first col.; USFWS according to Cowardin [1979], remaining cols.)

HGM Class	System	Subsystem	Class	Water Regime	Modifier	% of AA
Lacustrine fringe	Palustrine	—	EM	F	I	20
Riverine (upper perennial)	Palustrine		SS	C		80

(Abbreviations: System: Palustrine(P)/ Subsyst.: none/ Classes: Rock Bottom (RB), Unconsolidated bottom (UB), Aquatic Bed (AB), Unconsolidated Shore (US), Moss-lichen Wetland (ML), Emergent Wetland (EM), Scrub-Shrub Wetland (SS), Forested Wetland (FO)/ System: Lacustrine (L)/, Subsyst.: Limnetic (2)/ Classes: RB, UB, AB/ Subsystem: Littoral (4)/ Classes: RB, UB, AB, US, EM/ System: Riverine (R)/ Subsyst.: Lower Perennial (2)/ Classes: RB, UB, AB, US, EM/ Subsystem: Upper Perennial (3)/ Classes: RB, UB, AB, US/ Water Regimes: Permanently Flooded (H), Intermittently Exposed (G), Semipermanently Flooded (F), Seasonally Flooded (C), Saturated (B), Temporarily Flooded (A), Intermittently Flooded (J) Modifiers: Excavated (E), Impounded (I), Diked (D), Partly Drained (PD), Farmed (F), Artificial (A) HGM Classes: Riverine, Depressional, Slope, Mineral Soil Flats, Organic Soil Flats, Lacustrine Fringe

11. Estimated relative abundance: (of similarly classified sites within the same Major Montana Watershed Basin, see definitions) –
(Circle one) Unknown Rare [✓ Common] Abundant
Comments:

12. General condition of AA:
i. Regarding disturbance: (use matrix below to determine [circle] appropriate response)

Conditions within AA	*Predominant conditions adjacent to (within 500 feet of) AA*		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings	low disturbance	low disturbance	moderate disturbance
AA not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings	moderate disturbance	[✓ moderate disturbance]	high disturbance
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration; high road or building density.	high disturbance	high disturbance	high disturbance

Comments: (types of disturbance, intensity, season, etc.): w/in wildlife mgt area. stock ponds & diversions in drainage
ii. Prominent weedy, alien, & introduced species (including those not domesticated, feral): (list) none observed

iii. Provide brief descriptive summary of AA and surrounding land use/habitat:
Half-mile segment of S. Fork Sayles Creek between stock ponds; AA includes upper pond, managed for wildlife habitat & recreation, water diversion present.

13. Structural Diversity: (based on number of "Cowardin" *vegetated* classes present [do not include unvegetated classes], see #10 above)

# of "Cowardin" vegetated classes present in AA (see #10)	≥ 3 vegetated classes (or ≥ 2 if one is forested)	2 vegetated classes (or 1 if forested)	≤ 1 vegetated class
Rating (circle)	High	[✓ Moderate]	Low

Comments:

SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ______
Secondary habitat (**list species**) D S ______
Incidental habitat (**list species**) D [✓ S] Canada lynx
No usable habitat D S ______

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.9 (H)	.8 (M)	.7 (M)	.5 (L)	[✓ .3 (L)]	0 (L)

Sources for documented use (e.g. observations, records, etc): WYNDD

14B. Habitat for plant or animals rated S1, S2, or S3 by the ~~Montana Natural Heritage Program~~: (not including species listed in14A above)

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ______
Secondary habitat (**list species**) D S ______
Incidental habitat (**list species**) D S ______
No usable habitat D [✓ S] none Known or suspected

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.8 (H)	.7 (M)	.6 (M)	.2 (L)	.1 (L)	[✓ 0 (L)]

Sources for documented use (e.g. observations, records, etc.):

14C. General Wildlife Habitat Rating:

I. **Evidence of overall wildlife use in the AA** (circle substantial, moderate, or low based on supporting evidence):

Substantial (based on any of the following [check]):
- ☐ observations of abundant wildlife #'s or high species diversity (during any period)
- ☐ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ presence of extremely limiting habitat features not available in the surrounding area
- ☐ interviews with local biologists with knowledge of the AA

Low (based on any of the following [check]):
- ☐ few or no wildlife observations during peak use periods
- ☐ little to no wildlife sign
- ☐ sparse adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

Moderate (based on any of the following [check]):
- ☐ observations of scattered wildlife groups or individuals or relatively few species during peak periods
- ☒ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☒ adequate adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

ii. **Wildlife habitat features** (working from top to bottom, circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see instructions for further definitions of these terms].)

Structural diversity (see #13)	High								Moderate								Low			
Class cover distribution (all vegetated classes)	Even				Uneven				Even				Uneven				Even			
Duration of surface water in ≥ 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12i)	E	E	E	H	E	E	H	H	E	H	H	M	E	H	M	M	E	H	M	M
Moderate disturbance at AA (see #12i)	H	H	H	H	H	H	H	M	H	H	M	M	[✓ H]	M	M	L	H	M	L	L
High disturbance at AA (see #12i)	M	M	M	L	M	M	L	L	M	M	L	L	M	L	L	L	L	L	L	L

III. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Evidence of wildlife use (i)	*Wildlife habitat features rating (ii)*			
	Exceptional	High	Moderate	Low
Substantial	1 (E)	.9 (H)	.8 (H)	.7 (M)
Moderate	.9 (H)	[✓ .7 (M)]	.5 (M)	.3 (L)
Minimal	.6 (M)	.4 (M)	.2 (L)	.1 (L)

Comments:

14D. General Fish/Aquatic Habitat Rating: (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, etc., circle NA here and proceed to the next function. If fish use occurs in the AA but is not desired from a resource management perspective [such as fish use within an irrigation canal], then Habitat Quality [i below] should be marked as "Low", applied accordingly in ii below, and noted in the comments.)

i. **Habitat Quality** (circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25%	10–25%	<10%	>25%	10–25%	<10%	>25%	10–25%	<10%
Shading - >75% of streambank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	E	[✓ E]	H	H	H	M	M	M	M
Shading – 50 to 75% of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading - < 50% of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

ii. **Modified Habitat Quality** (Circle the appropriate response to the following question. If answer is Y, then reduce rating in i above by one level [E = H, H = M, M = L, L = L]). *Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the waterbody included on the MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support?* Y N Modified habitat quality rating = (circle) E [✓ H] M L

iii. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Types of fish known or suspected within AA	*Modified Habitat Quality (ii)*			
	Exceptional	High	Moderate	Low
Native game fish	1 (E)	.9 (H)	.7 (M)	.5 (M)
Introduced game fish	.9 (H)	.8 (H)	.6 (M)	.4 (M)
Non-game fish	.7 (M)	.6 (M)	.5 (M)	.3 (L)
No fish	.5 (M)	[✓ .3 (L)]	.2 (L)	.1 (L)

Comments: Fish use suspected precluded due to several stock ponds & diversion

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14E. Flood Attenuation: (applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, circle NA here and proceed to next function.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Estimated wetland area in AA subject to periodic flooding	≥ 10 acres			<10, >2 acres			≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains no outlet or restricted outlet	1(H)	.9(H)	.6(M)	.8(H)	.7(H)	.5(M)	.4(M)	.3(L)	.2(L)
AA contains unrestricted outlet	.9(H)	.8(H)	.5(M)	[✓ .7(H)]	.6(M)	.4(M)	.3(L)	.2(L)	.1(L)

ii. Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA (circle)? Y [✓ N]

Comments:

14F. Short and Long Term Surface Water Storage: (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, circle NA here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding	>5 acre feet			<5, >1 acre feet			≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond ≥ 5 out of 10 years	1(H)	.9(H)	.8(H)	.8(H)	.6(M)	.5(M)	.4(M)	.3(L)	.2(L)
Wetlands in AA flood or pond < 5 out of 10 years	.9(H)	.8(H)	.7(M)	[✓ .7(M)]	.5(M)	.4(M)	.3(L)	.2(L)	.1(L)

Comments: Assumes wetland floods < 5 out of 10 yrs.

14G. Sediment/Nutrient/Toxicant Retention and Removal: (Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, circle NA here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants or AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	≥ 70%		< 70%		≥ 70%		< 70%	
Evidence of flooding or ponding in AA	Yes	No	Yes	No	Yes	No	Yes	No
AA contains no or restricted outlet	1 (H)	.8 (H)	.7 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)	.2 (L)
AA contains unrestricted outlet	[✓ .9 (H)]	.7 (M)	.6 (M)	.4 (M)	.4 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14H Sediment/Shoreline Stabilization: (applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. **If does not apply, circle NA here and proceed to next function)**

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses	*Duration of surface water adjacent to rooted vegetation*		
	permanent / perennial	seasonal / intermittent	Temporary / ephemeral
≥ 65%	1 (H)	.9 (H)	.7 (M)
35-64%	[✓ .7 (M)]	.6 (M)	.5 (M)
< 35%	.3 (L)	.2 (L)	.1 (L)

Comments:

14I. Production Export/Food Chain Support:

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Factor A = acreage of vegetated component in the AA; Factor B = structural diversity rating from #13; Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P = permanent/perennial; S/I = seasonal/intermittent; T/E /A= temporary/ephemeral or absent [see instructions for further definitions of these terms].)

A	Vegetated component >5 acres						Vegetated component 1-5 acres						Vegetated component <1 acre					
B	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low	
C	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
P/P	1H	.9H	[✓ .9H]	.8H	.8H	.7M	.9H	.8H	.8H	.7M	.7M	.6M	.7M	.6M	.6M	.4M	.4M	.3L
S/I	.9H	.8H	.8H	.7M	.7M	.6M	.8H	.7M	.7M	.6M	.6M	.5M	.6M	.5M	.5M	.3L	.3L	.2L
T/E/A	.8H	.7M	.7M	.6M	.6M	.5M	.7M	.6M	.6M	.5M	.5M	.4M	.5M	.4M	.4M	.2L	.2L	.1L

Comments:

14J. Groundwater Discharge/Recharge: (Check the indicators in i & ii below that apply to the AA)

i. Discharge Indicators

___Springs are known or observed
___Vegetation growing during dormant season/drought
___Wetland occurs at the toe of a natural slope
___Seeps are present at the wetland edge
___AA permanently flooded during drought periods
___Wetland contains an outlet, but no inlet
___Other

ii. Recharge Indicators

___Permeable substrate present without underlying impeding layer
___Wetland contains inlet but no outlet
___Other

iii. Rating: Use the information from i and ii above and the table below to arrive at [circle] the functional points and rating [H = high, L = low] for this function.

Criteria	*Functional Points and Rating*
AA is known Discharge/Recharge area or one or more indicators of D/R present	1 (H)
No Discharge/Recharge indicators present	.1 (L)
Available Discharge/Recharge information inadequate to rate AA D/R potential	[✓ N/A (Unknown)]

Comments:

14K. Uniqueness:

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Replacement potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MNHP			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MNHP			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate		
Estimated relative abundance (#11)	rare	common	abundant	rare	common	abundant	rare	common	abundant
Low disturbance at AA (#12i)	1 (H)	.9 (H)	.8 (H)	.8 (H)	.6 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)
Moderate disturbance at AA (#12i)	.9 (H)	.8 (H)	.7 (M)	.7 (M)	.5 (M)	.4 (M)	.4 (M)	[✓ .3 (L)]	.2 (L)
High disturbance at AA (#12i)	.8 (H)	.7 (M)	.6 (M)	.6 (M)	.4 (M)	.3 (L)	.3 (L)	.2 (L)	.1 (L)

Comments:

14L. Recreation/Education Potential: i. Is the AA a known rec./ed. site: (circle) [✓ Y] N (If yes, rate as [circle] High [1] and go to ii; if no go to iii)

ii. Check categories that apply to the AA: ___ Educational/scientific study; ___ Consumptive rec.; ___ Non-consumptive rec.; ___Other

iii. Based on the location, diversity, size, and other site attributes, is there strong potential for rec./ed. use? Y N (If yes, go to ii, then proceed to iv; if no, then rate as [circle] Low [0.1])

iv. Rating (use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Ownership	*Disturbance at AA (#12i)*		
	low	moderate	high
public ownership	[✓ 1 (H)]	.5 (M)	.2 (L)
private ownership	.7 (M)	.3 (L)	.1 (L)

Comments:

FUNCTION & VALUE SUMMARY & OVERALL RATING

Function & Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units; (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	.3		1	
B. ~~MT~~ WY Natural Heritage Program Species Habitat	0		1	
C. General Wildlife Habitat	.7		1	
D. General Fish/Aquatic Habitat	.3		1	
E. Flood Attenuation	.7		1	
F. Short and Long Term Surface Water Storage	.7		1	
G. Sediment/Nutrient/Toxicant Removal	.9		1	
H. Sediment/Shoreline Stabilization	.7		1	
I. Production Export/Food Chain Support	.9		1	
J. Groundwater Discharge/Recharge	Unkn		1	
K. Uniqueness	.3		1	
L. Recreation/Education Potential	1		1	
Totals:	6.5		12	

OVERALL ANALYSIS AREA (AA) RATING: (Circle appropriate category based on the criteria outlined below) I II [✓ III] IV

Category I Wetland: (Must satisfy one of the following criteria; if does not meet criteria, go to Category II)
___ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; or
___ Score of 1 functional point for Uniqueness; or
___ Score of 1 functional point for Flood Attenuation and answer to Question 14E.ii is "yes"; or
___ Total actual functional points > 80% (round to nearest whole #) of total possible functional points.

Category II Wetland: (Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)
___ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; or
___ Score of .9 or 1 functional point for General Wildlife Habitat; or
___ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; or
___ "High" to "Exceptional" ratings for both General Wildlife Habitat and General Fish/Aquatic Habitat; or
___ Score of .9 functional point for Uniqueness; or
___ Total Actual Functional Points > 65% (round to nearest whole #) of total possible functional points.

Category III Wetland: (Criteria for Categories I, II or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if does not satisfy criteria go to Category III)
___ "Low" rating for Uniqueness; and
___ "Low" rating for Production Export/Food Chain Support; and
___ Total actual functional points < 30% (round to nearest whole #) of total possible functional points

Note: NWI map only ID's ponds, no wetlands

Wetland Assessment Site #1

MDT Montana Wetland Assessment Form (revised 5/25/1999)

1. Project Name: Clear Creek Watershed **2. Project #:** NA **Control #:** NA

3. Evaluation Date: Mo. 6 Day 4 Yr. 10 **4. Evaluator(s):** E2 **5 . Wetlands/Site #(s)** 2

6. Wetland Location(s): I. Legal: T 52 [✓ N] or S; R 83 E or [✓ W] S 36 ; T ___ N or S; R ___ E or W; S ___ ;
II. Approx. Stationing or Mileposts: NA

III. Watershed: 10090206 **GPS Reference No. (if applies):** —
Other Location Information:

7. a. Evaluating Agency: WEST Inc. ;
b. Purpose of Evaluation:
1.____Wetlands potentially affected by MDT project
2.____Mitigation wetlands; pre-construction
3.____ Mitigation wetlands; post-construction
4. x Other

8. Wetland size: (total acres) 1 (visually estimated)
including pond ______ (measured, e.g. by GPS [if applies])

9. Assessment area: (AA, tot., ac., see instructions on determining AA) 1 (visually estimated)
______ (measured, e.g. by GPS [if applies])

10. Classification of Wetland and Aquatic Habitats in AA (HGM according to Brinson, first col.; USFWS according to Cowardin [1979], remaining cols.)

HGM Class	System	Subsystem	Class	Water Regime	Modifier	% of AA
Lacustrine fringe	Palustrine	—	Em	C	I	65
			SS	A	I	35

(Abbreviations: **System:** Palustrine(P)/ **Subsyst.:** none/ **Classes:** Rock Bottom (RB), Unconsolidated bottom (UB), Aquatic Bed (AB), Unconsolidated Shore (US), Moss-lichen Wetland (ML), Emergent Wetland (EM), Scrub-Shrub Wetland (SS), Forested Wetland (FO)/ **System:** Lacustrine (L)/. **Subsyst.:** Limnetic (2)/ **Classes:** RB, UB, AB/ **Subsystem:** Littoral (4)/ **Classes:** RB UB, AB US, EM/ **System:** Riverine (R)/ **Subsyst.:** Lower Perennial (2)/ Classes: RB, UB, AB, US, EM/ **Subsystem:** Upper Perennial (3)/ Classes: RB, UB, AB, US/ **Water Regimes:** Permanently Flooded (H), Intermittently Exposed (G), Semipermanently Flooded (F), Seasonally Flooded (C), Saturated (B), Temporarily Flooded (A), Intermittently Flooded (J) **Modifiers:** Excavated (E), Impounded (I), Diked (D), Partly Drained (PD), Farmed (F). Artificial (A) **HGM Classes:** Riverine, Depressional, Slope, Mineral Soil Flats, Organic Soil Flats, Lacustrine Fringe

11. Estimated relative abundance: (of similarly classified sites within the same Major Montana Watershed Basin, see definitions)
(Circle one) Unknown Rare [✓ Common] Abundant
Comments:

12. General condition of AA:
i. **Regarding disturbance:** (use matrix below to determine [circle] appropriate response)

Conditions within AA	*Predominant conditions adjacent to (within 500 feet of) AA*		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roade or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings	low disturbance	low disturbance	moderate disturbance
AA not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings	moderate disturbance	[✓ moderate disturbance]	high disturbance
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration high road or building density	high disturbance	high disturbance	high disturbance

Comments: (types of disturbance, intensity, season, etc.): on State section; grazed; dammed
ii. Prominent weedy, alien, & introduced species (including those not domesticated, feral): (list) Russian olive

iii. Provide brief descriptive summary of AA and surrounding land use/habitat:
Pond & associated wetland on State section. Appears ponded for irrigation on adjacent private land. Grazing use evident. Wildlife observed.

13. Structural Diversity: (based on number of "Cowardin" *vegetated* classes present [do not include unvegetated classes], see #10 above)

# of "Cowardin" vegetated classes present in AA (see #10)	≥ 3 vegetated classes (or ≥ 2 if one is forested)	2 vegetated classes (or 1 if forested)	≤ 1 vegetated class
Rating (circle)	High	[✓ Moderate]	Low

Comments:

SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S
Secondary habitat (**list species**) D S
Incidental habitat (**list species**) D [✓ S] Canada lynx
No usable habitat D S

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.9 (H)	.8 (M)	.7 (M)	.5 (L)	[✓ .3 (L)]	0 (L)

Sources for documented use (e.g. observations, records, etc):
WYNND - Canada lynx range map

14B. Habitat for plant or animals rated S1, S2, or S3 by the Montana Natural Heritage Program: (not including species listed in14A above)

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S
Secondary habitat (**list species**) D S
Incidental habitat (**list species**) D S
No usable habitat D [✓ S] none known or suspected

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.8 (H)	.7 (M)	.6 (M)	.2 (L)	.1 (L)	[✓ 0 (L)]

Sources for documented use (e.g. observations, records, etc.):

14C. General Wildlife Habitat Rating:

I. **Evidence of overall wildlife use in the AA** (circle substantial, moderate, or low based on supporting evidence):

Substantial (based on any of the following [check]):
__ observations of abundant wildlife #'s or high species diversity (during any period)
__ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
__ presence of extremely limiting habitat features not available in the surrounding area
__ interviews with local biologists with knowledge of the AA

Low (based on any of the following [check]):
__ few or no wildlife observations during peak use periods
__ little to no wildlife sign
__ sparse adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

Moderate (based on any of the following [check]):
☒ observations of scattered wildlife groups or individuals or relatively few species during peak periods
☒ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
☒ adequate adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

ii. **Wildlife habitat features** (working from top to bottom, circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see instructions for further definitions of these terms].)

Structural diversity (see #13)	High								Moderate								Low			
Class cover distribution (all vegetated classes)	Even				Uneven				Even				Uneven				Even			
Duration of surface water in ≥ 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12i)	E	E	E	H	E	E	H	H	E	H	H	M	E	H	M	M	E	H	M	M
Moderate disturbance at AA (see #12i)	H	H	H	H	H	H	H	M	H	H	M	M	H	[✓ M]	M	L	H	M	L	L
High disturbance at AA (see #12i)	M	M	M	L	M	M	L	L	M	M	L	L	M	L	L	L	L	L	L	L

iii. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Evidence of wildlife use (i)	*Wildlife habitat features rating (ii)*			
	Exceptional	High	Moderate	Low
Substantial	1 (E)	.9 (H)	.8 (H)	.7 (M)
Moderate	.9 (H)	.7 (M)	[✓ .5 (M)]	.3 (L)
Minimal	.6 (M)	.4 (M)	.2 (L)	.1 (L)

Comments:

14D. General Fish/Aquatic Habitat Rating: (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, etc., circle NA here and proceed to the next function. If fish use occurs in the AA but is not desired from a resource management perspective [such as fish use within an irrigation canal], then Habitat Quality [i below] should be marked as "Low", applied accordingly in ii below, and noted in the comments.)

i. **Habitat Quality** (circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25%	10–25%	<10%	>25%	10–25%	<10%	>25%	10–25%	<10%
Shading - >75% of streambank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	E	E	H	H	H	M	M	M	M
Shading – 50 to 75% of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading - < 50% of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

ii. **Modified Habitat Quality** (Circle the appropriate response to the following question. If answer is Y, then reduce rating in i above by one level [E = H, H = M, M = L, L = L]). *Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the waterbody included on the MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support?* [✓ Y] N Modified habitat quality rating = (circle) E H M [✓ L]

iii. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Types of fish known or suspected within AA	*Modified Habitat Quality (ii)*			
	Exceptional	High	Moderate	Low
Native game fish	1 (E)	.9 (H)	.7 (M)	.5 (M)
Introduced game fish	.9 (H)	.8 (H)	.6 (M)	.4 (M)
Non-game fish	.7 (M)	.6 (M)	.5 (M)	.3 (L)
No fish	.5 (M)	.3 (L)	.2 (L)	[✓ .1 (L)]

Comments: Pond & associated wetland use to store irrigation water; water is released into irrigation system - not fish habitat

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14E. Flood Attenuation: (applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, circle NA here and proceed to next function.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Estimated wetland area in AA subject to periodic flooding	≥ 10 acres			<10, >2 acres			≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains no outlet or restricted outlet	1(H)	.9(H)	.6(M)	.8(H)	.7(H)	.5(M)	.4(M)	.3(L)	.2(L)
AA contains unrestricted outlet	.9(H)	.8(H)	.5(M)	.7(H)	.6(M)	.4(M)	.3(L)	[✓ .2(L)]	.1(L)

ii. Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA (circle)? Y [✓ N]

Comments:

14F. Short and Long Term Surface Water Storage: (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, circle NA here and proceed with the evaluation.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding	>5 acre feet			<5, >1 acre feet			≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond ≥ 5 out of 10 years	1(H)	.9(H)	.8(H)	.8(H)	.6(M)	.5(M)	.4(M)	.3(L)	.2(L)
Wetlands in AA flood or pond < 5 out of 10 years	.9(H)	.8(H)	.7(M)	.7(M)	.5(M)	.4(M)	.3(L)	[✓ .2(L)]	.1(L)

Comments: Assumes wetland floods < 5 out of 10 years

14G. Sediment/Nutrient/Toxicant Retention and Removal: (Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, circle NA here and proceed with the evaluation.)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants or AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	≥ 70%		< 70%		≥ 70%		< 70%	
Evidence of flooding or ponding in AA	Yes	No	Yes	No	Yes	No	Yes	No
AA contains no or restricted outlet	1 (H)	.8 (H)	.7 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)	.2 (L)
AA contains unrestricted outlet	[✓ .9 (H)]	.7 (M)	.6 (M)	.4 (M)	.4 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14H Sediment/Shoreline Stabilization: (applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. If does not apply, circle NA here and proceed to next function)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses	*Duration of surface water adjacent to rooted vegetation*		
	permanent / perennial	seasonal / intermittent	Temporary / ephemeral
≥ 65%	1 (H)	.9 (H)	.7 (M)
35-64%	.7 (M)	[✓ .6 (M)]	.5 (M)
< 35%	.3 (L)	.2 (L)	.1 (L)

Comments:

14I. Production Export/Food Chain Support:

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Factor A = acreage of vegetated component in the AA; Factor B = structural diversity rating from #13; Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P = permanent/perennial; S/I = seasonal/intermittent; T/E /A= temporary/ephemeral or absent [see instructions for further definitions of these terms].)

A	Vegetated component >5 acres						Vegetated component 1-5 acres						Vegetated component <1 acre					
B	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low	
C	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
P/P	1H	.9H	.9H	.8H	.8H	.7M	.9H	.8H	.8H	.7M	.7M	.6M	.7M	.6M	.6M	.4M	.4M	.3L
S/I	.9H	.8H	.8H	.7M	.7M	.6M	.8H	.7M	.7M	.6M	.6M	.5M	.6M	.5M	[✓ .5M]	.3L	.3L	.2L
T/E/A	.8H	.7M	.7M	.6M	.6M	.5M	.7M	.6M	.6M	.5M	.5M	.4M	.5M	.4M	.4M	.2L	.2L	.1L

Comments:

14J. Groundwater Discharge/Recharge: (Check the indicators in i & ii below that apply to the AA)

i. Discharge Indicators
- ☐ Springs are known or observed
- ☐ Vegetation growing during dormant season/drought
- ☐ Wetland occurs at the toe of a natural slope
- ☐ Seeps are present at the wetland edge
- ☐ AA permanently flooded during drought periods
- ☐ Wetland contains an outlet, but no inlet
- ☐ Other

ii. Recharge Indicators
- ☐ Permeable substrate present without underlying impeding layer
- ☐ Wetland contains inlet but no outlet
- ☐ Other

iii. Rating: Use the information from i and ii above and the table below to arrive at [circle] the functional points and rating [H = high, L = low] for this function.

Criteria	*Functional Points and Rating*
AA is known Discharge/Recharge area or one or more indicators of D/R present	1 (H)
No Discharge/Recharge indicators present	.1 (L)
Available Discharge/Recharge information inadequate to rate AA D/R potential	[✓ N/A (Unknown)]

Comments: Discharge or recharge information inadequate

14K. Uniqueness:

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Replacement potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MNHP			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MNHP			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate		
Estimated relative abundance (#11)	rare	common	abundant	rare	common	abundant	rare	common	abundant
Low disturbance at AA (#12i)	1 (H)	.9 (H)	.8 (H)	.8 (H)	.6 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)
Moderate disturbance at AA (#12i)	.9 (H)	.8 (H)	.7 (M)	.7 (M)	.5 (M)	.4 (M)	.4 (M)	[✓ .3 (L)]	.2 (L)
High disturbance at AA (#12i)	.8 (H)	.7 (M)	.6 (M)	.6 (M)	.4 (M)	.3 (L)	.3 (L)	.2 (L)	.1 (L)

Comments: stock ponds on small drainages common in watershed

14L. Recreation/Education Potential: i. Is the AA a known rec./ed. site: (circle) [✓ Y] N (If yes, rate as [circle] High [1] and go to ii; if no go to iii)

ii. Check categories that apply to the AA: ☐ Educational/scientific study; ☐ Consumptive rec.; ☒ Non-consumptive rec.; ☒ Other

iii. Based on the location, diversity, size, and other site attributes, is there strong potential for rec./ed. use? [✓ Y] N
(If yes, go to ii, then proceed to iv; if no, then rate as [circle] Low [0.1])

iv. Rating (use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Ownership	*Disturbance at AA (#12i)*		
	low	moderate	high
public ownership	[✓ 1 (H)]	.5 (M)	.2 (L)
private ownership	.7 (M)	.3 (L)	.1 (L)

Comments: w/in Bud Love Wildlife Mgmt Area - parking & trails for recreation use such as wildlife viewing, camping, hunting, fishing

FUNCTION & VALUE SUMMARY & OVERALL RATING

Function & Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units; (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	.3		1	
B. MT Natural Heritage Program Species Habitat	0		1	
C. General Wildlife Habitat	.5		1	
D. General Fish/Aquatic Habitat	.1		1	
E. Flood Attenuation	.2		1	
F. Short and Long Term Surface Water Storage	.2		1	
G. Sediment/Nutrient/Toxicant Removal	.9		1	
H. Sediment/Shoreline Stabilization	.6		1	
I. Production Export/Food Chain Support	.5		1	
J. Groundwater Discharge/Recharge	N/A		1	
K. Uniqueness	.3		1	
L. Recreation/Education Potential	1		1	
Totals:	4.6		12	

38%

OVERALL ANALYSIS AREA (AA) RATING: (Circle appropriate category based on the criteria outlined below) I II [✓ III] IV

Category I Wetland: (Must satisfy one of the following criteria; if does not meet criteria, go to Category II)
___ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; or
___ Score of 1 functional point for Uniqueness; or
___ Score of 1 functional point for Flood Attenuation and answer to Question 14E.ii is "yes"; or
___ Total actual functional points > 80% (round to nearest whole #) of total possible functional points.

Category II Wetland: (Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)
___ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; or
___ Score of .9 or 1 functional point for General Wildlife Habitat; or
___ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; or
___ "High" to "Exceptional" ratings for both General Wildlife Habitat and General Fish/Aquatic Habitat; or
___ Score of .9 functional point for Uniqueness; or
___ Total Actual Functional Points > 65% (round to nearest whole #) of total possible functional points.

Category III Wetland: (Criteria for Categories I, II or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if does not satisfy criteria go to Category III)
___ "Low" rating for Uniqueness; and
___ "Low" rating for Production Export/Food Chain Support; and
___ Total actual functional points < 30% (round to nearest whole #) of total possible functional points

Wetland Assessment Site #2

MDT Montana Wetland Assessment Form (revised 5/25/1999)

1. Project Name: Clear Creek Watershed Study **2. Project #:** NA **Control #:** NA

3. Evaluation Date: Mo. 6 **Day** 4 **Yr.** 10 **4. Evaluator(s):** E. Lock **5 . Wetlands/Site #(s)** 3

6. Wetland Location(s): i. Legal: T 52 [✓ N] or S; R 83 E or [✓ W] S 36 ; T ___ N or S; R ___ E or W; S ___ ;
ii. Approx. Stationing or Mileposts: NA

iii. Watershed: 10090206 **GPS Reference No. (if applies):** –
Other Location Information:

7. a. Evaluating Agency: WEST Inc. ;
b. Purpose of Evaluation:
1.____Wetlands potentially affected by MDT project
2.____Mitigation wetlands; pre-construction
3.____ Mitigation wetlands; post-construction
4. ✓ Other

8. Wetland size: (total acres) 2 (visually estimated)
______ (measured, e.g. by GPS [if applies])

9. Assessment area: (AA, tot., ac., see instructions on determining AA) 7 (visually estimated)
______ (measured, e.g. by GPS [if applies])
Includes floodplain along 0.3 mi stretch of Rock Creek

10. Classification of Wetland and Aquatic Habitats in AA (HGM according to Brinson, first col.; USFWS according to Cowardin [1979], remaining cols.)

HGM Class	System	Subsystem	Class	Water Regime	Modifier	% of AA
Riverine Upper or lower	Riverine	Upper Perennial	UB	C		
	Palustrine	–	EM	C		
			SS	B		

(Abbreviations: **System:** Palustrine(P)/ **Subsyst.:** none/ **Classes:** Rock Bottom (RB), Unconsolidated bottom (UB), Aquatic Bed (AB), Unconsolidated Shore (US), Moss-lichen Wetland (ML), Emergent Wetland (EM), Scrub-Shrub Wetland (SS), Forested Wetland (FO)/ **System:** Lacustrine (L)/, **Subsyst.:** Limnetic (2)/ **Classes:** RB, UB, AB/ **Subsystem:** Littoral (4)/ **Classes:** RB UB, AB US, EM/ **System:** Riverine (R)/ **Subsyst.:** Lower Perennial (2)/ Classes: RB, UB, AB, US, EM/ **Subsystem:** Upper Perennial (3)/ **Classes:** RB, UB, AB, US/ **Water Regimes:** Permanently Flooded (H), Intermittently Exposed (G), Semipermanently Flooded (F), Seasonally Flooded (C), Saturated (B), Temporarily Flooded (A), Intermittently Flooded (J) **Modifiers:** Excavated (E), Impounded (I), Diked (D), Partly Drained (PD), Farmed (F), Artificial (A) **HGM Classes:** Riverine, Depressional, Slope, Mineral Soil Flats, Organic Soil Flats, Lacustrine Fringe

11. Estimated relative abundance: (of similarly classified sites within the same Major Montana Watershed Basin, see definitions)
(Circle one) Unknown Rare [✓ Common] Abundant
Comments:

12. General condition of AA:
i. Regarding disturbance: (use matrix below to determine [circle] appropriate response)

Conditions within AA	*Predominant conditions adjacent to (within 500 feet of) AA*		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings	low disturbance	low disturbance	moderate disturbance
AA not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings	moderate disturbance	[✓ moderate disturbance]	high disturbance
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration high road or building density	high disturbance	high disturbance	high disturbance

Comments: (types of disturbance, intensity, season, etc.): Grazing evident
ii. Prominent weedy, alien, & introduced species (including those not domesticated, feral): (list)

iii. Provide brief descriptive summary of AA and surrounding land use/habitat:
Wetland habitats w/in Rock Creek floodplain on State section. Includes areas of cattail marsh in old oxbows + willow wetlands

13. Structural Diversity: (based on number of "Cowardin" *vegetated* classes present [do not include unvegetated classes], see #10 above)

# of "Cowardin" vegetated classes present in AA (see #10)	≥ 3 vegetated classes (or ≥ 2 if one is forested)	2 vegetated classes (or 1 if forested)	≤ 1 vegetated class
Rating (circle)	[✓ High]	Moderate	Low

Comments:

SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ____________
Secondary habitat (**list species**) D S ____________
Incidental habitat (**list species**) D [✓ S] Canada lynx
No usable habitat D S ____________

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.9 (H)	.8 (M)	.7 (M)	.5 (L)	[✓ .3 (L)]	0 (L)

Sources for documented use (e.g. observations, records, etc): Canada lynx range map

14B. Habitat for plant or animals rated S1, S2, or S3 by the Montana Natural Heritage Program: (not including species listed in14A above)

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ____________
Secondary habitat (**list species**) D S ____________
Incidental habitat (**list species**) D S ____________
No usable habitat D S none known or suspected

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.8 (H)	.7 (M)	.6 (M)	.2 (L)	.1 (L)	[✓ 0 (L)]

Sources for documented use (e.g. observations, records, etc.):

14C. General Wildlife Habitat Rating:

I. **Evidence of overall wildlife use in the AA** (circle substantial, moderate, or low based on supporting evidence):

Substantial (based on any of the following [check]):
- ☐ observations of abundant wildlife #'s or high species diversity (during any period)
- ☐ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ presence of extremely limiting habitat features not available in the surrounding area
- ☐ interviews with local biologists with knowledge of the AA

Low (based on any of the following [check]):
- ☐ few or no wildlife observations during peak use periods
- ☐ little to no wildlife sign
- ☐ sparse adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

Moderate (based on any of the following [check]):
- ☐ observations of scattered wildlife groups or individuals or relatively few species during peak periods
- ☒ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☒ adequate adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

ii. **Wildlife habitat features** (working from top to bottom, circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see instructions for further definitions of these terms].)

Structural diversity (see #13)	High								Moderate								Low			
Class cover distribution (all vegetated classes)	Even				Uneven				Even				Uneven				Even			
Duration of surface water in ≥ 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12i)	E	E	E	H	E	E	H	H	E	H	H	M	E	H	M	M	E	H	M	M
Moderate disturbance at AA (see #12i)	H	H	H	H	[✓ H]	H	H	M	H	H	M	M	H	M	M	L	H	M	L	L
High disturbance at AA (see #12i)	M	M	M	L	M	M	L	L	M	M	L	L	M	L	L	L	L	L	L	L

III. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Evidence of wildlife use (i)	*Wildlife habitat features rating (ii)*			
	Exceptional	High	Moderate	Low
Substantial	1 (E)	.9 (H)	.8 (H)	.7 (M)
Moderate	[✓ .9 (H)]	.7 (M)	.5 (M)	.3 (L)
Minimal	.6 (M)	.4 (M)	.2 (L)	.1 (L)

Comments:

14D. General Fish/Aquatic Habitat Rating: (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, etc., circle NA here and proceed to the next function. If fish use occurs in the AA but is not desired from a resource management perspective [such as fish use within an irrigation canal], then Habitat Quality [i below] should be marked as "Low", applied accordingly in ii below, and noted in the comments.)

i. **Habitat Quality** (circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25%	10–25%	<10%	>25%	10–25%	<10%	>25%	10–25%	<10%
Shading - >75% of streambank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	E	E	H	H	H	M	M	M	M
Shading – 50 to 75% of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	H	M	[✓ M]	M	M	M	L	L
Shading - < 50% of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

ii. **Modified Habitat Quality** (Circle the appropriate response to the following question. If answer is Y, then reduce rating in i above by one level [E = H, H = M, M = L, L = L]). *Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the waterbody included on the MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support?* Y [✓ N] Modified habitat quality rating = (circle) E H M L

iii. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Types of fish known or suspected within AA	*Modified Habitat Quality (ii)*			
	Exceptional	High	Moderate	Low
Native game fish	1 (E)	.9 (H)	[✓ .7 (M)]	.5 (M)
Introduced game fish	.9 (H)	.8 (H)	[✓ .6 (M)]	.4 (M)
Non-game fish	.7 (M)	.6 (M)	.5 (M)	.3 (L)
No fish	.5 (M)	.3 (L)	.2 (L)	.1 (L)

Comments: Native & introduced fish presence assumed

14E. Flood Attenuation: (applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, circle NA here and proceed to next function.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Estimated wetland area in AA subject to periodic flooding	≥ 10 acres			<10, >2 acres			≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains no outlet or restricted outlet	1(H)	.9(H)	.6(M)	.8(H)	.7(H)	.5(M)	.4(M)	.3(L)	.2(L)
AA contains unrestricted outlet	.9(H)	.8(H)	.5(M)	.7(H)	[✓ .6(M)]	.4(M)	.3(L)	.2(L)	.1(L)

ii. Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA (circle)? [✓ Y] N

Comments:

14F. Short and Long Term Surface Water Storage: (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, circle NA here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding	>5 acre feet			<5, >1 acre feet			≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond ≥ 5 out of 10 years	1(H)	.9(H)	.8(H)	.8(H)	[✓ .6(M)]	.5(M)	.4(M)	.3(L)	.2(L)
Wetlands in AA flood or pond < 5 out of 10 years	.9(H)	.8(H)	.7(M)	.7(M)	.5(M)	.4(M)	.3(L)	.2(L)	.1(L)

Comments: Assumes floods more than 5 out of 10 years

14G. Sediment/Nutrient/Toxicant Retention and Removal: (Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, circle NA here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants or AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	≥ 70%		< 70%		≥ 70%		< 70%	
Evidence of flooding or ponding in AA	Yes	No	Yes	No	Yes	No	Yes	No
AA contains no or restricted outlet	1 (H)	.8 (H)	.7 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)	.2 (L)
AA contains unrestricted outlet	.9 (H)	.7 (M)	[✓ .6 (M)]	.4 (M)	.4 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14H Sediment/Shoreline Stabilization: (applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. If does not apply, circle NA here and proceed to next function)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses	*Duration of surface water adjacent to rooted vegetation*		
	permanent / perennial	seasonal / intermittent	Temporary / ephemeral
≥ 65%	1 (H)	.9 (H)	.7 (M)
35-64%	.7 (M)	[✓ .6 (M)]	.5 (M)
< 35%	.3 (L)	.2 (L)	.1 (L)

Comments: mixed riparian & wetland communities in floodplain

14I. Production Export/Food Chain Support:
i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Factor A = acreage of vegetated component in the AA; Factor B = structural diversity rating from #13; Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P = permanent/perennial; S/I = seasonal/intermittent; T/E /A= temporary/ephemeral or absent [see instructions for further definitions of these terms].)

A	Vegetated component >5 acres						Vegetated component 1-5 acres						Vegetated component <1 acre					
B	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low	
C	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
P/P	1H	.9H	.9H	.8H	.8H	.7M	.9H	.8H	.8H	.7M	.7M	.6M	.7M	.6M	.6M	.4M	.4M	.3L
S/I	.9H	.8H	.8H	.7M	.7M	.6M	[✓ .8H]	.7M	.7M	.6M	.6M	.5M	.6M	.5M	.5M	.3L	.3L	.2L
T/E/A	.8H	.7M	.7M	.6M	.6M	.5M	.7M	.6M	.6M	.5M	.5M	.4M	.5M	.4M	.4M	.2L	.2L	.1L

Comments:

14J. Groundwater Discharge/Recharge: (Check the indicators in i & ii below that apply to the AA)

i. Discharge Indicators
- ___Springs are known or observed
- ___Vegetation growing during dormant season/drought
- ___Wetland occurs at the toe of a natural slope
- ___Seeps are present at the wetland edge
- ___AA permanently flooded during drought periods
- ___Wetland contains an outlet, but no inlet
- ___Other

ii. Recharge Indicators
- ___Permeable substrate present without underlying impeding layer
- ___Wetland contains inlet but no outlet
- ___Other

iii. Rating: Use the information from i and ii above and the table below to arrive at [circle] the functional points and rating [H = high, L = low] for this function.

Criteria	*Functional Points and Rating*
AA is known Discharge/Recharge area or one or more indicators of D/R present	1 (H)
No Discharge/Recharge indicators present	.1 (L)
Available Discharge/Recharge information inadequate to rate AA D/R potential	[✓ N/A (Unknown)]

Comments: Discharge or recharge information inadequate

14K. Uniqueness:
i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Replacement potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MNHP			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MNHP			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate		
Estimated relative abundance (#11)	rare	common	abundant	rare	common	abundant	rare	common	abundant
Low disturbance at AA (#12i)	1 (H)	.9 (H)	.8 (H)	.8 (H)	.6 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)
Moderate disturbance at AA (#12i)	.9 (H)	.8 (H)	.7 (M)	.7 (M)	[✓ .5 (M)]	.4 (M)	.4 (M)	.3 (L)	.2 (L)
High disturbance at AA (#12i)	.8 (H)	.7 (M)	.6 (M)	.6 (M)	.4 (M)	.3 (L)	.3 (L)	.2 (L)	.1 (L)

Comments:

14L. Recreation/Education Potential: i. Is the AA a known rec./ed. site: (circle) [✓ Y] N (If yes, rate as [circle] High [1] and go to ii; if no go to iii)

ii. Check categories that apply to the AA: ___ Educational/scientific study; _X_ Consumptive rec.; ___ Non-consumptive rec.; ___Other

iii. Based on the location, diversity, size, and other site attributes, is there strong potential for rec./ed. use? Y N
(If yes, go to ii, then proceed to iv; if no, then rate as [circle] Low [0.1])

iv. Rating (use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Ownership	*Disturbance at AA (#12i)*		
	low	moderate	high
public ownership	[✓ 1 (H)]	.5 (M)	.2 (L)
private ownership	.7 (M)	.3 (L)	.1 (L)

Comments: On State land- fishing & hunting use - signed

FUNCTION & VALUE SUMMARY & OVERALL RATING

Function & Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units; (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	.3		1	
B. MT Natural Heritage Program Species Habitat	0		1	
C. General Wildlife Habitat	.9		1	
D. General Fish/Aquatic Habitat	.7		1	
E. Flood Attenuation	.6		1	
F. Short and Long Term Surface Water Storage	.6		1	
G. Sediment/Nutrient/Toxicant Removal	.6		1	
H. Sediment/Shoreline Stabilization	.6		1	
I. Production Export/Food Chain Support	.8		1	
J. Groundwater Discharge/Recharge	N/A		1	
K. Uniqueness	.5		1	
L. Recreation/Education Potential	1		1	
Totals:	6.6		12	

55%

OVERALL ANALYSIS AREA (AA) RATING: (Circle appropriate category based on the criteria outlined below) I [✓ II] III IV

Category I Wetland: (Must satisfy one of the following criteria; if does not meet criteria, go to Category II)
___ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; or
___ Score of 1 functional point for Uniqueness; or
___ Score of 1 functional point for Flood Attenuation and answer to Question 14E.ii is "yes"; or
___ Total actual functional points > 80% (round to nearest whole #) of total possible functional points.

Category II Wetland: (Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)
___ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; or
✓ Score of .9 or 1 functional point for General Wildlife Habitat; or
___ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; or
___ "High" to "Exceptional" ratings for both General Wildlife Habitat and General Fish/Aquatic Habitat; or
___ Score of .9 functional point for Uniqueness; or
___ Total Actual Functional Points > 65% (round to nearest whole #) of total possible functional points.

Category III Wetland: (Criteria for Categories I, II or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if does not satisfy criteria go to Category III)
___ "Low" rating for Uniqueness; and
___ "Low" rating for Production Export/Food Chain Support; and
___ Total actual functional points < 30% (round to nearest whole #) of total possible functional points

06/04/2010

06/04/2010

Wetland Assessment Site #3

MDT Montana Wetland Assessment Form (revised 5/25/1999)

1. **Project Name:** Clear Creek Watershed Study 2. **Project #:** NA **Control #:** NA

3. **Evaluation Date:** Mo. 6 Day 3 Yr. 10 4. **Evaluator(s):** E. Lack 5. **Wetlands/Site #(s)** 4

6. **Wetland Location(s): i. Legal:** T 50 [✓ N] or S; R 82 E or [✓ W] S 4 ; T ___ N or S; R ___ E or W; S ___ ;
ii. Approx. Stationing or Mileposts:

iii. Watershed: 10090206 **GPS Reference No. (if applies):** —
Other Location Information:

7. a. **Evaluating Agency:** WEST, Inc. ;
b. **Purpose of Evaluation:**
1.____Wetlands potentially affected by MDT project
2.____Mitigation wetlands; pre-construction
3.____ Mitigation wetlands; post-construction
4. X Other

8. **Wetland size:** (total acres) 10 (visually estimated)
______ (measured, e.g. by GPS [if applies])

9. **Assessment area:** (AA, tot., ac., 50 (visually estimated)
see instructions on determining AA) ______ (measured, e.g. by GPS [if applies])
Clear Creek riparian area @ Buffalo City Park

10. **Classification of Wetland and Aquatic Habitats in AA** (HGM according to Brinson, first col.; USFWS according to Cowardin [1979], remaining cols.)

HGM Class	System	Subsystem	Class	Water Regime	Modifier	% of AA
Riverine	Riverine	Upper perennial	UB	C		5
			EM	C		15
			SS	B		35

(Abbreviations: **System:** Palustrine(P)/ **Subsyst.:** none/ **Classes:** Rock Bottom (RB), Unconsolidated bottom (UB), Aquatic Bed (AB), Unconsolidated Shore (US), Moss-lichen Wetland (ML), Emergent Wetland (EM), Scrub-Shrub Wetland (SS), Forested Wetland (FO)/ **System:** Lacustrine (L)/, **Subsyst.:** Limnetic (2)/ **Classes:** RB, UB, AB/ **Subsystem:** Littoral (4)/ **Classes:** RB UB, AB US, EM/ **System:** Riverine (R)/ **Subsyst.:** Lower Perennial (2)/ Classes: RB, UB, AB, US, EM/ **Subsystem:** Upper Perennial (3)/ Classes: RB, UB, AB, US/ **Water Regimes:** Permanently Flooded (H), Intermittently Exposed (G), Semipermanently Flooded (F), Seasonally Flooded (C), Saturated (B), Temporarily Flooded (A), Intermittently Flooded (J) **Modifiers:** Excavated (E), Impounded (I), Diked (D), Partly Drained (PD), Farmed (F), Artificial (A) **HGM Classes:** Riverine, Depressional, Slope, Mineral Soil Flats, Organic Soil Flats, Lacustrine Fringe

11. **Estimated relative abundance:** (of similarly classified sites within the same Major Montana Watershed Basin, see definitions)
(Circle one) Unknown Rare [✓ Common] Abundant
Comments:

12. **General condition of AA:**
i. **Regarding disturbance:** (use matrix below to determine [circle] appropriate response)

Conditions within AA	*Predominant conditions adjacent to (within 500 feet of) AA*		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings.	low disturbance	low disturbance	moderate disturbance
AA not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings	moderate disturbance	[✓ moderate disturbance]	high disturbance
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration high road or building density	high disturbance	high disturbance	high disturbance

Comments: (types of disturbance, intensity, season, etc.): city park/greenway
ii. Prominent weedy, alien, & introduced species (including those not domesticated, feral): (list)

iii. Provide brief descriptive summary of AA and surrounding land use/habitat:
Clear Creek riparian corridor within city park

13. **Structural Diversity:** (based on number of "Cowardin" *vegetated* classes present [do not include unvegetated classes], see #10 above)

# of "Cowardin" vegetated classes present in AA (see #10)	≥ 3 vegetated classes (or ≥ 2 if one is forested)	2 vegetated classes (or 1 if forested)	≤ 1 vegetated class
Rating (circle)	[✓ High]	Moderate	Low

Comments:

SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S
Secondary habitat (**list species**) D S
Incidental habitat (**list species**) D [✓ S] Canada lynx
No usable habitat D S

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.9 (H)	.8 (M)	.7 (M)	.5 (L)	.3 (L)	[✓ 0 (L)]

Sources for documented use (e.g. observations, records, etc):
Canada lynx range map

14B. Habitat for plant or animals rated S1, S2, or S3 by the Montana Natural Heritage Program: (not including species listed in14A above)

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S
Secondary habitat (**list species**) D S
Incidental habitat (**list species**) D S
No usable habitat D S none known or suspected

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.8 (H)	.7 (M)	.6 (M)	.2 (L)	[✓ .1 (L)]	0 (L)

Sources for documented use (e.g. observations, records, etc.):

14C. General Wildlife Habitat Rating:

I. **Evidence of overall wildlife use in the AA** (circle substantial, moderate, or low based on supporting evidence):

Substantial (based on any of the following [check]):
- ☐ observations of abundant wildlife #'s or high species diversity (during any period)
- ☐ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ presence of extremely limiting habitat features not available in the surrounding area
- ☐ interviews with local biologists with knowledge of the AA

Low (based on any of the following [check]):
- ☐ few or no wildlife observations during peak use periods
- ☐ little to no wildlife sign
- ☐ sparse adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

Moderate (based on any of the following [check]):
- ☐ observations of scattered wildlife groups or individuals or relatively few species during peak periods
- ☒ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ adequate adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

ii. **Wildlife habitat features** (working from top to bottom, circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see instructions for further definitions of these terms].)

Structural diversity (see #13)	High								Moderate								Low			
Class cover distribution (all vegetated classes)	Even				Uneven				Even				Uneven				Even			
Duration of surface water in ≥ 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12i)	E	E	E	H	E	E	H	H	E	H	H	M	E	H	M	M	E	H	M	M
Moderate disturbance at AA (see #12i)	H	H	H	H	[✓ H]	H	H	M	H	H	M	M	H	M	M	L	H	M	L	L
High disturbance at AA (see #12i)	M	M	M	L	M	M	L	L	M	M	L	L	M	L	L	L	L	L	L	L

III. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Evidence of wildlife use (i)	*Wildlife habitat features rating (ii)*			
	Exceptional	High	Moderate	Low
Substantial	1 (E)	.9 (H)	.8 (H)	.7 (M)
Moderate	[✓ .9 (H)]	.7 (M)	.5 (M)	.3 (L)
Minimal	.6 (M)	.4 (M)	.2 (L)	.1 (L)

Comments:

14D. General Fish/Aquatic Habitat Rating: (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, etc., circle **NA** here and proceed to the next function. If fish use occurs in the AA but is not desired from a resource management perspective [such as fish use within an irrigation canal], then Habitat Quality [i below] should be marked as "Low", applied accordingly in ii below, and noted ih the comments.)

i. **Habitat Quality** (circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25%	10–25%	<10%	>25%	10–25%	<10%	>25%	10–25%	<10%
Shading - >**75%** of streambank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	E	E	H	H	H	M	M	M	M
Shading – **50 to 75%** of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	H	M	[✓ M]	M	M	M	L	L
Shading - < **50%** of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

ii. **Modified Habitat Quality** (Circle the appropriate response to the following question. If answer is Y, then reduce rating in i above by one level [E = H, H = M, M = L, L = L]). *Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the waterbody included on the MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support?* Y [✓ N] Modified habitat quality rating = (circle) **E H M L**

iii. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Types of fish known or suspected within AA	*Modified Habitat Quality (ii)*			
	Exceptional	High	Moderate	Low
Native game fish	1 (E)	.9 (H)	[✓ .7 (M)]	.5 (M)
Introduced game fish	.9 (H)	.8 (H)	[✓ .6 (M)]	.4 (M)
Non-game fish	.7 (M)	.6 (M)	.5 (M)	.3 (L)
No fish	.5 (M)	.3 (L)	.2 (L)	.1 (L)

Comments: Assumes native + introduced fish present

14E. Flood Attenuation: (applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, circle **NA** here and proceed to next function.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Estimated wetland area in AA subject to periodic flooding	≥ 10 acres			<10, >2 acres			≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains **no outlet or restricted outlet**	1(H)	.9(H)	.6(M)	.8(H)	.7(H)	.5(M)	.4(M)	.3(L)	.2(L)
AA contains **unrestricted outlet**	.9(H)	[✓ .8(H)]	.5(M)	.7(H)	.6(M)	.4(M)	.3(L)	.2(L)	.1(L)

ii. Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA (circle)? [✓ Y] N

Comments:

14F. Short and Long Term Surface Water Storage: (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, circle **NA** here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding	>5 acre feet			<5, >1 acre feet			≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond **≥ 5 out of 10 years**	1(H)	[✓ .9(H)]	.8(H)	.8(H)	.6(M)	.5(M)	.4(M)	.3(L)	.2(L)
Wetlands in AA flood or pond **< 5 out of 10 years**	.9(H)	.8(H)	.7(M)	.7(M)	.5(M)	.4(M)	.3(L)	.2(L)	.1(L)

Comments: Assumes floods more than 5 out of 10 years

14G. Sediment/Nutrient/Toxicant Retention and Removal: (Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, circle **NA** here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants or AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	≥ 70%		< 70%		≥ 70%		< 70%	
Evidence of flooding or ponding in AA	Yes	No	Yes	No	Yes	No	Yes	No
AA contains no or restricted outlet	1 (H)	.8 (H)	.7 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)	.2 (L)
AA contains unrestricted outlet	[✓ .9 (H)]	.7 (M)	.6 (M)	.4 (M)	.4 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14H Sediment/Shoreline Stabilization: (applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. If does not apply, circle NA here and proceed to next function)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses	*Duration of surface water adjacent to rooted vegetation*		
	permanent / perennial	seasonal / intermittent	Temporary / ephemeral
≥ 65%	1 (H)	.9 (H)	.7 (M)
35-64%	.7 (M)	[✓ .6 (M)]	.5 (M)
< 35%	.3 (L)	.2 (L)	.1 (L)

Comments: mixed wetland & riparian communities in floodplain

14I. Production Export/Food Chain Support:
i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Factor A = acreage of vegetated component in the AA; Factor B = structural diversity rating from #13; Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P = permanent/perennial; S/I = seasonal/intermittent; T/E /A= temporary/ephemeral or absent [see instructions for further definitions of these terms].)

A	Vegetated component >5 acres						Vegetated component 1-5 acres						Vegetated component <1 acre					
B	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low	
C	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
P/P	1H	.9H	.9H	.8H	.8H	.7M	.9H	.8H	.8H	.7M	.7M	.6M	.7M	.6M	.6M	.4M	.4M	.3L
S/I	[✓ .9H]	.8H	.8H	.7M	.7M	.6M	.8H	.7M	.7M	.6M	.6M	.5M	.6M	.5M	.5M	.3L	.3L	.2L
T/E/A	.8H	.7M	.7M	.6M	.6M	.5M	.7M	.6M	.6M	.5M	.5M	.4M	.5M	.4M	.4M	.2L	.2L	.1L

Comments:

14J. Groundwater Discharge/Recharge: (Check the indicators in i & ii below that apply to the AA)

i. Discharge Indicators
- ___Springs are known or observed
- ___Vegetation growing during dormant season/drought
- ___Wetland occurs at the toe of a natural slope
- ___Seeps are present at the wetland edge
- ___AA permanently flooded during drought periods
- ___Wetland contains an outlet, but no inlet
- ___Other

ii. Recharge Indicators
- ___Permeable substrate present without underlying impeding layer
- ___Wetland contains inlet but no outlet
- ___Other

iii. Rating: Use the information from i and ii above and the table below to arrive at [circle] the functional points and rating [H = high, L = low] for this function.

Criteria	*Functional Points and Rating*
AA is known Discharge/Recharge area or one or more indicators of D/R present	1 (H)
No Discharge/Recharge indicators present	.1 (L)
Available Discharge/Recharge information inadequate to rate AA D/R potential	[✓ N/A (Unknown)]

Comments: Discharge & recharge information inadequate

14K. Uniqueness:
i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Replacement potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MNHP			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MNHP			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate		
Estimated relative abundance (#11)	rare	common	abundant	rare	common	abundant	rare	common	abundant
Low disturbance at AA (#12i)	1 (H)	.9 (H)	.8 (H)	.8 (H)	.6 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)
Moderate disturbance at AA (#12i)	.9 (H)	.8 (H)	.7 (M)	.7 (M)	[✓ .5 (M)]	.4 (M)	.4 (M)	.3 (L)	.2 (L)
High disturbance at AA (#12i)	.8 (H)	.7 (M)	.6 (M)	.6 (M)	.4 (M)	.3 (L)	.3 (L)	.2 (L)	.1 (L)

Comments:

14L. Recreation/Education Potential: i. Is the AA a known rec./ed. site: (circle) [✓ Y] N (If yes, rate as [circle] High [1] and go to ii; if no go to iii)
ii. Check categories that apply to the AA: ___ Educational/scientific study; ___ Consumptive rec.; _X_ Non-consumptive rec.; ___Other
iii. Based on the location, diversity, size, and other site attributes, is there strong potential for rec./ed. use? Y N
(If yes, go to ii, then proceed to iv; if no, then rate as [circle] Low [0.1])
iv. Rating (use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Ownership	*Disturbance at AA (#12i)*		
	low	moderate	high
public ownership	[✓ 1 (H)]	.5 (M)	.2 (L)
private ownership	.7 (M)	.3 (L)	.1 (L)

Comments:

FUNCTION & VALUE SUMMARY & OVERALL RATING

Function & Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units; (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	.3		1	
B. MT Natural Heritage Program Species Habitat	0		1	
C. General Wildlife Habitat	.9		1	
D. General Fish/Aquatic Habitat	.7			
E. Flood Attenuation	.8			
F. Short and Long Term Surface Water Storage	.9			
G. Sediment/Nutrient/Toxicant Removal	.9			
H. Sediment/Shoreline Stabilization	.6			
I. Production Export/Food Chain Support	.9		1	
J. Groundwater Discharge/Recharge	NA		1	
K. Uniqueness	.5		1	
L. Recreation/Education Potential	1		1	
Totals:	7.5			

63%

OVERALL ANALYSIS AREA (AA) RATING: (Circle appropriate category based on the criteria outlined below) [✓ I] II III IV

Category I Wetland: (Must satisfy one of the following criteria; if does not meet criteria, go to Category II)
___ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; or
___ Score of 1 functional point for Uniqueness; or
✓ Score of 1 functional point for Flood Attenuation and answer to Question 4E.ii is "yes"; or
___ Total actual functional points > 80% (round to nearest whole #) of total possible functional points.

Category II Wetland: (Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)
___ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; or
___ Score of .9 or 1 functional point for General Wildlife Habitat; or
___ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; or
___ "High" to "Exceptional" ratings for both General Wildlife Habitat and General Fish/Aquatic Habitat; or
___ Score of .9 functional point for Uniqueness; or
___ Total Actual Functional Points > 65% (round to nearest whole #) of total possible functional points.

Category III Wetland: (Criteria for Categories I, II or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if does not satisfy criteria go to Category III)
___ "Low" rating for Uniqueness; and
___ "Low" rating for Production Export/Food Chain Support; and
___ Total actual functional points < 30% (round to nearest whole #) of total possible functional points

Wetland Assessment Site #4

MDT Montana Wetland Assessment Form (revised 5/25/1999)

1. Project Name: Clear Creek Watershed Study **2. Project #:** NA **Control #:** NA

3. Evaluation Date: Mo. 6 Day 3 Yr. 10 **4. Evaluator(s):** E. Lack **5. Wetlands/Site #(s)** 5

6. Wetland Location(s): I. Legal: T 51 [✓ N] or S; R 82 E or [✓ W] S ______; T ____ N or S; R ____ E or W; S ______;
II. Approx. Stationing or Mileposts: ______

III. Watershed: 10090206 **GPS Reference No. (if applies):** —
Other Location Information:

7. a. Evaluating Agency: WEST Inc. ;
b. Purpose of Evaluation:
1.____Wetlands potentially affected by MDT project
2.____Mitigation wetlands; pre-construction
3.____ Mitigation wetlands; post-construction
4. X Other

8. Wetland size: (total acres) 50 (visually estimated)
______ (measured, e.g. by GPS [if applies])

9. Assessment area: (AA, tot., ac., see instructions on determining AA) 50 (visually estimated)
______ (measured, e.g. by GPS [if applies])

10. Classification of Wetland and Aquatic Habitats in AA (HGM according to Brinson, first col.; USFWS according to Cowardin [1979], remaining cols.)

HGM Class	System	Subsystem	Class	Water Regime	Modifier	% of AA
Slope	Palustrine		EM	B		

(Abbreviations: **System:** Palustrine(P)/ **Subsyst.:** none/ **Classes:** Rock Bottom (RB), Unconsolidated bottom (UB), Aquatic Bed (AB), Unconsolidated Shore (US), Moss-lichen Wetland (ML), Emergent Wetland (EM), Scrub-Shrub Wetland (SS), Forested Wetland (FO)/ **System:** Lacustrine (L)/, **Subsyst.:** Limnetic (2)/ **Classes:** RB, UB, AB/ **Subsystem:** Littoral (4)/ **Classes:** RB, UB, AB US, EM/ **System:** Riverine (R)/ **Subsyst.:** Lower Perennial (2)/ Classes: RB, UB, AB, US, EM/ **Subsystem:** Upper Perennial (3)/ Classes: RB, UB, AB, US/ **Water Regimes:** Permanently Flooded (H), Intermittently Exposed (G), Semipermanently Flooded (F), Seasonally Flooded (C), Saturated (B), Temporarily Flooded (A), Intermittently Flooded (J) **Modifiers:** Excavated (E), Impounded (I), Diked (D), Partly Drained (PD), Farmed (F), Artificial (A) **HGM Classes:** Riverine, Depressional, Slope, Mineral Soil Flats, Organic Soil Flats, Lacustrine Fringe

11. Estimated relative abundance: (of similarly classified sites within the same Major Montana Watershed Basin, see definitions)
(Circle one) Unknown Rare [✓ Common] Abundant
Comments:

12. General condition of AA:
i. Regarding disturbance: (use matrix below to determine [circle] appropriate response)

Conditions within AA	*Predominant conditions adjacent to (within 500 feet of) AA*		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings	low disturbance	low disturbance	moderate disturbance
AA not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings	moderate disturbance	[✓ moderate disturbance]	high disturbance
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration high road or building density	high disturbance	high disturbance	high disturbance

Comments: (types of disturbance, intensity, season, etc.): grazing
ii. Prominent weedy, alien, & introduced species (including those not domesticated, feral): (list) ______

iii. Provide brief descriptive summary of AA and surrounding land use/habitat:

Wet meadow on slope in rangeland

13. Structural Diversity: (based on number of "Cowardin" *vegetated* classes present [do not include unvegetated classes], see #10 above)

# of "Cowardin" vegetated classes present in AA (see #10)	≥ 3 vegetated classes (or ≥ 2 if one is forested)	2 vegetated classes (or 1 if forested)	≤ 1 vegetated class
Rating (circle)	High	Moderate	[✓ Low]

Comments:

SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ______________________
Secondary habitat (**list species**) D S ______________________
Incidental habitat (**list species**) D S ______________________
No usable habitat D S none known or suspected

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.9 (H)	.8 (M)	.7 (M)	.5 (L)	.3 (L)	[✓ 0 (L)]

Sources for documented use (e.g. observations, records, etc):

14B. Habitat for plant or animals rated S1, S2, or S3 by the Montana Natural Heritage Program: (not including species listed in14A above)

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ______________________
Secondary habitat (**list species**) D S ______________________
Incidental habitat (**list species**) D S ______________________
No usable habitat D S none known or suspected

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.8 (H)	.7 (M)	.6 (M)	.2 (L)	.1 (L)	[✓ 0 (L)]

Sources for documented use (e.g. observations, records, etc.):

14C. General Wildlife Habitat Rating:

I. **Evidence of overall wildlife use in the AA** (circle substantial, moderate, or low based on supporting evidence):

Substantial (based on any of the following [check]):
__ observations of abundant wildlife #'s or high species diversity (during any period)
__ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
__ presence of extremely limiting habitat features not available in the surrounding area
__ interviews with local biologists with knowledge of the AA

Low (based on any of the following [check]):
__ few or no wildlife observations during peak use periods
X little to no wildlife sign
__ sparse adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

Moderate (based on any of the following [check]):
__ observations of scattered wildlife groups or individuals or relatively few species during peak periods
__ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
__ adequate adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

ii. **Wildlife habitat features** (working from top to bottom, circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see instructions for further definitions of these terms].)

Structural diversity (see #13)	High								Moderate								Low			
Class cover distribution (all vegetated classes)	Even				Uneven				Even				Uneven				Even			
Duration of surface water in ≥ 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12i)	E	E	E	H	E	E	H	H	E	H	H	M	E	H	M	M	E	H	M	M
Moderate disturbance at AA (see #12i)	H	H	H	H	H	H	H	M	H	H	M	M	H	M	M	L	H	M	[✓ L]	L
High disturbance at AA (see #12i)	M	M	M	L	M	M	L	L	M	M	L	L	M	L	L	L	L	L	L	L

III. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Evidence of wildlife use (i)	*Wildlife habitat features rating (ii)*			
	Exceptional	High	Moderate	Low
Substantial	1 (E)	.9 (H)	.8 (H)	.7 (M)
Moderate	.9 (H)	.7 (M)	.5 (M)	.3 (L)
Minimal	.6 (M)	.4 (M)	.2 (L)	[✓ .1 (L)]

Comments:

14D. General Fish/Aquatic Habitat Rating: (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, etc., circle [✓ NA] here and proceed to the next function. If fish use occurs in the AA but is not desired from a resource management perspective [such as fish use within an irrigation canal], then Habitat Quality [i below] should be marked as "Low", applied accordingly in ii below, and noted ih the comments.)

i. **Habitat Quality** (circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25%	10–25%	<10%	>25%	10–25%	<10%	>25%	10–25%	<10%
Shading - >75% of streambank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	E	E	H	H	H	M	M	M	M
Shading – 50 to 75% of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading - < 50% of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

ii. **Modified Habitat Quality** (Circle the appropriate response to the following question. If answer is Y, then reduce rating in i above by one level [E = H, H = M, M = L, L = L]). *Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the waterbody included on the MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support?* Y N Modified habitat quality rating = (circle) E H M L

iii. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Types of fish known or suspected within AA	*Modified Habitat Quality (ii)*			
	Exceptional	High	Moderate	Low
Native game fish	1 (E)	.9 (H)	.7 (M)	.5 (M)
Introduced game fish	.9 (H)	.8 (H)	.6 (M)	.4 (M)
Non-game fish	.7 (M)	.6 (M)	.5 (M)	.3 (L)
No fish	.5 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14E. Flood Attenuation: (applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, circle [✓ NA] here and proceed to next function.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Estimated wetland area in AA subject to periodic flooding	≥ 10 acres			<10, >2 acres			≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains no outlet or restricted outlet	1(H)	.9(H)	.6(M)	.8(H)	.7(H)	.5(M)	.4(M)	.3(L)	.2(L)
AA contains unrestricted outlet	.9(H)	.8(H)	.5(M)	.7(H)	.6(M)	.4(M)	.3(L)	.2(L)	.1(L)

ii. Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA (circle)? Y N

Comments:

14F. Short and Long Term Surface Water Storage: (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, circle [✓ NA] here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding	>5 acre feet			<5, >1 acre feet			≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond ≥ 5 out of 10 years	1(H)	.9(H)	.8(H)	.8(H)	.6(M)	.5(M)	.4(M)	.3(L)	.2(L)
Wetlands in AA flood or pond < 5 out of 10 years	.9(H)	.8(H)	.7(M)	.7(M)	.5(M)	.4(M)	.3(L)	.2(L)	.1(L)

Comments:

14G. Sediment/Nutrient/Toxicant Retention and Removal: (Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, circle [✓ NA] here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants or AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	≥ 70%		< 70%		≥ 70%		< 70%	
Evidence of flooding or ponding in AA	Yes	No	Yes	No	Yes	No	Yes	No
AA contains no or restricted outlet	1 (H)	.8 (H)	.7 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)	.2 (L)
AA contains unrestricted outlet	.9 (H)	.7 (M)	.6 (M)	.4 (M)	.4 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14H Sediment/Shoreline Stabilization: (applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. If does not apply, circle [✓ NA] here and proceed to next function)

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses	*Duration of surface water adjacent to rooted vegetation*		
	permanent / perennial	seasonal / intermittent	Temporary / ephemeral
≥ 65%	1 (H)	.9 (H)	.7 (M)
35-64%	.7 (M)	.6 (M)	.5 (M)
< 35%	.3 (L)	.2 (L)	.1 (L)

Comments:

14I. Production Export/Food Chain Support:

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Factor A = acreage of vegetated component in the AA; Factor B = structural diversity rating from #13; Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P = permanent/perennial; S/I = seasonal/intermittent; T/E /A= temporary/ephemeral or absent [see instructions for further definitions of these terms].)

A	Vegetated component >5 acres						Vegetated component 1-5 acres						Vegetated component <1 acre					
B	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low	
C	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
P/P	1H	.9H	.9H	.8H	.8H	.7M	.9H	.8H	.8H	.7M	.7M	.6M	.7M	.6M	.6M	.4M	.4M	.3L
S/I	.9H	.8H	.8H	.7M	.7M	[✓ .6M]	.8H	.7M	.7M	.6M	.6M	.5M	.6M	.5M	.5M	.3L	.3L	.2L
T/E/ A	.8H	.7M	.7M	.6M	.6M	.5M	.7M	.6M	.6M	.5M	.5M	.4M	.5M	.4M	.4M	.2L	.2L	.1L

Comments:

14J. Groundwater Discharge/Recharge: (Check the indicators in i & ii below that apply to the AA)

i. Discharge Indicators

___Springs are known or observed
_x_Vegetation growing during dormant season/drought*
___Wetland occurs at the toe of a natural slope
___Seeps are present at the wetland edge
___AA permanently flooded during drought periods
___Wetland contains an outlet, but no inlet
___Other

ii. Recharge Indicators

___Permeable substrate present without underlying impeding layer
___Wetland contains inlet but no outlet
___Other

*suspected, not observed

iii. Rating: Use the information from i and ii above and the table below to arrive at [circle] the functional points and rating [H = high, L = low] for this function.

Criteria	*Functional Points and Rating*
AA is known Discharge/Recharge area or one or more indicators of D/R present	[✓ 1 (H)]
No Discharge/Recharge indicators present	.1 (L)
Available Discharge/Recharge information inadequate to rate AA D/R potential	N/A (Unknown)

Comments:

14K. Uniqueness:

i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Replacement potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MNHP			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MNHP			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate		
Estimated relative abundance (#11)	rare	common	abundant	rare	common	abundant	rare	common	abundant
Low disturbance at AA (#12i)	1 (H)	.9 (H)	.8 (H)	.8 (H)	.6 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)
Moderate disturbance at AA (#12i)	.9 (H)	.8 (H)	.7 (M)	.7 (M)	.5 (M)	.4 (M)	.4 (M)	[✓ .3 (L)]	.2 (L)
High disturbance at AA (#12i)	.8 (H)	.7 (M)	.6 (M)	.6 (M)	.4 (M)	.3 (L)	.3 (L)	.2 (L)	.1 (L)

Comments:

14L. Recreation/Education Potential: i. Is the AA a known rec./ed. site: (circle) Y [✓ N] (If yes, rate as [circle] High [1] and go to ii; if no go to iii)

ii. Check categories that apply to the AA: ___ Educational/scientific study; ___ Consumptive rec.; ___ Non-consumptive rec.; ___Other

iii. Based on the location, diversity, size, and other site attributes, is there strong potential for rec./ed. use? Y [✓ N]

(If yes, go to ii, then proceed to iv; if no, then rate as [circle] Low [0.1])

iv. Rating (use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Ownership	*Disturbance at AA (#12i)*		
	low	moderate	high
public ownership	1 (H)	.5 (M)	.2 (L)
private ownership	.7 (M)	.3 (L)	[✓ .1 (L)]

Comments:

FUNCTION & VALUE SUMMARY & OVERALL RATING

Function & Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units; (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	0		1	
B. MT Natural Heritage Program Species Habitat	0		1	
C. General Wildlife Habitat	.1		1	
D. General Fish/Aquatic Habitat	NA			
E. Flood Attenuation	NA			
F. Short and Long Term Surface Water Storage	NA			
G. Sediment/Nutrient/Toxicant Removal	NA			
H. Sediment/Shoreline Stabilization	NA			
I. Production Export/Food Chain Support	.6		1	
J. Groundwater Discharge/Recharge	1		1	
K. Uniqueness	.3		1	
L. Recreation/Education Potential	.1		1	
Totals:	2.1		7	

30%

OVERALL ANALYSIS AREA (AA) RATING: (Circle appropriate category based on the criteria outlined below) I II [✓ III] IV

Category I Wetland: (Must satisfy one of the following criteria; if does not meet criteria, go to Category II)
___ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; or
___ Score of 1 functional point for Uniqueness; or
___ Score of 1 functional point for Flood Attenuation and answer to Question 14E.ii is "yes"; or
___ Total actual functional points > 80% (round to nearest whole #) of total possible functional points.

Category II Wetland: (Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)
___ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; or
___ Score of .9 or 1 functional point for General Wildlife Habitat; or
___ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; or
___ "High" to "Exceptional" ratings for both General Wildlife Habitat and General Fish/Aquatic Habitat; or
___ Score of .9 functional point for Uniqueness; or
___ Total Actual Functional Points > 65% (round to nearest whole #) of total possible functional points.

Category III Wetland: (Criteria for Categories I, II or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if does not satisfy criteria go to Category III)
___ "Low" rating for Uniqueness; and
___ "Low" rating for Production Export/Food Chain Support; and
___ Total actual functional points < 30% (round to nearest whole #) of total possible functional points

Wetland Assessment Site #5

MDT Montana Wetland Assessment Form (revised 5/25/1999)

1. **Project Name:** Clear Creek Watershed Study 2. **Project #:** NA **Control #:** NA

3. **Evaluation Date:** Mo. 6 Day 3 Yr. 10 4. **Evaluator(s):** E. Lack 5 . **Wetlands/Site #(s)** 6

6. **Wetland Location(s): i. Legal:** T ____ N or S; R ____ E or W; S ________; T ____ N or S; R ____ E or W; S ________;
ii. Approx. Stationing or Mileposts: ________
iii. Watershed: 10090206 **GPS Reference No. (if applies):** —
Other Location Information:

7. a. **Evaluating Agency:** WEST Inc.;
b. **Purpose of Evaluation:**
1.____Wetlands potentially affected by MDT project
2.____Mitigation wetlands; pre-construction
3.____ Mitigation wetlands; post-construction
4.X Other

8. **Wetland size:** (total acres) 30 (visually estimated)
________ (measured, e.g. by GPS [if applies])

9. **Assessment area:** (AA, tot., ac., see instructions on determining AA) 25 (visually estimated)
________ (measured, e.g. by GPS [if applies])

Includes wetlands & riparian on south & west shores

10. **Classification of Wetland and Aquatic Habitats in AA** (HGM according to Brinson, first col.; USFWS according to Cowardin [1979], remaining cols.)

HGM Class	System	Subsystem	Class	Water Regime	Modifier	% of AA
Lacustrine fringe	Palustrine		EM	C	I	
	Palustrine		SS	C	I	

(Abbreviations: **System:** Palustrine(P)/ **Subsyst.:** none/ **Classes:** Rock Bottom (RB), Unconsolidated bottom (UB), Aquatic Bed (AB), Unconsolidated Shore (US), Moss-lichen Wetland (ML), Emergent Wetland (EM), Scrub-Shrub Wetland (SS), Forested Wetland (FO)/ **System:** Lacustrine (L)/, **Subsyst.:** Limnetic (2)/ **Classes:** RB, UB, AB/ **Subsystem:** Littoral (4)/ **Classes:** RB UB, AB US, EM/ **System:** Riverine (R)/ **Subsyst.:** Lower Perennial (2)/ Classes: RB, UB, AB, US, EM/ **Subsystem:** Upper Perennial (3)/ Classes: RB, UB, AB, US/ **Water Regimes:** Permanently Flooded (H), Intermittently Exposed (G), Semipermanently Flooded (F), Seasonally Flooded (C), Saturated (B), Temporarily Flooded (A), Intermittently Flooded (J) **Modifiers:** Excavated (E), Impounded (I), Diked (D), Partly Drained (PD), Farmed (F), Artificial (A) **HGM Classes:** Riverine, Depressional, Slope, Mineral Soil Flats, Organic Soil Flats, Lacustrine Fringe

11. **Estimated relative abundance:** (of similarly classified sites within the same Major Montana Watershed Basin, see definitions)
(Circle one) Unknown [✓ Rare] Common Abundant
Comments:

12. **General condition of AA:**
i. **Regarding disturbance:** (use matrix below to determine [circle] appropriate response)

Conditions within AA	*Predominant conditions adjacent to (within 500 feet of) AA*		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings.	low disturbance	low disturbance	moderate disturbance
AA not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings	moderate disturbance	[✓ moderate disturbance]	high disturbance
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration, high road or building density.	high disturbance	high disturbance	high disturbance

Comments: (types of disturbance, intensity, season, etc.): reservoir, roads, recreation facilities
ii. Prominent weedy, alien, & introduced species (including those not domesticated, feral): (list) ________

iii. Provide brief descriptive summary of AA and surrounding land use/habitat:
Fringe wetlands around Healy Reservoir - patches of willows & reeds.

13. **Structural Diversity:** (based on number of "Cowardin" *vegetated* classes present [do not include unvegetated classes], see #10 above)

# of "Cowardin" vegetated classes present in AA (see #10)	≥ 3 vegetated classes (or ≥ 2 if one is forested)	2 vegetated classes (or 1 if forested)	≤ 1 vegetated class
Rating (circle)	High	[✓ Moderate]	Low

Comments:

SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ______________________
Secondary habitat (**list species**) D S ______________________
Incidental habitat (**list species**) D S ______________________
No usable habitat D [✓ S] none known or suspected

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.9 (H)	.8 (M)	.7 (M)	.5 (L)	.3 (L)	[✓ 0 (L)]

Sources for documented use (e.g. observations, records, etc):

14B. Habitat for plant or animals rated S1, S2, or S3 by the Montana Natural Heritage Program: (not including species listed in14A above)

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ______________________
Secondary habitat (**list species**) D S ______________________
Incidental habitat (**list species**) D S ______________________
No usable habitat D S none known or suspected

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.8 (H)	.7 (M)	.6 (M)	.2 (L)	.1 (L)	[✓ 0 (L)]

Sources for documented use (e.g. observations, records, etc.):

14C. General Wildlife Habitat Rating:

I. **Evidence of overall wildlife use in the AA** (circle substantial, moderate, or low based on supporting evidence):

Substantial (based on any of the following [check]):
__ observations of abundant wildlife #'s or high species diversity (during any period)
__ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
__ presence of extremely limiting habitat features not available in the surrounding area
__ interviews with local biologists with knowledge of the AA

Low (based on any of the following [check]):
__ few or no wildlife observations during peak use periods
__ little to no wildlife sign
__ sparse adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

Moderate (based on any of the following [check]):
X observations of scattered wildlife groups or individuals or relatively few species during peak periods
X common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
X adequate adjacent upland food sources
__ interviews with local biologists with knowledge of the AA

ii. **Wildlife habitat features** (working from top to bottom, circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral: and A = absent [see instructions for further definitions of these terms].)

Structural diversity (see #13)	High								Moderate								Low			
Class cover distribution (all vegetated classes)	Even				Uneven				Even				Uneven				Even			
Duration of surface water in ≥ 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12i)	E	E	E	H	E	E	H	H	E	H	H	M	E	H	M	M	E	H	M	M
Moderate disturbance at AA (see #12i)	H	H	H	H	H	H	H	M	H	H	M	M	H	[✓ M]	M	L	H	M	L	L
High disturbance at AA (see #12i)	M	M	M	L	M	M	L	L	M	M	L	L	M	L	L	L	L	L	L	L

iii. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Evidence of wildlife use (i)	*Wildlife habitat features rating (ii)*			
	Exceptional	High	Moderate	Low
Substantial	1 (E)	.9 (H)	.8 (H)	.7 (M)
Moderate	.9 (H)	.7 (M)	[✓ .5 (M)]	.3 (L)
Minimal	.6 (M)	.4 (M)	.2 (L)	.1 (L)

Comments:

14D. General Fish/Aquatic Habitat Rating: (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, etc., circle **NA** here and proceed to the next function. If fish use occurs in the AA but is not desired from a resource management perspective [such as fish use within an irrigation canal], then Habitat Quality [i below] should be marked as "Low", applied accordingly in ii below, and noted in the comments.)

i. **Habitat Quality** (circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25%	10–25%	<10%	>25%	10–25%	<10%	>25%	10–25%	<10%
Shading - >**75%** of streambank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	E	E	H	H	H	M	M	M	M
Shading – **50 to 75%** of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading - < **50%** of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	M	M	M	[✓ L]	L	L	L	L

ii. **Modified Habitat Quality** (Circle the appropriate response to the following question. If answer is Y, then reduce rating in i above by one level [E = H, H = M, M = L, L = L]). *Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the waterbody included on the MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support?* [✓ Y] N Modified habitat quality rating = (circle) E H M [✓ L]

iii. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Types of fish known or suspected within AA	*Modified Habitat Quality (ii)*			
	Exceptional	High	Moderate	Low
Native game fish	1 (E)	.9 (H)	.7 (M)	[✓ .5 (M)]
Introduced game fish	.9 (H)	.8 (H)	.6 (M)	.4 (M)
Non-game fish	.7 (M)	.6 (M)	.5 (M)	.3 (L)
No fish	.5 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14E. Flood Attenuation: (applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, circle **NA** here and proceed to next function.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Estimated wetland area in AA subject to periodic flooding	≥ 10 acres			<10, >2 acres			≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains **no outlet** or **restricted outlet**	1(H)	.9(H)	.6(M)	.8(H)	.7(H)	.5(M)	.4(M)	.3(L)	.2(L)
AA contains **unrestricted outlet**	.9(H)	[✓ .8(H)]	.5(M)	.7(H)	.6(M)	.4(M)	.3(L)	.2(L)	.1(L)

ii. Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA (circle)? Y [✓ N]

Comments:

14F. Short and Long Term Surface Water Storage: (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, circle **NA** here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding	>5 acre feet			<5, >1 acre feet			≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond **≥ 5 out of 10 years**	1(H)	.9(H)	.8(H)	.8(H)	.6(M)	.5(M)	.4(M)	.3(L)	.2(L)
Wetlands in AA flood or pond **< 5 out of 10 years**	.9(H)	[✓ .8(H)]	.7(M)	.7(M)	.5(M)	.4(M)	.3(L)	.2(L)	.1(L)

Comments: Assumes flooding < 5 out of 10 yrs

14G. Sediment/Nutrient/Toxicant Retention and Removal: (Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, circle **NA** here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants or AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	≥ 70%		< 70%		≥ 70%		< 70%	
Evidence of flooding or ponding in AA	Yes	No	Yes	No	Yes	No	Yes	No
AA contains **no or restricted outlet**	1 (H)	.8 (H)	.7 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)	.2 (L)
AA contains **unrestricted outlet**	.9 (H)	.7 (M)	[✓ .6 (M)]	.4 (M)	.4 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14H Sediment/Shoreline Stabilization: (applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. If does not apply, circle NA here and proceed to next function)

I. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses	*Duration of surface water adjacent to rooted vegetation*		
	permanent / perennial	seasonal / intermittent	Temporary / ephemeral
≥ 65%	1 (H)	.9 (H)	.7 (M)
35-64%	.7 (M)	[✓ .6 (M)]	.5 (M)
< 35%	.3 (L)	.2 (L)	.1 (L)

Comments:

14I. Production Export/Food Chain Support:
I. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Factor A = acreage of vegetated component in the AA; Factor B = structural diversity rating from #13; Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P = permanent/perennial; S/I = seasonal/intermittent; T/E /A= temporary/ephemeral or absent [see instructions for further definitions of these terms].)

A	Vegetated component >5 acres						Vegetated component 1-5 acres						Vegetated component <1 acre					
B	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low	
C	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
P/P	1H	.9H	.9H	.8H	.8H	.7M	.9H	.8H	.8H	.7M	.7M	.6M	.7M	.6M	.6M	.4M	.4M	.3L
S/I	.9H	.8H	[✓ .8H]	.7M	.7M	.6M	.8H	.7M	.7M	.6M	.6M	.5M	.6M	.5M	.5M	.3L	.3L	.2L
T/E/A	.8H	.7M	.7M	.6M	.6M	.5M	.7M	.6M	.6M	.5M	.5M	.4M	.5M	.4M	.4M	.2L	.2L	.1L

Comments:

14J. Groundwater Discharge/Recharge: (Check the indicators in i & ii below that apply to the AA)

i. Discharge Indicators
- ___Springs are known or observed
- ___Vegetation growing during dormant season/drought
- ___Wetland occurs at the toe of a natural slope
- ___Seeps are present at the wetland edge
- ___AA permanently flooded during drought periods
- ___Wetland contains an outlet, but no inlet
- ___Other

ii. Recharge Indicators
- ___Permeable substrate present without underlying impeding layer
- ___Wetland contains inlet but no outlet
- ___Other

iii. Rating: Use the information from i and ii above and the table below to arrive at [circle] the functional points and rating [H = high, L = low] for this function.

Criteria	*Functional Points and Rating*
AA is known Discharge/Recharge area or one or more indicators of D/R present	1 (H)
No Discharge/Recharge indicators present	.1 (L)
Available Discharge/Recharge information inadequate to rate AA D/R potential	[✓ N/A (Unknown)]

Comments: Discharge/recharge information inadequate

14K. Uniqueness:
i. Rating (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Replacement potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MNHP			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MNHP			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate		
Estimated relative abundance (#11)	rare	common	abundant	rare	common	abundant	rare	common	abundant
Low disturbance at AA (#12i)	1 (H)	.9 (H)	.8 (H)	.8 (H)	.6 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)
Moderate disturbance at AA (#12i)	.9 (H)	.8 (H)	.7 (M)	.7 (M)	.5 (M)	.4 (M)	.4 (M)	[✓ .3 (L)]	.2 (L)
High disturbance at AA (#12i)	.8 (H)	.7 (M)	.6 (M)	.6 (M)	.4 (M)	.3 (L)	.3 (L)	.2 (L)	.1 (L)

Comments:

14L. Recreation/Education Potential: i. Is the AA a known rec./ed. site: (circle) [✓ Y] N (If yes, rate as [circle] High [1] and go to ii; if no go to iii)

ii. Check categories that apply to the AA: ___ Educational/scientific study; _x_ Consumptive rec.; ___ Non-consumptive rec.; ___Other

iii. Based on the location, diversity, size, and other site attributes, is there strong potential for rec./ed. use? Y N
(If yes, go to ii, then proceed to iv; if no, then rate as [circle] Low [0.1])

iv. Rating (use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Ownership	*Disturbance at AA (#12i)*		
	low	moderate	high
public ownership	[✓ 1 (H)]	.5 (M)	.2 (L)
private ownership	.7 (M)	.3 (L)	.1 (L)

Comments: Fishing, boating at Healy Reservoir

FUNCTION & VALUE SUMMARY & OVERALL RATING

Function & Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units; (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	0		1	
B. MT Natural Heritage Program Species Habitat	0		1	
C. General Wildlife Habitat	.5		1	
D. General Fish/Aquatic Habitat	.5		1	
E. Flood Attenuation	.8		1	
F. Short and Long Term Surface Water Storage	.8		1	
G. Sediment/Nutrient/Toxicant Removal	.6		1	
H. Sediment/Shoreline Stabilization	.6		1	
I. Production Export/Food Chain Support	.8		1	
J. Groundwater Discharge/Recharge	NA		1	
K. Uniqueness	.3		1	
L. Recreation/Education Potential	1		1	
Totals:	5.9		12	

49%

OVERALL ANALYSIS AREA (AA) RATING: (Circle appropriate category based on the criteria outlined below) I II [✓ III] IV

Category I Wetland: (Must satisfy one of the following criteria; if does not meet criteria, go to Category II)
___ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; or
___ Score of 1 functional point for Uniqueness; or
___ Score of 1 functional point for Flood Attenuation and answer to Question 14E.ii is "yes"; or
___ Total actual functional points > 80% (round to nearest whole #) of total possible functional points.

Category II Wetland: (Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)
___ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; or
___ Score of .9 or 1 functional point for General Wildlife Habitat; or
___ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; or
___ "High" to "Exceptional" ratings for both General Wildlife Habitat and General Fish/Aquatic Habitat; or
___ Score of .9 functional point for Uniqueness; or
___ Total Actual Functional Points > 65% (round to nearest whole #) of total possible functional points.

Category III Wetland: (Criteria for Categories I, II or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if does not satisfy criteria go to Category III)
___ "Low" rating for Uniqueness; and
___ "Low" rating for Production Export/Food Chain Support; and
___ Total actual functional points < 30% (round to nearest whole #) of total possible functional points

Wetland Assessment Site #6

MDT Montana Wetland Assessment Form (revised 5/25/1999)

1. **Project Name:** Clear Creek Watershed Study 2. **Project #:** NA **Control #:** NA

3. **Evaluation Date:** Mo. 6 Day 3 Yr. 10 4. **Evaluator(s):** E. Lack 5. **Wetlands/Site #(s)** 7

6. **Wetland Location(s): I. Legal:** T ____ N or S; R ____ E or W; S ________ ; T ____ N or S; R ____ E or W; S ________ ;
II. Approx. Stationing or Mileposts:

III. Watershed: 10090206 **GPS Reference No. (if applies):**
Other Location Information:

7. a. **Evaluating Agency:** WEST Inc. ;
b. **Purpose of Evaluation:**
1.____Wetlands potentially affected by MDT project
2.____Mitigation wetlands; pre-construction
3.____ Mitigation wetlands; post-construction
4._x_ Other

8. **Wetland size:** (total acres) 5 (visually estimated)
______ (measured, e.g. by GPS [if applies])

9. **Assessment area:** (AA, tot., ac., see instructions on determining AA) 5 (visually estimated)
______ (measured, e.g. by GPS [if applies])

10. **Classification of Wetland and Aquatic Habitats in AA** (HGM according to Brinson, first col.; USFWS according to Cowardin [1979], remaining cols.)

HGM Class	System	Subsystem	Class	Water Regime	Modifier	% of AA
Depression (closed)	Palustrine		EM	J		

(Abbreviations: System: Palustrine(P)/ Subsyst.: none/ Classes: Rock Bottom (RB), Unconsolidated bottom (UB), Aquatic Bed (AB), Unconsolidated Shore (US), Moss-lichen Wetland (ML), Emergent Wetland (EM), Scrub-Shrub Wetland (SS), Forested Wetland (FO)/ System: Lacustrine (L)/, Subsyst.: Limnetic (2)/ Classes: RB, UB, AB/ Subsystem: Littoral (4)/ Classes: RB, UB, AB, US, EM/ System: Riverine (R)/ Subsyst.: Lower Perennial (2)/ Classes: RB, UB, AB, US, EM/ Subsystem: Upper Perennial (3)/ Classes: RB, UB, AB, US/ Water Regimes: Permanently Flooded (H), Intermittently Exposed (G), Semipermanently Flooded (F), Seasonally Flooded (C), Saturated (B), Temporarily Flooded (A), Intermittently Flooded (J) Modifiers: Excavated (E), Impounded (I), Diked (D), Partly Drained (PD), Farmed (F), Artificial (A) HGM Classes: Riverine, Depressional, Slope, Mineral Soil Flats, Organic Soil Flats, Lacustrine Fringe

11. **Estimated relative abundance:** (of similarly classified sites within the same Major Montana Watershed Basin, see definitions)
(Circle one) Unknown Rare [✓ Common] Abundant
Comments:

12. **General condition of AA:**
i. **Regarding disturbance:** (use matrix below to determine [circle] appropriate response)

Conditions within AA	*Predominant conditions adjacent to (within 500 feet of) AA*		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings	low disturbance	low disturbance	moderate disturbance
AA not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings	moderate disturbance	[✓ moderate disturbance]	high disturbance
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration, high road or building density.	high disturbance	high disturbance	high disturbance

Comments: (types of disturbance, intensity, season, etc.): rangeland, road
ii. **Prominent weedy, alien, & introduced species (including those not domesticated, feral): (list)**

iii. **Provide brief descriptive summary of AA and surrounding land use/habitat:**
Cattail marsh in oxbow off Piney Creek

13. **Structural Diversity:** (based on number of "Cowardin" *vegetated* classes present [do not include unvegetated classes], see #10 above)

# of "Cowardin" vegetated classes present in AA (see #10)	≥ 3 vegetated classes (or ≥ 2 if one is forested)	2 vegetated classes (or 1 if forested)	≤ 1 vegetated class
Rating (circle)	High	Moderate	[✓ Low]

Comments:

SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ______
Secondary habitat (**list species**) D S ______
Incidental habitat (**list species**) D S ______
No usable habitat D S none documented or suspected

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.9 (H)	.8 (M)	.7 (M)	.5 (L)	.3 (L)	[✓ 0 (L)]

Sources for documented use (e.g. observations, records, etc):

14B. Habitat for plant or animals rated S1, S2, or S3 by the Montana Natural Heritage Program: (not including species listed in14A above)

I. AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S ______
Secondary habitat (**list species**) D S ______
Incidental habitat (**list species**) D S ______
No usable habitat D S none documented or suspected

II. **Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Highest Habitat Level	doc./primary	sus/primary	doc./secondary	sus./secondary	doc./incidental	sus./incidental	None
Functional Points and Rating	1 (H)	.8 (H)	.7 (M)	.6 (M)	.2 (L)	.1 (L)	[✓ 0 (L)]

Sources for documented use (e.g. observations, records, etc.):

14C. General Wildlife Habitat Rating:

I. **Evidence of overall wildlife use in the AA** (circle substantial, moderate, or low based on supporting evidence):

Substantial (based on any of the following [check]):
- ☐ observations of abundant wildlife #'s or high species diversity (during any period)
- ☐ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ presence of extremely limiting habitat features not available in the surrounding area
- ☐ interviews with local biologists with knowledge of the AA

Low (based on any of the following [check]):
- ☐ few or no wildlife observations during peak use periods
- ☐ little to no wildlife sign
- ☐ sparse adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

Moderate (based on any of the following [check]):
- ☒ observations of scattered wildlife groups or individuals or relatively few species during peak periods
- ☐ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ adequate adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

ii. **Wildlife habitat features** (working from top to bottom, circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see instructions for further definitions of these terms].)

Structural diversity (see #13)	High								Moderate								Low			
Class cover distribution (all vegetated classes)	Even				Uneven				Even				Uneven				Even			
Duration of surface water in ≥ 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12i)	E	E	E	H	E	E	H	H	E	H	H	M	E	H	M	M	E	H	M	M
Moderate disturbance at AA (see #12i)	H	H	H	H	H	H	H	M	H	H	M	M	H	M	M	L	H	[✓ M]	L	L
High disturbance at AA (see #12i)	M	M	M	L	M	M	L	L	M	M	L	L	M	L	L	L	L	L	L	L

III. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Evidence of wildlife use (i)	*Wildlife habitat features rating (ii)*			
	Exceptional	High	Moderate	Low
Substantial	1 (E)	.9 (H)	.8 (H)	.7 (M)
Moderate	.9 (H)	.7 (M)	[✓ .5 (M)]	.3 (L)
Minimal	.6 (M)	.4 (M)	.2 (L)	.1 (L)

Comments:

14D. General Fish/Aquatic Habitat Rating: (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, etc., circle [✓ NA] here and proceed to the next function. If fish use occurs in the AA but is not desired from a resource management perspective [such as fish use within an irrigation canal], then Habitat Quality [i below] should be marked as "Low", applied accordingly in ii below, and noted in the comments.)

i. **Habitat Quality** (circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of surface water in AA	Permanent / Perennial			Seasonal / Intermittent			Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.	>25%	10–25%	<10%	>25%	10–25%	<10%	>25%	10–25%	<10%
Shading - >75% of streambank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities	E	E	H	H	H	M	M	M	M
Shading – 50 to 75% of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	H	M	M	M	M	M	L	L
Shading - < 50% of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities	H	M	M	M	L	L	L	L	L

ii. **Modified Habitat Quality** (Circle the appropriate response to the following question. If answer is Y, then reduce rating in i above by one level [E = H, H = M, M = L, L = L]). *Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity or is the waterbody included on the MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support?* Y N Modified habitat quality rating = (circle) E H M L

iii. **Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

Types of fish known or suspected within AA	*Modified Habitat Quality (ii)*			
	Exceptional	High	Moderate	Low
Native game fish	1 (E)	.9 (H)	.7 (M)	.5 (M)
Introduced game fish	.9 (H)	.8 (H)	.6 (M)	.4 (M)
Non-game fish	.7 (M)	.6 (M)	.5 (M)	.3 (L)
No fish	.5 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14E. Flood Attenuation: (applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, circle [✓ NA] here and proceed to next function.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

Estimated wetland area in AA subject to periodic flooding	≥ 10 acres			<10, >2 acres			≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains no outlet or restricted outlet	1(H)	.9(H)	.6(M)	.8(H)	.7(H)	.5(M)	.4(M)	.3(L)	.2(L)
AA contains unrestricted outlet	.9(H)	.8(H)	.5(M)	.7(H)	.6(M)	.4(M)	.3(L)	.2(L)	.1(L)

ii. Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA (circle)? Y [✓ N]

Comments:

14F. Short and Long Term Surface Water Storage: (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, circle NA here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding	>5 acre feet			<5, >1 acre feet			≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond ≥ 5 out of 10 years	1(H)	[✓ .9(H)]	.8(H)	.8(H)	.6(M)	.5(M)	.4(M)	.3(L)	.2(L)
Wetlands in AA flood or pond < 5 out of 10 years	.9(H)	.8(H)	.7(M)	.7(M)	.5(M)	.4(M)	.3(L)	.2(L)	.1(L)

Comments: Assumes flooding ≥ 5 out of 10 yrs

14G. Sediment/Nutrient/Toxicant Retention and Removal: (Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, circle NA here and proceed with the evaluation.)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Sediment, nutrient, and toxicant input levels within AA	AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants or AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	≥ 70%		< 70%		≥ 70%		< 70%	
Evidence of flooding or ponding in AA	Yes	No	Yes	No	Yes	No	Yes	No
AA contains no or restricted outlet	[✓ 1 (H)]	.8 (H)	.7 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)	.2 (L)
AA contains unrestricted outlet	.9 (H)	.7 (M)	.6 (M)	.4 (M)	.4 (M)	.3 (L)	.2 (L)	.1 (L)

Comments:

14H Sediment/Shoreline Stabilization: (applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. If does not apply, circle [✓ NA] here and proceed to next function)

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses	*Duration of surface water adjacent to rooted vegetation*		
	permanent / perennial	seasonal / intermittent	Temporary / ephemeral
≥ 65%	1 (H)	.9 (H)	.7 (M)
35-64%	.7 (M)	.6 (M)	.5 (M)
< 35%	.3 (L)	.2 (L)	.1 (L)

Comments:

14I. Production Export/Food Chain Support:

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Factor A = acreage of vegetated component in the AA; Factor B = structural diversity rating from #13; Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P = permanent/perennial; S/I = seasonal/intermittent; T/E /A= temporary/ephemeral or absent [see instructions for further definitions of these terms].)

A	Vegetated component >5 acres						Vegetated component 1-5 acres						Vegetated component <1 acre					
B	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low	
C	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
P/P	1H	.9H	.9H	.8H	.8H	.7M	.9H	.8H	.8H	.7M	.7M	.6M	.7M	.6M	.6M	.4M	.4M	.3L
S/I	.9H	.8H	.8H	.7M	.7M	[✓ .6M]	.8H	.7M	.7M	.6M	.6M	.5M	.6M	.5M	.5M	.3L	.3L	.2L
T/E/A	.8H	.7M	.7M	.6M	.6M	.5M	.7M	.6M	.6M	.5M	.5M	.4M	.5M	.4M	.4M	.2L	.2L	.1L

Comments:

14J. Groundwater Discharge/Recharge: (Check the indicators in i & ii below that apply to the AA)

i. **Discharge Indicators**
- ___Springs are known or observed
- ___Vegetation growing during dormant season/drought
- ___Wetland occurs at the toe of a natural slope
- ___Seeps are present at the wetland edge
- ___AA permanently flooded during drought periods
- ___Wetland contains an outlet, but no inlet
- ___Other

ii. **Recharge Indicators**
- ___Permeable substrate present without underlying impeding layer
- _X_Wetland contains inlet but no outlet
- ___Other

iii. **Rating:** Use the information from i and ii above and the table below to arrive at [circle] the functional points and rating [H = high, L = low] for this function.

Criteria	*Functional Points and Rating*
AA is known Discharge/Recharge area or one or more indicators of D/R present	[✓ 1 (H)]
No Discharge/Recharge indicators present	.1 (L)
Available Discharge/Recharge information inadequate to rate AA D/R potential	N/A (Unknown)

Comments:

14K. Uniqueness:

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Replacement potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MNHP			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MNHP			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate		
Estimated relative abundance (#11)	rare	common	abundant	rare	common	abundant	rare	common	abundant
Low disturbance at AA (#12i)	1 (H)	.9 (H)	.8 (H)	.8 (H)	.6 (M)	.5 (M)	.5 (M)	.4 (M)	.3 (L)
Moderate disturbance at AA (#12i)	.9 (H)	.8 (H)	.7 (M)	.7 (M)	.5 (M)	.4 (M)	.4 (M)	[✓ .3 (L)]	.2 (L)
High disturbance at AA (#12i)	.8 (H)	.7 (M)	.6 (M)	.6 (M)	.4 (M)	.3 (L)	.3 (L)	.2 (L)	.1 (L)

Comments:

14L. Recreation/Education Potential: i. Is the AA a known rec./ed. site: (circle) Y [✓ N] (If yes, rate as [circle] High [1] and go to ii; if no go to iii)

ii. **Check categories that apply to the AA:** ___ Educational/scientific study; ___ Consumptive rec.; ___ Non-consumptive rec.; ___Other

iii. **Based on the location, diversity, size, and other site attributes, is there strong potential for rec./ed. use?** Y [✓ N]
(If yes, go to ii, then proceed to iv; if no, then rate as [circle] Low [0.1])

iv. **Rating** (use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

Ownership	*Disturbance at AA (#12i)*		
	low	moderate	high
public ownership	1 (H)	.5 (M)	.2 (L)
private ownership	.7 (M)	.3 (L)	[✓ .1 (L)]

Comments:

FUNCTION & VALUE SUMMARY & OVERALL RATING

Function & Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units; (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	0		1	
B. MT Natural Heritage Program Species Habitat	0		1	
C. General Wildlife Habitat	.5		1	
D. General Fish/Aquatic Habitat	NA		0	
E. Flood Attenuation	NA		0	
F. Short and Long Term Surface Water Storage	.9		1	
G. Sediment/Nutrient/Toxicant Removal	1		1	
H. Sediment/Shoreline Stabilization	NA		0	
I. Production Export/Food Chain Support	.6		1	
J. Groundwater Discharge/Recharge	1		1	
K. Uniqueness	.3		1	
L. Recreation/Education Potential	.1		1	
Totals:	4.4		9	

49%

OVERALL ANALYSIS AREA (AA) RATING: (Circle appropriate category based on the criteria outlined below) I II [✓ III] IV

Category I Wetland: (Must satisfy one of the following criteria; if does not meet criteria, go to Category II)
___ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; or
___ Score of 1 functional point for Uniqueness; or
___ Score of 1 functional point for Flood Attenuation and answer to Question 14E.ii is "yes"; or
___ Total actual functional points > 80% (round to nearest whole #) of total possible functional points.

Category II Wetland: (Criteria for Category I not satisfied and meets any one of the following criteria; if not satisfied, go to Category IV)
___ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; or
___ Score of .9 or 1 functional point for General Wildlife Habitat; or
___ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; or
___ "High" to "Exceptional" ratings for both General Wildlife Habitat and General Fish/Aquatic Habitat; or
___ Score of .9 functional point for Uniqueness; or
___ Total Actual Functional Points > 65% (round to nearest whole #) of total possible functional points.

Category III Wetland: (Criteria for Categories I, II or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if does not satisfy criteria go to Category III)
___ "Low" rating for Uniqueness; and
___ "Low" rating for Production Export/Food Chain Support; and
___ Total actual functional points < 30% (round to nearest whole #) of total possible functional points

Wetland Assessment Site #7

Appendix 3F
NRCS Soil Groups

Appendix 3F – NRCS Soil Groups

Soil Group Number	Soil Group Name
10	Agneston, Granile, Rock outcrop
11(1)	Agneston, Leighcan; or Chittum, Rock Outcrop
13(1)	Cirqueland; or Clayburn, Wallrock
15(1)	Cloud Peak, Eutroboralfs, Argiborolls; or Coutis, Greenman
16	Cryaquolls
18	Fourmile
19	Frisco, Troutville
22(1)	Forkwood, Kishona; or Hanson Variant, Starley
25	Lucky, Burgess, Hazton
26	Mirror, Teewinot, Bross
29	Owen Creek, Echemoor, Bynum
31	Rock Outcrop, Agneston, Rubble land
33	Rock Outcrop, Mirror, Teewinot
35	Rock Outcrop, Starman Variant
36	Rock Outcrop, Teewinot, Agneston
37	Rubble land
40	Tellman, Granile, Agneston
41	Tine, Fourmile
42	Tolman, Beenom Variant, Carbol Variant
43	Tongue River, Gateway
101	Absted-Haverdad association, 0 to 6 percent slopes
102	Absted-Haverdad association, moist, 0 to 6 percent slopes
103	Absted-Slickspots complex, 0 to 6 percent slopes
104	Agneston-Granile-Rock outcrop association, 10 to 50 percent slopes
105	Arnegard-Farnuf association, 0 to 6 percent slopes
106	Arnegard-Farnuf association, 6 to 25 percent slopes
107	Assinniboine-Dast association, 3 to 65 percent slopes
108	Baux-Bauxson association, 0 to 65 percent slopes
109	Baux-Bauxson association, dry,0 to 65 percent slopes
110	Baux-Bauxson-Kirtley association, 3 to 60 percent slopes
111	Baux-Bauxson-Wetterdon association, 0 to 75 percent slopes
112	Bidman-Arvada fine sandy loams, 0 to 6 percent slopes
113	Bidman-Arvada complex, moist, 0 to 3 percent slopes
114	Bidman-Ulm, dry, complex 0 to 6 percent slopes
115	Bidman, moist-Ulm loams, 0 to 6 percent slopes
116	Big Horn-Wolf, dry, loams, 0 to 6 percent slopes
117	Cambria-Forkwood complex, 0 to 15 percent slopes
118	Cambria-Forkwood complex, moist, 0 to 9 percent slopes
119	Cedak-Recluse association, 3 to 6 percent slopes
120	Cedak-Recluse association, 6 to 9 percent slopes
121	Cedak-Recluse association, 9 to 15 percent slopes
122	Cedak-Recluse association, dry, 3 to 15 percent slopes
123	Clarkelen loam, 0 to 3 percent slopes
124	Clarkelen fine sandy loam, moist, 0 to 3 percent slopes
125	Cloud Peak-Tolman complex, 10 to 75 percent slopes
127	Cushman-Forkwood association, 3 to 15 percent slopes
128	Cushman-Forkwood association, moist, 0 to 9 percent slopes
129	Cushman-Forkwood association, moist, 9 to 15 percent slopes

Soil Group Number	Soil Group Name
130	Cushman-Worf association, 3 to 25 percent slopes
131	Cushman-Worf association, moist, 3 to 15 percent slopes
133	Doney-Doney variant complex, 6 to 75 percent slopes
136	Draknab loamy fine sand, 0 to 3 percent slopes
138	Farnuf loam, 6 to 9 percent slopes
140	Farnuf variant loam, wet, 0 to 3 percent slopes
141	Farnuf variant-Cloud Peak variant complex, 0 to 6 percent slopes
142	Forkwood loam, 0 to 3 percent slopes
143	Forkwood loam, 3 to 6 percent slopes
144	Forkwood loam, 6 to 9 percent slopes
145	Gayhart-Bahl association, 6 to 30 percent slopes
146	Gayhart-Bahl association, moist, 6 to 15 percent slopes
148	Hargreave-Moskee association, 3 to 9 percent slopes
149	Hargreave-Moskee association, 9 to 15 percent slopes
150	Hargreave-Moskee association, dry, 3 to 15 percent slopes
152	Harlan-Kirtley association, 3 to 9 percent slopes
153	Harlan-Kirtley association, 9 to 15 percent slopes
154	Haverdad very fine sandy loam, 0 to 3 percent slopes
155	Haverdad loam, moist, 0 to 3 percent slopes
156	Haverdad silt loam, saline, 0 to 3 percent slopes
157	Haverdad loam, moist, saline, 0 to 3 percent slopes
158	Haverdad-Draknab complex, 0 to 3 percent slopes
159	Haverdad-Draknab complex, moist, 0 to 3 percent slopes
160	Haverdad-Worthenton complex, 0 to 3 percent slopes
161	Haverdad, moist-Worthenton complex, 0 to 3 percent slopes
162	Havertel silt loam, 0 to 3 percent slopes
163	Hesperus variant-Reget association, 10 to 65 percent slopes
164	Hiland-Bowbac association, 3 to 15 percent slopes
165	Hiland-Bowbac association, moist, 3 to 15 percent slopes
166	Hiland-Decolney complex, 3 to 15 percent slopes
167	Hiland-Vonalee complex, moist, 3 to 10 percent slopes
168	Hilight-Rock outcrop complex, 10 to 30 percent slopes
169	Jonpol-Platmak association, 0 to 9 percent slopes
170	Jonpol-Platmak association, 9 to 25 percent slopes
171	Kishona-Cambria complex, 0 to 3 percent slopes
172	Kishona-Cambria complex, 3 to 6 percent slopes
173	Lambman-Hargreave association, 3 to 15 percent slopes
174	Lucky-Burgess-Hazton associaiton, 8 to 30 percent slopes
175	Moskee sandy loam, 0 to 3 percent slopes
177	Moskee fine sandy loam, 6 to 9 percent slopes
178	Moskee-Noden complex, 0 to 9 percent slopes
179	Moskee-Noden fine sandy loams, 9 to 15 percent slopes
180	Moskee-Noden fine sandy loams, dry, 0 to 15 percent slopes
183	Moskee-Worthenton, moist, association, 0 to 45 percent slopes
186	Nesda-Rubble land complex, 0 to 3 percent slopes
190	Norbert-Reget-Savar association, 3 to 35 percent slopes
192	Nuncho loam, 0 to 3 percent slopes
193	Nuncho loam, 3 to 6 percent slopes
194	Nuncho loam, 6 to 9 percent slopes
195	Nuncho clay loam, 0 to 3 percent slopes
196	Nuncho clay loam, 3 to 6 percent slopes

Soil Group Number	Soil Group Name
197	Nuncho-Emigrant association, 3 to 9 percent slopes
198	Nuncho-Emigrant association, 9 to 15 percent slopes
199	Nuncho variant clay loam, 0 to 6 percent slopes
201	Parmleed-Bidman association, 3 to 15 percent slopes
202	Parmleed-Bidman association, moist, 3 to 9 percent slopes
203	Parmleed-Bidman association, moist, 9 to 25 percent slopes
204	Parmleed-Renohill complex, 3 to 25 percent slopes
205	Parmleed-Renohill complex, moist, 3 to 9 percent slopes
206	Parmleed-Renohill complex, moist, 9 to 25 percent slopes
207	Parmleed-Worfka association, 0 to 15 percent slopes
208	Parmleed-Worfka association, moist, 0 to 9 percent slopes
209	Parmleed-Worfka association, moist, 9 to 25 percent slopes
212	Platmak loam, 0 to 3 percent slopes
213	Platmak loam, 3 to 6 percent slopes
214	Platmak loam, dry, 0 to 9 percent slopes
215	Platsher loam, 0 to 3 percent slopes
216	Platsher loam, 3 to 6 percent slopes
217	Platsher clay loam, 0 to 3 percent slopes
220	Platsher-Wolfvar loams, 3 to 6 percent slopes
221	Platsher-Wolfvar complex, 6 to 9 percent slopes
223	Recluse loam, 0 to 3 percent slopes
224	Recluse loam, 3 to 6 percent slopes
225	Recluse loam, 6 to 9 percent slopes
226	Recluse-Bauxson-Baux association, 9 to 30 percent slopes
228	Reeder-Farnuf association, 9 to 15 percent slopes
232	Reget variant-Reget association, 10 to 65 percent slopes
233	Renohill-Savageton clay loams, 3 to 15 percent slopes
234	Renohill-Savageton complex, moist, 3 to 10 percent slopes
235	Renohill-Savageton clay loams, moist, 10 to 15 percent slopes
236	Renohill-Ulm, dry, association, 6 to 15 percent slopes
237	Renohill, moist-Ulm association, 3 to 10 percent slopes
238	Renohill-Worfka association, 6 to 15 percent slopes
239	Renohill-Worfka association, moist, 3 to 20 percent slopes
240	Renohill, moist-Wyarno association, 6 to 9 percent slopes
241	Rock outcrop-Agneston-Rubble land association, 20 to 50 percent slopes
244	Samday-Gayhart-Hilight clay loams, moist, 2 to 60 percent slopes
246	Savage loam, 0 to 6 percent slopes
248	Savage silt loam, 9 to 15 percent slopes
249	Savage-Farnuf silt loams, gravelly substratum, 0 to 6 percent slopes
252	Searing-Ringling association, 2 to 75 percent slopes
254	Shingle, moist-Baux-Rock outcrop complex, 30 to 60 percent slopes
255	Shingle-Haverdad association, 0 to 80 percent slopes
256	Shingle-Haverdad association, moist, 0 to 80 percent slopes
257	Shingle-Nihill complex, 3 to 80 percent slopes
258	Shingle-Nihill complex, moist, 3 to 80 percent slopes
260	Shingle-Rock outcrop complex, 30 to 50 percent slopes
261	Shingle, moist-Rock outcrop complex, 30 to 50 percent slopes
262	Shingle-Samday clay loams, 6 to 60 percent slopes
263	Shingle-Samday clay loams, moist, 3 to 55 percent slopes
264	Shingle-Taluce complex, 9 to 15 percent slopes
265	Shingle-Taluce complex, moist, 9 to 15 percent slopes

Soil Group Number	Soil Group Name
266	Shingle-Theedle complex, 45 to 75 percent slopes
267	Shingle-Theedle loams, moist, 45 to 75 percent slopes
268	Shingle-Theedle-Kishona association, 6 to 25 percent slopes
269	Shingle-Theedle-Kishona association, moist, 3 to 30 percent slopes
270	Shingle-Theedle-Rock outcrop association, moist, 15 to 45 percent slopes
271	Shingle-Wibaux complex, 0 to 60 percent slopes
273	Shingle-Worf complex, 6 to 15 percent slopes
274	Shingle-Worf complex, moist, 9 to 15 percent slopes
277	Taluce-Tullock-Rock outcrop association, 3 to 15 percent slopes
278	Taluce-Tullock-Vonalee association, 6 to 15 percent slopes
279	Taluce-Tullock-Vonalee association, moist, 9 to 30 percent slopes
280	Taluce variant-Treoff-Theedle variant association, 10 to 65 percent slopes
281	Theedle-Kishona association, 6 to 15 percent slopes
282	Theedle-Kishona association, moist, 6 to 9 percent slopes
283	Theedle-Kishona association, moist, 9 to 15 percent slopes
284	Tolman-Beeno-Beenom complex, 5 to 45 percent slopes
286	Trimad-Trivar complex, 0 to 25 percent slopes
288	Twin Creek loam, 0 to 6 percent slopes
289	Twin Creek variant silt loam, 0 to 3 percent slopes
291	Ulm clay loam, 3 to 6 percent slopes
292	Ulm clay loam, dry, 0 to 3 percent slopes
293	Ulm clay loam, dry, 3 to 6 percent slopes
299	Wetterdon-Recluse complex, 0 to 9 percent slopes
302	Wolf loam, 0 to 3 percent slopes
303	Wolf loam, 3 to 6 percent slopes
304	Worfka-Shingle-Samday complex, 6 to 30 percent slopes
305	Worfka-Shingle-Samday complex, moist, 6 to 30 percent slopes
306	Worthenton clay loam, 0 to 3 percent slopes
307	Worthenton-Recluse association, 0 to 3 percent slopes
308	Worthenton variant-Assinniboine variant association, 0 to 6 percent slopes
309	Wyarno clay loam, 0 to 3 percent slopes
310	Wyarno clay loam, 3 to 6 percent slopes
311	Wyarno clay loam, 6 to 9 percent slopes
312	Wyarno clay loam, dry, 0 to 3 percent slopes
313	Wyarno clay loam, dry, 3 to 6 percent slopes
314	Wyarno clay loam, dry, 6 to 9 percent slopes
315	Zigweid loam, 0 to 3 percent slopes
316	Zigweid-Cambria loams, 0 to 6 percent slopes
317	Zigweid-Kishona-Cambria complex, 6 to 15 percent slopes
318	Zigweid-Kishona-Cambria complex, moist, 0 to 3 percent slopes
319	Zigweid-Kishona-Cambria complex, moist, 3 to 6 percent slopes
320	Zigweid-Kishona-Cambria loams, moist, 6 to 9 percent slopes
321	Water
601	Keyner-Cambria loams, 0 to 3 percent slopes
603	Lawver-Teckla-Wibaux complex, 0 to 6 percent slopes
604	Wibaux-Rock outcrop complex, 25 to 60 percent slopes
605	Teckla very fine sandy loam, 0 to 10 percent slopes
606	Muleherder-Wibaux complex, 3 to 40 percents slopes
607	Haverdad loam, 0 to 3 percent slopes, rarely flooded
608	Bidman-Parmleed loams, 0 to 6 percent slopes
609	Ulm-Bidman complex, 0 to 6 percent slopes

Soil Group Number	Soil Group Name
612	Clarkelen fine sandy loam, 0 to 3 percent slopes, occasionally flooded
614	Forkwood loam, 0 to 6 percent slopes
615	Cambria-Kishona loams, 6 to 15 percent slopes
618	Worthenton-Recluse loams, 0 to 3 percent slopes
619	Coaliams loam, subirrigated, 0 to 3 percent slopes, rarely flooded
622	Cambria-Kishona loams, 0 to 6 percent slopes
623	Parmleed-Bidman fine sandy loams, 3 to 15 percent slopes
624	Shingle-Haverdad, frequently flooded complex, 0 to 80 percent slopes
626	Nesda very fine sandy loam, 0 to 3 percent slopes, occasionally flooded
628	Featherlegs fine sandy loam, 3 to 6 percent slopes
629	Cushman-Cambria loams, 6 to 15 percent slopes
633	Urban land-Vonalf-Mittenbutte complex, 0 to 10 percent slopes
634	Urban land-Vonalf complex, 0 to 3 percent slopes
635	Urban land-Rockypoint complex, 0 to 3 percent slopes, occasionally flooded
636	Felix clay, 0 to 2 percent slopes
637	Forkwood loam, 0 to 3 percent slopes
638	Forkwood loam, 3 to 6 percent slopes
639	Forkwood-Cushman loams, 0 to 6 percent slopes
640	Forkwood-Cushman loams, 6 to 15 percent slopes
641	Forkwood-Ulm loams, 0 to 6 percent slopes
642	Recluse, dry-Wibaux complex, 3 to 30 percent slopes
645	Hiland fine sandy loam, 0 to 3 percent slopes
646	Julesburg fine sandy loam, 0 to 6 percent slopes
649	Haverdad-Clarkelen complex, lowlands, 0 to 3 percent slopes, rarely flooded
652	Hiland fine sandy loam, 0 to 6 percent slopes
653	Hiland fine sandy loam, 3 to 6 percent slopes
654	Hiland-Bowbac complex, 3 to 15 percent slopes
655	Hiland-Bowbac fine sandy loams, 0 to 6 percent slopes
656	Hiland-Bowbac fine sandy loams, 6 to 15 percent slopes
659	Hiland-Vonalee fine sandy loams, 6 to 15 percent slopes
661	Cushman-Worf loams, 3 to 25 percent slopes
663	Cambria-Forkwood complex, 0 to 15 percent slopes
664	Absted-Haverdad, rarely flooded very fine sandy loams, 0 to 6 percent slopes
665	Absted-Slickspots complex, 0 to 6 percent slopes
666	Cambria-Kishona complex, 3 to 6 percent slopes
667	Renohill-Savageton clay loams, 3 to 15 percent slopes
670	Wyarno clay loam, 0 to 3 percent slopes
675	Forkwood-Ulm complex, 0 to 3 percent slopes
676	Forkwood-Ulm complex, 3 to 6 percent slopes
677	Forkwood loam, 6 to 9 percent slopes
678	Cambria-Kishona loams, 0 to 3 percent slopes
680	Wyarno clay loam, 3 to 6 percent slopes
684	Samday-Shingle-Badland complex, 10 to 45 percent slopes
692	Shingle-Badland complex, 30 to 50 percent slopes
695	Shingle-Taluce-Badland complex, 6 to 45 percent slopes
697	Shingle-Theedle-Kishona complex, 6 to 25 percent slopes
701	Shingle-Worf loams, 3 to 30 percent slopes
702	Featherlegs-Naturita-Willowman complex, 0 to 6 percent slopes
703	Featherlegs-Moskee sandy loams, 6 to 15 percent slopes
705	Terro-Taluce sandy loams, 6 to 30 percent slopes

Soil Group Number	Soil Group Name
707	Theedle-Kishona loams, 6 to 20 percent slopes
708	Theedle-Kishona-Shingle loams, 3 to 30 percent slopes
709	Theedle-Shingle loams, 3 to 30 percent slopes
710	Treoff-Featherlegs complex, 10 to 55 percent slopes, extremely stony
711	Turnercrest-Keeline-Taluce fine sandy loams, 6 to 30 percent slopes
712	Featherlegs-Moskee sandy loams, 0 to 6 percent slopes
715	Ulm-Renohill clay loams, 6 to 15 percent slopes
717	Vonalee-Terro fine sandy loams, 2 to 10 percent slopes
718	Vonalee-Terro-Taluce fine sandy loams, 3 to 30 percent slopes
719	Shingle-Wibaux complex, 0 to 60 percent slopes
720	Wibaux-Shingle-Taluce complex, 6 to 40 percent slopes
722	Theedle-Nihill complex, 5 to 40 percent slopes
726	Shingle-Taluce complex, 6 to 40 percent slopes, cobbly
727	Haverdad-Kishona complex, 0 to 6 percent slopes
728	Selpats-Larim, 0 to 6 percent slopes
736	Deekay-Oldwolf loams, 6 to 15 percent slopes
740	Arwite-Elwop fine sandy loams, 6 to 15 percent slopes
744	Recluse-Willowman-Nuncho complex, 6 to 40 percent slopes
748	Moskee-Noden fine sandy loams, 0 to 15 percent slopes, dry
750	Fairburn-Ironbutte-Rock outcrop complex, 0 to 60 percent slopes
752	Fairburn-Mittenbutte complex, 6 to 45 percent slopes
754	Jaywest-Moorhead loams, 0 to 6 percent slopes
756	Spottedhorse-Leiter complex, 6 to 15 percent slopes
758	Hargreave-Moskee-Mittenbutte sandy loams, 3 to 25 percent slopes
759	Hargreave-Moskee complex, 3 to 9 percent slopes
760	Hargreave-Moskee complex, 9 to 15 percent slopes
762	Vonalf-Xema-Mittenbutte fine sandy loams, 3 to 30 percent slopes
763	Recluse loam, 0 to 6 percent slopes
766	Moskee fine sandy loam, 0 to 6 percent slopes
767	Moskee fine sandy loam, 6 to 15 percent slopes
770	Nuncho clay loam, 0 to 6 percent slopes
775	Ironbutte-Rock outcrop complex, 10 to 60 percent slopes
776	Rockybutte-Ironbutte complex, 10 to 40 percent slopes
777	Rockybutte-Brislawn-Ironbutte complex, 0 to 15 percent slopes
780	Xema-Mittenbutte-Rock outcrop complex, 6 to 30 percent slopes
782	Cedak-Recluse complex, 6 to 9 percent slopes
783	Wolf loam, 3 to 6 percent slopes
784	Treoff-Xema complex, 10 to 65 percent slopes
786	Renohill-Savageton complex, 3 to 10 percent slopes, moist
787	Nuncho-Emigrant complex, 3 to 9 percent slopes
788	Nuncho loam, 3 to 6 percent slopes
789	Harlan-Kirtley complex, 3 to 9 percent slopes
790	Fairburn-Baux-Rock outcrop complex, 30 to 60 percent slopes
791	Harlan-Kirtley loams, 9 to 15 percent slopes
851	Ziggy-Iwait loams, 0 to 6 percent slopes
853	Fairburn-Mittenbutte complex, 6 to 45 percent slopes, cobbly
855	Fairburn-Ucross-Iwait complex, 6 to 25 percent slopes
857	Vonalf-Xema fine sandy loams, 3 to 10 percent slopes
859	Greenhope sandy loam, 0 to 3 percent slopes
860	Greenhope sandy loam, 3 to 6 percent slopes
861	Greenhope sandy loam, 6 to 9 percent slopes

Soil Group Number	Soil Group Name
867	Iwait sandy loam, saline, 0 to 3 percent slopes
879	Quarterback-Coaliams complex, 0 to 3 percent slopes, rarely flooded
880	Arwite fine sandy loam, 0 to 3 percent slopes
881	Arwite fine sandy loam, 3 to 6 percent slopes
893	Deekay loam, 0 to 3 percent slopes
894	Deekay loam, 3 to 6 percent slopes
895	Deekay loam, 6 to 9 percent slopes
901	Iwait-Ziggy-Deekay loams, 6 to 9 percent slopes
903	Manter fine sandy loam, 3 to 6 percent slopes
904	Moskee sandy loam, 0 to 3 percent slopes
905	Moskee sandy loam, 3 to 6 percent slopes
906	Moskee sandy loam, 6 to 9 percent slopes
920	Elwop-Arwite fine sandy loams, 6 to 15 percent slopes
921	Elwop-Lambman fine sandy loams, 6 to 15 percent slopes
923	Recluse loam, 0 to 3 percent slopes
924	Recluse loam, 3 to 6 percent slopes
925	Recluse loam, 6 to 9 percent slopes
927	Baux-Ironbutte-Rock outcrop complex, 3 to 60 percent slopes
929	Elwop-Arwite fine sandy loams, 3 to 6 percent slopes
933	Baux-Bauxson-Kirtley complex, 3 to 60 percent slopes
938	Water
939	Disturbed land
959	Reeder-Farnuf complex, 9 to 15 percent slopes
960	Farnuf loam, 6 to 9 percent slopes
961	Savage-Farnuf silt loams, 0 to 6 percent slopes, gravelly substratum
962	Wolf loam, 0 to 3 percent slopes
963	Trimad-Trivar complex, 0 to 25 percent slopes
964	Nesda-Rubble land complex, 0 to 3 percent slopes
968	Varney-Trimad sandy loams, 6 to 45 percent slopes
970	Jarre-Pachel, very deep complex, 3 to 50 percent slopes
971	Cragnot-Pensore, conglomerate-Roto, conglomerate, gravelly sandy loams, 6 to 60 percent slopes
973	Roto-Bloodstone-Riedel complex, 6 to 60 percent slopes
975	Bronec-Foreleft complex, 3 to 15 percent slopes
976	Cragnot-Dullknife-Whitesage complex, 6 to 20 percent slopes
977	Skelridge-Delridge-Yamacall complex, 10 to 50 percent slopes
978	Abac, dry-Bloodstone-Fetterman complex, 6 to 60 percent slopes
980	Nesda-Dalecreek complex, 0 to 6 percent slopes
982	Assinniboine-Dast fine sandy loams, 3 to 65 percent slopes
983	Perma-Breeton fine sandy loams, 5 to 30 percent slopes
984	Bronec-Trimad complex, 6 to 30 percent slopes
987	Wolfvar-Crago loams, 3 to 25 percent slopes
988	Cloud Peak-Dullknife complex, 10 to 70 percent slopes
989	Cloud Peak gravelly silt loam, 5 to 45 percent slopes
990	Rock outcrop-Cloud Peak association, 10 to 70 percent slopes
993	Agneston-Granile-Rock outcrop association, 5 to 50 percent slopes
994	Rock outcrop-Agneston-Rubble land association, 5 to 60 percent slopes
995	Fourmile sandy loam, 0 to 25 percent slopes
997	Lucky-Burgess-Hazton association, 2 to 30 percent slopes
998	Owen Creek-Echemoor-Bynum association, 2 to 30 percent slopes
999	Leavitt-Passcreek association, 2 to 30 percent slopes

Soil Group Number	Soil Group Name
GP	Pits, gravel
M-W	Water, miscellaneous
W	Water

Notes:

1. The same soil group number was assigned to multiple soil group names in the Bighorn National Forest data set. Thus, multiple soil groups may be represented by soil group numbers 11, 13, 15, and 22.

Appendix 3G
Surface Water Rights Tabulation

Appendix 3G.1

Direct Flow Surface Water Rights Tabulation

Clear Creek Watershed Direct Flow Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	TOTAL FLOW	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	TOTAL CAPACITY (AF/Yr)	DIVERSION CAPACITY AT HEAD GATE	LONGITUDE	LATITUDE
P34236.0D	ALDERTON DOMESTIC PUMP	08/14/2009	Complete	0.06	North Piney Creek		JOHN	ALDERTON	DOM_SW	053N	083W	08	NE1/4SW1/4		0.056	-106.884758	44.577761
P19436.0D	Allen Ditch	09/05/1940	Fully Adjudicated	0.07	North Piney Creek		L.	Allen	DOM_SW; IRR_SW; STO	053N	084W	12	SW1/4NE1/4		0.307	-106.919094	44.582075
P12859.0D	AMES DITCH NO. 1	12/04/1914	Expired	0.36	Spring Draw		FLORENCE	AMES	IRR_SW	056N	078W	09	NE1/4SE1/4			-106.246822	44.841369
P12860.0D	AMES DITCH NO. 2	12/04/1914	Expired	0.17	Ames Gulch		FLORENCE	AMES	IRR_SW	056N	078W	10	SW1/4SE1/4			-106.232914	44.836617
P12820.0D	Anna Collins Ditch No. 1	06/13/1914	Fully Adjudicated	0.14	Fred's Draw		ANNA	COLLINS	IRR_SW	056N	079W	24	SE1/4SW1/4			-106.319741	44.805797
P12821.0D	Anna Collins Ditch No. 2	06/13/1914	Fully Adjudicated	0.15	Reservoir Creek		ANNA	COLLINS	IRR_SW	056N	079W	24	SE1/4NW1/4			-106.319671	44.812662
P3114.0D	Arapahoe Ditch	04/08/1901	Fully Adjudicated	0.26	Mowry Creek		CHARLES W.	GRIFFEN	IRR_SW	052N	083W	33	SE1/4NW1/4			-106.852400	44.436510
P2168.0E	Arapahoe Ditch {Enl. of}	12/20/1909	Fully Adjudicated				G.G.	Oliver	IRR_SW	052N	083W	33	NW1/4NE1/4				
CR CC60/386	Arn Ditch	11/09/1944		0.03	Arn Spring		ETHEL E. MILLER	ARN	IRR_SW	053N	083W	08	SW1/4SW1/4			-106.889610	44.574260
P19939.0D	Arn Ditch	11/09/1944	Fully Adjudicated	0.03	Arn Spring				DOM_SW; IRR_SW	053N	083W	08	SW1/4SW1/4		0.340	-106.890181	44.574918
CR CB02/026	Arroyo Ditch	12/31/1898		0.00	Arroyo Draw		RALPH B CHARLOTTE K	ALLEY	IRR_SW	051N	082W	15	NE1/4NW1/4			-106.711840	44.395810
P2037.0D	Arroyo Ditch	12/31/1898	Fully Adjudicated	0.28	Arroyo Draw			Bolinger Ranch Partnership	IRR_SW	051N	085W	15	NE1/4NW1/4			-106.712137	44.395142
CR CC42/301	Arroyo Reservoir	08/02/1919		12.90	Arroyo Draw		RALPH B CHARLOTTE K	ALLEY	IRR_SW	051N	082W	15	NE1/4NW1/4			-106.711840	44.395810
P401.0E	Athorpe Ditch {Enl. of}	01/21/1899	Fully Adjudicated	0.67	Piney Creek				IRR_SW	053N	081W	11	SE1/4SE1/4		-1		
CR CC22/053	Athorpe Ditch,, Enl.	01/21/1899		0.67	Piney Creek		EMILY E.	CAMPBELL	IRR_SW	053N	081W	09	SW1/4NW1/4			-106.627410	44.580920
CR CC70/073	Athorpe Ditch,, Enl.	01/21/1899			Piney Creek		RAYMOND N.	PLANK	IRR_SW	053N	081W	10	NW1/4SW1/4			-106.607160	44.576980
OR 02/194	Athrope Ditch	04/30/1884		1.79	Piney Creek	Darius Athorpe			IRR_SW	053N	081W	09	SW1/4NW1/4				
T2223.0-	Athrope Ditch	04/30/1884			Piney Creek		ALFRED J.	COOKSLEY		053N	081W	09	NW1/4SW1/4				
P34223.0D	B.E. CAMPBELL PUMP	07/13/2009	Complete	0.06	Rock Creek		B	CAMPBELL	DOM_SW	051N	082W	15	NE1/4SW1/4	0.06	0.056	-106.710361	44.388417
CR CC22/025	Babione Ditch No. 1	03/08/1905		0.21	Rhiner Creek			BABIONE W.H.	IRR_SW	053N	084W	18	SE1/4NW1/4			-107.025770	44.567270
CR CC46/202	Babione Ditch No. 1	03/08/1905			Rhiner Creek		SARAH ANNE	BABIONE	IRR_SW	053N	084W	18	SE1/4NW1/4			-107.025770	44.567270
P6653.0D	Babione Ditch No. 1	03/08/1905	Fully Adjudicated	0.00	Rhiner Creek		W.H.	Babione	IRR_SW	053N	084W	18	SE1/4NW1/4			-107.025775	44.567252
CR CC22/026	Babione Ditch No. 2	03/08/1905		0.07	Rhiner Creek		W.H.	BABIONE	IRR_SW	053N	084W	18	SE1/4NW1/4			-107.025770	44.567270
P6654.0D	Babione Ditch No. 2	03/08/1905	Fully Adjudicated	0.07	Rhiner Creek		W.H.	Babione	IRR_SW	053N	084W	18	SE1/4NW1/4			-107.025775	44.567252
P7550.0E	BALKENBUSH ENL OF PINEY DIVIDE DITCH ENLARGEMENT OF BALKENBUSH RESERVOIR	07/27/2007	Complete		South Piney Creek				RES	053N	084W	13	SE1/4SE1/4		40.260	-106.912989	44.558681
CR CC69/139	Barker Ditch	06/08/1961		0.13	French Creek		MARGARET M.	BARKER	IRR_SW	051N	082W	21	NW1/4SW1/4			-106.737780	44.373940
P22531.0D	Barker Ditch	06/08/1961	Fully Adjudicated	0.13	French Creek		Arthur J. & Margaret M.	Barker	IRR_SW	051N	082W	21	NW1/4SW1/4		6.910	-106.735778	44.374250
CR CC74/180	Barker Ditch,, Enl.	10/18/1972		0.09			MARGARET M.	BARKER	IRR_SW	051N	082W	21	NW1/4SW1/4			-106.737780	44.373940
P6434.0E	Barker Ditch,, First Enlargement of the	10/18/1972	Fully Adjudicated	0.09			Margaret M.	Barker	IRR_SW	051N	082W	21	NW1/4SW1/4		6.91		
P1643.0E	Barkey Ditch {Enl. of}	09/24/1906	Fully Adjudicated				Ida R.	Barkey	IRR_SW	052N	085W	13	SW1/4SE1/4				
CR CC25/132	Barkey Ditch,, Enl.	09/24/1906		0.98			IDA R.	BARKEY	IRR_SW	052N	083W	25	SE1/4SW1/4			-106.792530	44.443200

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P1242.0D	Barlow Ditch	05/27/1896	Fully Adjudicated	0.57	South Piney Creek		George W.	Barlow	DOM_SW; IRR_SW	053N	084W	13	SW1/4SW1/4			-106.928121	44.558397
P33086.0D	Barn - Apartment Pump System	08/09/2004	Unadjudicated		Bear Gulch		Louise Benz	Plank Revocable Trust	DOM_SW	053N	083W	28	SE1/4NW1/4		0.056	-106.864828	44.538484
CR CC22/055	Barnes Burris Ditch - No. 846,, Enl.	05/15/1900		3.85	Piney Creek		ERNEST B.	WILLIAMS	IRR_SW	053N	082W	11	NW1/4SE1/4			-106.697940	44.577660
CR CC64/367	Barnes Burris Ditch - No. 846,, Enl.	05/15/1900			Piney Creek		WALTER C.	CALLAHAN	IRR_SW	053N	082W	11	NW1/4SE1/4			-106.697940	44.577660
CR CC64/368	Barnes Burris Ditch - No. 846,, Enl.	05/15/1900			Piney Creek		JENNIE	WILLIAMS	IRR_SW	053N	082W	11	NW1/4SE1/4			-106.697940	44.577660
P568.0E	Barnes Burris Ditch - No. 846,, Williams Extension	05/15/1900	Fully Adjudicated		Piney Creek		E.B.	Williams	IRR_SW	053N	082W	22	SW1/4NW1/4		-1		
P12826.0D	Barr Ditch	11/16/1914		0.74	Barr Draw		AGNESS	STURDEVANT	IRR_SW	053N	081W	18	NW1/4NW1/4		-1.000	-106.668680	44.570189
CR CC36/263	Beal Ditch	02/21/1914		0.45	Beal Draw		LAURA B.	BEAL	IRR_SW	055N	079W	33				-106.378170	44.695590
P12271.0D	Beal Ditch	02/21/1914	Fully Adjudicated		Beal Draw		Laura B.	Beal	IRR_SW	055N	079W	33	SW1/4NW1/4			-106.384549	44.696527
P12272.0D	Beal Ditch	02/21/1914	Fully Adjudicated	1.07	Gulch		Laura B.	Beal	IRR_SW	055N	079W	33	SW1/4NW1/4			-106.385876	44.697313
OR 02/194	Bear Gulch (Buckingham) Ditch	05/01/1889		0.43	Bear Gulch	J.H. Buckingham			IRR_SW	053N	083W	31	NE1/4NW1/4			-106.904620	44.527620
CR CC26/246	Beaver Dam Ditch	09/08/1896		1.91			FRED L.	NEWTON	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC26/248	Beaver Dam Ditch	09/28/1896		1.04	South Piney Creek		HAMILTON	WILCOX	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC35/540	Beaver Dam Ditch	09/28/1896			South Piney Creek		HAMILTON	WILCOX		052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC62/024	Beaver Dam Ditch	06/26/1925		0.53	Spring Branch		RALPH I.	GOODWIN	IRR_SW	053N	083W	29	NE1/4SW1/4			-106.884540	44.534760
CR CC69/003	Beaver Dam Ditch	09/28/1896			South Piney Creek		CHARLES E.	HUSON	IRR_SW	051N	082W	08	SE1/4NE1/4			-106.742250	44.406680
P1334.0D	Beaver Dam Ditch	09/28/1896	Fully Adjudicated	2.45	South Piney Creek		Chas. H.	Reynolds	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.028646	44.474677
P17015.0D	Beaver Dam Ditch	06/26/1925	Fully Adjudicated	0.54	Spring Branch		F.W.	LEACH	IRR_SW	053N	083W	29	NE1/4SW1/4		2.88		
P3053.0E	Belle of Bear Creek or Babcock Ditch {Enl. of} (ENL BELLE OF BEAR GULCH)	09/08/1914	Fully Adjudicated	0.1			Rudolph	Mueller	DOM_SW; IRR_SW	053N	083W	28	SW1/4NW1/4		-1		
CR CC41/483	Belle of Bear Creek or Babcock Ditch,, Enl.	09/08/1914		0.10			RUDOLPH	MUELLER	DOM_SW; IRR_SW	053N	083W	28	SW1/4NW1/4			-106.869430	44.538330
OR 02/194	Belle of Bear Gulch Ditch	06/10/1886		0.36	Bear Gulch	Rudolph Mueller			IRR_SW	053N	083W	28	SW1/4NW1/4			-106.869430	44.538330
CR CC72/379	Bennett Pipe Line	01/08/1975		0.02	North Piney Creek		PETER J. VIRGINIA RAISCH	POWELL	DOM_SW	053N	084W	11	SE1/4NE1/4			-106.935030	44.581970
P24592.0D	Bennett Pipe Line	01/08/1975	Fully Adjudicated	0.02	North Piney Creek				DOM_SW	053N	084W	11	SE1/4NE1/4		0.022	-106.936254	44.580191
CR CC90/051	BIG BONANZA DITCH	12/31/1883	Fully Adjudicated	0.09	Clear Creek		CRAIG AND JUDITH Z.	JOHNSON	IRR_SW	053N	080W	19	SW1/4NW1/4			-106.545303	44.550478
OR 02/182	BIG BONANZA DITCH	04/30/1882	Fully Adjudicated	7.43	Clear Creek		N.E.	CRAMER	IRR_SW	052N	081W	12	NW1/4SW1/4			-106.557200	44.491958
OR 02/182	BIG BONANZA DITCH	12/31/1883	Fully Adjudicated	0.00	Clear Creek		OSCAR	PHEIFFER	IRR_SW	052N	081W	12	NW1/4SW1/4			-106.557200	44.491958
T2097	BIG BONANZA DITCH	12/31/1883	Fully Adjudicated	14.19	Clear Creek		OSCAR	PHEIFFER	IRR_SW	052N	081W	12	NW1/4SW1/4			-106.557200	44.491958
CR CC73/336	Big Bonanza Ditch 1st app., ENLARGEMENT OF	04/28/1971	Fully Adjudicated	0.49	Clear Creek		KONRAD	LEIS	IRR_SW	052N	081W	12	NW1/4SW1/4			-106.557200	44.491958
CR CC26/251	BIG BONANZA DITCH AS CHANGED FROM THE ENLARGEMENT OF Des Moines Ditch 1st app.	01/19/1904	Fully Adjudicated	2.92	Clear Creek	WALTER BROTHERS			IRR_SW	052N	081W	12	NW1/4SW1/4			-106.557200	44.491958
P6396.0E	Big Bonanza Ditch,, Enlargement of	04/28/1971	Fully Adjudicated	0.49	Clear Creek (drainage of)		Konrad	Leis	IRR_SW	052N	081W	12	NW1/4SW1/4		40.100	-106.556667	44.492222
OR 02/194	Big Piney No. 1 Ditch	05/05/1881		0.36	South Piney Creek	Christian J. Hepp			IRR_SW	053N	084W	13	SE1/4NW1/4				
OR 02/194	BIG PINEY NO. 1 DITCH	05/05/1881		2.03	South Piney Creek		CHRISTIAN	HEPP	IRR_SW	053N	083W	34	SE1/4NW1/4			-106.841928	44.522511
CR CC29/333	Billy Ditch	01/24/1906		0.80	North Fork Sayles Creek			BRYANT OLIVER	IRR_SW	051N	083W	07	NW1/4NE1/4			-106.888190	44.411180

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P7036.0D	Billy Ditch	01/24/1906	Fully Adjudicated	0.80	North Fork Sayles Creek		LENA	SAYLES	IRR_SW	051N	084W	12	NE1/4NE1/4			-106.903313	44.411344
P7184.0D	BOB DITCH	05/01/1906	Fully Adjudicated		Bob's Draw		R.E.L.	POOL	DOM_SW; IRR_SW; STO	056N	078W	18	SE1/4NW1/4			-106.297960	44.830366
OR 02/194	Bouncer Ditch	09/30/1883		2.14	Piney Creek	Allen Williams			IRR_SW	053N	081W	07	NE1/4NE1/4			-106.652400	44.584260
P17141.0D	Box Elder Ditch	08/21/1926	Fully Adjudicated	1.22	Box Elder Creek		Anna	Wolfe	IRR_SW	053N	081W	21	SW1/4SW1/4		2.700	-106.628149	44.543496
P4615.0E	Box Elder Ditch,, First Enl.	08/06/1928			Box Elder Creek		Anna	Wolfe	IRR_SW	053N	081W	21	SW1/4SW1/4		2.700	-106.628039	44.543448
CR CC76/173	Braten Pipeline	01/23/1973		0.06	Braten Spring		RAY A. LOUISA C.	BRATEN	DOM_SW	050N	083W	09	NE1/4SW1/4			-106.853620	44.315500
P23969.0D	Braten Pipeline	01/23/1973	Fully Adjudicated	0.06	Braten Spring		Ray A.	Braten	DOM_SW	050N	083W	09	NE1/4SW1/4		0.116	-106.853621	44.315502
P2460.0E	Brewers Ditch {Enl. of}	04/20/1911	Fully Adjudicated	1.59	South Fork		J.H.	McDonald	IRR_SW	052N	084W	25	SW1/4SE1/4		-1		
CR CC34/204	Brewers Ditch,, Enl.	04/20/1911		1.59	South Fork		J. H.	MCDONALD	IRR_SW	052N	084W	25	SW1/4SE1/4			-106.908000	44.444240
P6070.0E	BROCK RESERVOIR ENLARGEMENT OF JOHNSON DITCH	02/17/1961	Fully Adjudicated	0.00	Clear Creek		LEWIS	BROCK	RES	050N	082W	05	NW1/4SW1/4		25.080	-106.758092	44.330069
CR CA01/267	Brown & Foster Ditch	10/03/1896		2.85		John R. Brown			IRR_SW	050N	084W	28	SW1/4NW1/4			-106.979520	44.278930
CR CC14/061	Brown & Foster Ditch	10/03/1896		2.78			SARAH	FOSTER	IRR_SW	050N	084W	28	SW1/4NW1/4			-106.979520	44.278930
P1326.0D	Brown & Foster Ditch	10/03/1896	Fully Adjudicated	7.64			ANNIE	HOLLOWAY	IRR_SW	050N	084W	05	SW1/4NW1/4		-1.000	-107.000710	44.337990
P20362.0D	Brug and Schuman Pump No. 1 Ditch	03/20/1950	Fully Adjudicated	1.14	Clear Creek		John	Brug	IRR_SW	053N	080W	10	SW1/4SW1/4		1.270	-106.486190	44.573635
CR CC32/112	Brundage East Side Ditch	12/24/1906		1.15	Reed Draw			BRUNDAGE BROTHERS	IRR_SW	057N	076W	All					
CR CC32/107	Brundage Powder River Ditch	03/29/1904		4.52	Clear Creek		SUE	BRUNDAGE	IRR_SW	057N	077W	35	SW1/4SE1/4			-106.102900	44.870190
CR CC32/108	Brundage Powder River Ditch	03/29/1904		1.24	Clear Creek		W. S.	PATCH	IRR_SW	057N	077W	35	SW1/4SE1/4			-106.102900	44.870190
P5925.0D	Brundage Powder River Ditch	03/29/1904	Fully Adjudicated	5.77	Clear Creek		V.A.	Brundage	IRR_SW	057N	077W	36	SW1/4SE1/4			-106.083061	44.870224
P1677.0E	Brundage Powder River Ditch {Enl. of}	01/04/1907	Fully Adjudicated		Clear Creek (drainage of)		V.A.	Sue	IRR_SW	057N	077W	36	SW1/4SE1/4				
CR CC32/109	Brundage Powder River Ditch,, Enl.	01/04/1907		1.02	Clear Creek (drainage of)		SUE	BRUNDAGE	IRR_SW	057N	077W	35	SW1/4SE1/4			-106.102900	44.870190
CR CC43/559	Buckingham Ditch,, Enl.	12/04/1922		1.17	Bear Gulch		JOSEPH A.	BUCKINGHAM	IRR_SW	053N	083W	31	NE1/4NW1/4			-106.904620	44.527620
CR CC69/137	Buell Pipeline	03/28/1968		0.22	Buell Spring Area		CHARLEY M.	BUELL	IRR_SW; STO	052N	083W	21	NE1/4SE1/4			-106.842950	44.461600
P22898.0D	Buell Pipeline	03/28/1968	Fully Adjudicated	0.22	Buell Spring Area		Charley M.	Buell	IRR_SW; STO	052N	083W	21	NE1/4SE1/4		0.223	-106.842947	44.461602
P3112.0E	Buffalo Creek Ditch {Enl. of}	01/14/1915	Fully Adjudicated		Cemetery Draw		John T.	Foster	IRR_SW	056N	079W	34	NE1/4SW1/4				
P10868.0D	Buffalo Ditch	07/01/1911							IRR_SW	056N	079W	35				-106.337500	44.782050
P12437.0D	Buffalo Ditch	05/27/1914	Fully Adjudicated	2.33	Buffalo Creek			Maxwell Bros. & Huntsman	IRR_SW	056N	079W	34	NE1/4SW1/4			-106.359287	44.778930
P8599.0D	Buffalo Ditch	08/10/1908	Fully Adjudicated	0.81	Buffalo Creek		SLATER A.	MAXWELL	IRR_SW	056N	079W	35	SW1/4NW1/4			-106.344495	44.783224
P2510.0E	Buffalo Ditch {Enl. of}	07/01/1911			Cemetery Draw		Fred	Huntsman	IRR_SW	056N	079W	35	SW1/4NE1/4			-106.334994	44.783709
P10867.0D	Buffalo Ditch No. 2	07/01/1911							IRR_SW	056N	079W	35				-106.337500	44.782050
OR 02/182	Buffalo Mill Co. Ditch	06/01/1887		40	Clear Creek (drainage of)	Buffalo Mill Co.			MUN_SW	050N	083W	10	SE1/4NW1/4				
OR 29/344	Buffalo Mill Co. Ditch	06/01/1887			Clear Creek (drainage of)			TOWN OF BUFFALO	MUN_SW	050N	082W	05	NE1/4SE1/4				
OR 03/151	Buffalo Water Wagon Pipe Line and Ditch	12/31/1879		4.00				TOWN OF BUFFALO	MUN_SW	050N	082W	04	SW1/4SE1/4			-106.727720	44.326410
CR CC81/443	Buffalo Water Wagon Pipe Line and Ditch,, Enl.	06/13/1996		10.03		City of Buffalo			POW	050N	083W	10	SE1/4NW1/4			-106.833660	44.319240

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P7222.0E	Buffalo Water Wagon Pipe Line and Ditch,, Hydropower Enlargement of the	06/13/1996	Fully Adjudicated	0.00				City of Buffalo	POW	050N	083W	10	SE1/4NW1/4		10.030	-106.833660	44.319240
CR CC70/025	Buffalo Water Wagon Pipeline and Ditch	11/21/1968		100.00	South Fork South Piney Creek			TOWN OF BUFFALO	MUN_SW; STO	050N	082W	10	SE1/4NW1/4			-106.712980	44.319350
P23403.0D	Buffalo Water Wagon Pipeline and Ditch	11/21/1968	Fully Adjudicated	0.00	South Fork South Piney Creek			City of Buffalo	MUN_SW	050N	083W	10	SE1/4NW1/4		10.340	-106.835455	44.320706
OR 06/505	BURN CLEUCH DITCH	10/29/1881	Fully Adjudicated	0.69	Little Goose Creek		ALBERT	PIERCE	IRR_SW	052N	083W	35	SW1/4NW1/4			-106.818681	44.435064
CR CC22/050	Burris Ditch	11/26/1895		0.57	Piney Creek		M.A.	HAMILTON	IRR_SW	053N	082W	11	SW1/4SE1/4			-106.697920	44.574050
P864.0D	Burris Ditch	11/26/1895	Fully Adjudicated	5.71	Piney Creek		Barnes C.	Burris	IRR_SW	053N	082W	11	SW1/4SE1/4				
CR CC84/006	BUSHAWAY IRRIGATION SYSTEM	03/17/1997		0.09	Bear Gulch	LOUISE BENZ PLANK REVOCABLE TRUST			DOM_SW	053N	083W	28	SW1/4NW1/4			-106.867775	44.537258
P31808.0D	Bushaway Irrigation System	03/17/1997	Unadjudicated	0.09	Bear Gulch			Loiuse Benz Plank Revocable Trust	DSP	053N	083W	28	SW1/4NW1/4		0.094	-106.867768	44.537248
P22912.0D	Businga Pump System	12/10/1962	Unadjudicated	0.00	Businga Spring Creek		Claude	Businga	IRR_SW	053N	083W	18	NW1/4NE1/4		0.300	-106.899792	44.570484
CR CC62/402	Byxbe Pipe Line & Ditch	07/06/1948		0.57	Clear Creek		TERESA F.	LITTLE	IRR_SW	053N	080W	11	NE1/4SW1/4			-106.461930	44.576720
P20242.0D	Byxbe Pipe Line & Ditch	07/06/1948	Fully Adjudicated	0.57	Clear Creek		Ivan	Byxbe	IRR_SW	053N	079W	06	SE1/4NW1/4		0.580	-106.419752	44.595579
P9695.0D	Cabin Ditch No. 1	04/11/1910	Fully Adjudicated	0.41	East Cabin Creek		ALICE M.	WATT	IRR_SW	057N	077W	05	SW1/4SW1/4			-106.174249	44.942720
P9696.0D	Cabin Ditch No. 2	04/11/1910	Fully Adjudicated	0.50	Wagonroad Draw		ALICE M.	WATT	IRR_SW	057N	077W	05	SW1/4SW1/4			-106.174208	44.943655
P9693.0D	Cabin Ditch No. 3	04/11/1910	Fully Adjudicated	0.1	East Cabin Creek		EMMETT L.	HUTSONPILLER	IRR_SW	057N	077W	16	SE1/4SE1/4				
P9694.0D	Cabin Ditch No. 4	04/11/1910	Fully Adjudicated	0.36	West Cabin Creek		EMMETT L.	HUTSONPILLER	IRR_SW	057N	077W	16	SW1/4SW1/4			-106.153843	44.912204
CR CC38/628	Cadiz Ditch	07/12/1915		2.22	Clear Creek			ESTATE OF L. Z. LEITER	IRR_SW	055N	078W	30	SW1/4NE1/4				
P13354.0D	Cadiz Ditch	07/12/1915	Fully Adjudicated	2.22	Clear Creek			LEITER ESTATE	IRR_SW	055N	078W	30	SW1/4NE1/4			-106.363116	44.752755
P3911.0E	Cadiz Ditch {Enl. of}	06/15/1918	Unadjudicated	9.6	Clear Creek (drainage of)			L.Z. Lester Estate	IRR_SW	055N	078W	20	SW1/4SE1/4		5.5		
OR 02/192	Caleb Ditch	03/31/1880		0.28	Johnson Creek	John McRae			IRR_SW	051N	082W	06	SE1/4NW1/4			-106.772270	44.421270
P20030.0D	Campbell Ditch	04/17/1946	Unadjudicated	0.04	Beaver Springs		Donald	Campbell	IRR_SW	053N	083W	18	NW1/4NW1/4		0.500	-106.894143	44.570509
CR CC72/357	Campbell Pipeline No. 1	10/17/1972		0.09	North Piney Creek		MALCOLM S. RETA	CAMPBELL	IRR_SW	053N	083W	08	NW1/4SW1/4			-106.889580	44.578110
P23945.0D	Campbell Pipeline No. 1	10/17/1972	Fully Adjudicated	0.14	North Piney Creek		Malcolm S.	Campbell	IRR_SW	053N	083W	08	NW1/4SW1/4		0.045	-106.889358	44.578994
P2183.0E	Canon Ditch {Enl. of}	04/05/1910		0	South Fork Sayles Creek			Bryant & Oliver	IRR_SW	051N	083W	08	NW1/4NW1/4		-1		
P17772.0D	Canyon Ditch	04/29/1930	Unadjudicated	0.49	South Fork Sayles Creek			Love Land & Cattle Co.	IRR_SW	051N	083W	08	NE1/4SW1/4		4.800	-106.872712	44.404394
OR 02/182	Carwile & Lobban Ditch	05/10/1883		1.45	Clear Creek (drainage of)	J.M. Lobban & C.W. Hine & Chas. w. White & R.A. Bennett			IRR_SW	050N	082W	04	SW1/4SE1/4			-106.727720	44.326410
OR 02/182	Carwile & Lobban Ditch	05/10/1883		1.10	Clear Creek (drainage of)	Julius G. Oliver			IRR_SW	050N	082W	04	SW1/4SE1/4			-106.727720	44.326410
OR 02/182	Carwile & Lobban Ditch	05/10/1883		0.86	Clear Creek (drainage of)	Oren C. Kilkenny			IRR_SW	050N	082W	04	SW1/4SE1/4			-106.727720	44.326410

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P3978.0E	Carwile and Lobban Ditch {Enl. of}	11/25/1918	Unadjudicated	5.83	Clear Creek (drainage of)			Northern Wyoming Land Co.	DOM_SW; IRR_SW; STO	050N	082W	02	NW1/4SE1/4		-1		
P6784.0D	Chaffee No. 1 Ditch	04/07/1905	Fully Adjudicated	0.86	Clear Creek		Maude	Chaffee	DOM_SW; IRR_SW	056N	077W	31	SE1/4NE1/4			-106.169262	44.788434
P6782.0D	Chaffee No. 3 Ditch	04/07/1905	Fully Adjudicated	0.32	Chaffee Gulch		Maude	Chaffee	DOM_SW; IRR_SW	056N	077W	29	SW1/4SW1/4			-106.165287	44.795926
P18372.0D	Chaffin Ditch	05/14/1934	Unadjudicated		North Piney Creek		John	Chaffin	DOM_SW; IRR_SW	053N	083W	07	SW1/4SW1/4		1.500	-106.909926	44.574247
CR CC87/036	Chantry Domestic Pump	11/16/2007		0.06	North Piney Creek	The Chantry Family Living Trust			DOM_SW	053N	084W	11	NE1/4SE1/4			-106.935090	44.578110
P33836.0D	Chantry Domestic Pump Diversion	11/16/2007	Fully Adjudicated		North Piney Creek		Joel & Ruth	Chantry	DOM_SW	053N	084W	11	NE1/4SE1/4		0.056	-106.935090	44.578110
P33995.0D	Chase 1 Domestic Pump	08/25/2008	Unadjudicated		Rock Creek		Paul M.	Brunkhorst	DOM_SW	051N	082W	08	SE1/4NE1/4		0.056	-106.742250	44.406680
P33116.0D	CHEVRON TEXACO OFFICE DOMESTIC	09/01/2004	Fully Adjudicated	0.45	Piney Creek	T CROSS T RANCH			DOM_SW	053N	083W	26	SW1/4NE1/4		0.450	-106.818808	44.538292
CR CC79/278	Clarendon Ditch	05/06/1991		0.46	Spring Creek		CHARLES	ORCHARD	STO	053N	084W	12	SE1/4SE1/4			-106.914950	44.574250
P30789.0D	Clarendon Ditch	05/06/1991	Fully Adjudicated	0.40	Spring Creek			OLD DALTON DITCH USERS GROUP ETAL	IRR_SW; STO	053N	084W	12	SE1/4SE1/4		26.690	-106.914858	44.574482
CR CC22/068	Clarissa Huson Ditch,, Enl.	05/06/1903		0.85	Clear Creek (drainage of)		CLARISSA A.	HUSON	IRR_SW	053N	080W	11	NE1/4SW1/4			-106.461930	44.576720
P1032.0E	Clarissa Huson Ditch,, Huson Ditch {Enl. of} (ENL HUSON)	05/06/1903	Fully Adjudicated	2.28	Clear Creek (drainage of)		Clarissa	Huson	IRR_SW; STO	053N	079W	07	NW1/4NW1/4		-1		
OR 02/182	Clear Cr. Land & Ditch Co. Ditch	06/20/1883		3.57	Clear Creek (drainage of)	Robert Foote			IRR_SW	050N	082W	03	SE1/4NW1/4			-106.713980	44.335330
OR 02/182	Clear Cr. Land & Ditch Co. Ditch	05/31/1887		5.00	Clear Creek (drainage of)	Robert Foote			IRR_SW	050N	082W	03	SE1/4NW1/4			-106.713980	44.335330
OR 02/182	Clear Cr. Land & Ditch Co. Ditch	06/20/1883		2.28	Clear Creek (drainage of)	Elizabeth Montgomery			IRR_SW	050N	082W	03	SE1/4NW1/4			-106.713980	44.335330
OR 02/182	Clear Cr. Land & Ditch Co. Ditch	06/20/1883		1.07	Clear Creek (drainage of)	Andrew K. Kennedy			IRR_SW	050N	082W	03	SE1/4NW1/4			-106.713980	44.335330
OR 02/182	Clear Cr. Land & Ditch Co. Ditch	06/20/1883		5.71	Clear Creek (drainage of)	Oliver J. Smythe			IRR_SW	050N	082W	03	SE1/4NW1/4			-106.713980	44.335330
CR CC72/276	Clear Creek Inn Pipe Line No. 3	04/14/1970		0.08	North Elk Spring		SAM H. GOLDIE M.	MAVRAKIS	DOM_SW	050N	084W	12	NE1/4NW1/4			-106.912960	44.325560
P23427.0D	Clear Creek Inn Pipe Line No. 3	04/14/1970	Fully Adjudicated	0.08	North Elk Spring			Clear Creek Inn Corp.	DOM_SW	050N	084W	12	NE1/4NW1/4		0.081	-106.912959	44.325565
OR 02/182	Clear Creek Land & Ditch Co. Ditch	06/20/1883		2.28	Clear Creek (drainage of)	Mrs. Nellie Kennedy			IRR_SW	050N	082W	03	SE1/4NW1/4				
OR 57/085	Clear Creek Land & Ditch Co. Ditch	06/20/1883			Clear Creek (drainage of)	Tom D. Rule			IRR_SW	050N	082W	03	SW1/4NW1/4				
P4220.0E	Clear Creek Land and Ditch Co. Canal {Enl. of}		Fully Adjudicated	6.49	Clear Creek (drainage of)		Eva E.	Works	IRR_SW	050N	082W	03	SE1/4NW1/4		30		
CR CC45/439	Clear Creek Land and Ditch Co. Canal,, Enl.	09/23/1920		0.00	Clear Creek (drainage of)		EVA E.	WORKS	IRR_SW	050N	082W	03	SE1/4NW1/4			-106.713980	44.335330
OR 57/086	Clear Creek Land and Ditch Company Ditch	03/24/1884				Tom D. Rule			IRR_SW	050N	082W	03	SW1/4NW1/4			-106.717370	44.333740
CR CC46/225	Clear Creek Pipe Line	01/15/1915		-20.00	Clear Creek		BUFFALO NORTHWEST	ELECTRIC CO.	POW	050N	083W	02	NW1/4SE1/4			-106.808390	44.330110
P12943.0D	Clear Creek Pipe Line	01/15/1915			Clear Creek				POW	050N	083W	02	NW1/4SE1/4		-1.000	-106.808058	44.329111

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CR CC76/163	Clear Creek-Lake DeSmet Supply Ditch	02/25/1955		17738.00	Clear Creek			TEXACO INC.	RES	051N	081W	09	NW1/4SW1/4			-106.616510	44.402980
P22928.0D	CLEAR CREEK-LAKE DESMET SUPPLY DITCH	02/25/1955	Fully Adjudicated	580.00	Clear Creek	M&M RANCH ACQUISITIO N CO LLC			RES	051N	081W	09	NW1/4SW1/4		580.000	-106.614547	44.401653
CR CC76/171	Clear Creek-Lake DeSmet Supply Ditch-Rock Creek Diversion	02/25/1955		200.00	Rock Creek			TEXACO INC.	RES	051N	081W	09	NW1/4SW1/4			-106.616511	44.402981
P22930.0D	CLEAR CREEK-LAKE DESMET SUPPLY DITCH-ROCK CREEK DIVERSION	02/25/1955	Fully Adjudicated	200.00	Rock Creek	M&M RANCH ACQUISITIO N CO LLC			RES	051N	081W	09	NW1/4SW1/4		969.600	-106.615239	44.403181
CR CC59/029	Cleo Ditch	11/12/1940		0.29	South Gulch		CLEO Z.	SPURRIER	IRR_SW	053N	084W	13	NW1/4SW1/4			-106.930000	44.563340
P19477.0D	Cleo Ditch	11/12/1940	Fully Adjudicated	0.29	South Gulch		Cleo Z.	Spurrier	IRR_SW	053N	084W	13	SE1/4SE1/4		1.500	-106.914894	44.559360
CR CC44/542	Cloud Peak Reservoir,, Enl.	08/17/1908		2390.00	Piney Creek			ROCK CREEK PINEY RES. DITCH CO.	IRR_SW	051N	085W	09	SE1/4SE1/4			-107.085900	44.403180
P6245.0D	Coal Bank Ditch	09/30/1904	Fully Adjudicated	1.07	Sand Creek (36-51-82)			MUNKERS & MATHER	IRR_SW	051N	082W	36	SE1/4SW1/4			-106.672546	44.341679
P10657.0D	Coal Banks Ditch	03/23/1911	Unadjudicated	0.29	Cemetery Draw		GEO. W.	MUNKRES	IRR_SW	051N	082W	36	SW1/4SW1/4			-106.677390	44.341414
P7499.0E	Coalition Enlargement Reynolds Lake DeSmet Intake Tunnel	06/19/2003	Unadjudicated		Piney Creek			Lake DeSmet Counties Coalition Joint Powers Board	RES	053N	083W	25	SW1/4SW1/4		1018.000	-106.808750	44.531000
CR CC45/568	Coffeen Ditch,, Enl.	11/19/1926		0.00	South Piney Creek		FRANKLIN R.	SPRACKLEN	IRR_SW	053N	084W	23	NE1/4NE1/4			-106.934990	44.556160
CR CC45/569	Coffeen Ditch,, Enl.	11/19/1926		0.00	North Piney Creek		FRANK R.	SPRACKLEN	IRR_SW	053N	083W	07	SE1/4NE1/4			-106.894620	44.581960
P4504.0E	Coffeen Ditch,, Spracklen Enlargement No. 1	11/19/1926	Fully Adjudicated	0.77	South Piney Creek		Frank R.	Spracklen	IRR_SW	053N	084W	23	NE1/4NE1/4		40.8		
P4505.0E	Coffeen Ditch,, Spracklen Enlargement No. 2	11/19/1926	Fully Adjudicated	0	North Piney Creek		Frank R.	Spracklen	IRR_SW	053N	083W	07	SE1/4NE1/4		40.8		
P7039.0D	Coleman Ditch No. 1	01/20/1906	Fully Adjudicated	0.20	Lone Tree Creek		NILES R.	COLEMAN	IRR_SW	054N	081W	15	NW1/4NW1/4			-106.608688	44.654816
P11899.0D	Coleman Ditch No. 2	06/20/1913		0.10	Prusak Draw		LUELLA	COLEMAN	IRR_SW	054N	081W	22	NE1/4NE1/4			-106.592854	44.643045
P11900.0D	Coleman Ditch No. 3	06/20/1913		0.13	Prusak Draw		LUELLA	COLEMAN	IRR_SW	054N	081W	15	NW1/4SE1/4		-1.000	-106.598230	44.648739
P11901.0D	Coleman Ditch No. 4	06/20/1913		0.20	SUMMIT DRAW		LUELLA	COLEMAN	IRR_SW	054N	081W	15	SW1/4SE1/4			-106.597621	44.645090
P9444.0D	Collins Ditch	06/24/1909	Fully Adjudicated	1.27	Indian Creek		Frederick	Collins	IRR_SW	056N	079W	24	NE1/4SW1/4			-106.322217	44.807643
P2737.0E	Collins Ditch,, Fredericks Collins Enlargement of	01/09/1913			Indian Creek		Frederick	Collins	IRR_SW	056N	079W	24	NE1/4SW1/4				
P12822.0D	Collins Lateral Ditch	11/25/1914	Fully Adjudicated	0.12	Fred's Draw		ANNA	COLLINS	IRR_SW	056N	079W	24	SE1/4SW1/4			-106.319741	44.805797
P2623.0D	Connelly Ditch	05/16/1900	Fully Adjudicated	0.56	Box Elder Creek		MRS. B.	CONNELLY	IRR_SW	053N	081W	31	NW1/4SE1/4			-106.658361	44.519161
P18816.0D	Connolly Ditch	03/07/1935	Fully Adjudicated	2.68	Harper Draw		John	Belus	IRR_SW; STO	053N	081W	31	NE1/4NE1/4		7.400	-106.651880	44.526723
P4651.0E	Connolly Ditch,, 1st Enlargement of	05/02/1929	Fully Adjudicated		Box Elder Creek		John	Belris	IRR_SW	053N	081W	31	NW1/4SE1/4		0.55		
M9.0-	Cook Ditch	07/05/1889					MILTON C. AND EDITH C.	SHERMAN		049N	082W	19	SW1/4SW1/4				
OR 28/179	Cook Ditch	07/05/1889		3.6				EXXON MINERALS COMPANY	IRR_SW	049N	082W	19	SW1/4SW1/4				
OR 28/179	Cook Ditch	07/05/1889		1.2			ART	HAINES	IRR_SW	049N	082W	19	SW1/4SW1/4				
P2544.0E	Cook Ditch {Enl. of}	03/13/1912	Fully Adjudicated		North Fork Crazy Woman Creek			Kingsbury-Todd Co.	IRR_SW; RES	049N	082W	30	NE1/4NW1/4				

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P34341.0D	COOKSLEY WATER HAUL	05/07/2010	Complete	0.67	Piney Creek	WYOMING OIL & GAS COMMISSION	RON	WHITE	TEM	053N	081W	10	NE1/4SW1/4			-106.602306	44.576583
CR CC71/081	Cooley Pipeline	03/08/1968		0.04	Cooley Spring		CHESTER R.	COOLEY	DOM_SW	053N	083W	18	SE1/4NW1/4			-106.904830	44.566910
P22925.0D	Cooley Pipeline	03/08/1968	Fully Adjudicated	0.04	Cooley Spring		CHESTER R.	COOLEY	DOM_SW	053N	083W	18	SE1/4NW1/4		0.044	-106.904832	44.566905
CR CC22/062	Crescent Ditch	10/22/1897		0.64	Cameron Gulch		M. A.	HAMILTON	IRR_SW	053N	082W	10	NW1/4NE1/4			-106.718130	44.585000
P1660.0D	Crescent Ditch	10/22/1897	Fully Adjudicated	1.14	Cameron Gulch		M.A.	HAMILTON	IRR_SW	053N	082W	10	NW1/4NE1/4			-106.719311	44.584170
CR CC69/250	Crossroads Inn Pipeline	05/08/1968		0.25	French Creek		UNIVERSITY OF WYO	BOARD/TRUSTEES	IND_SW	051N	082W	26	NE1/4SW1/4			-106.692290	44.359680
P22850.0D	Crossroads Inn Pipeline	05/08/1968	Fully Adjudicated	0.25	French Creek		C.A.	Reeves	IND_SW	051N	082W	26	NE1/4SW1/4		0.251	-106.692474	44.359528
OR 02/182	Crown Ditch	12/31/1884		2.28	Clear Creek (drainage of)	Julius G. Oliver			IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
OR 02/182	Crown Ditch	12/31/1884		3.43	Clear Creek (drainage of)	Edward E. & Jno. F. Adams			IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
OR 02/182	Crown Ditch	12/31/1884		2.28	Clear Creek (drainage of)	John K. Spearing			IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
OR 05/429	Crown Ditch	12/31/1884		1.14	Clear Creek (drainage of)	Edward D. Metcalf			IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
P2151.0E	Crown Ditch {Enl. of}	08/06/1909	Fully Adjudicated	1.08	Clear Creek (drainage of)		J.A.	Jones	IRR_SW	050N	082W	05	SE1/4SE1/4		-1		
P4051.0E	Crown Ditch,, Coffey Enl. No. 2	12/05/1919	Fully Adjudicated	1.97	Clear Creek (drainage of)		J. Frank	Coffey	DOM_SW; IRR_SW	050N	082W	05	SE1/4SE1/4		16.62		
P3965.0E	Crown Ditch,, Coffey Enlargement of	02/01/1919	Fully Adjudicated	0.28	Clear Creek (drainage of)		J. Frank	Coffey	IRR_SW	050N	082W	05	SE1/4SE1/4		24.5		
CR CC22/073	Crown Ditch,, Enl.	08/24/1904		1.00	Clear Creek (drainage of)		S. J.	MCNEASE	IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
CR CC27/290	Crown Ditch,, Enl.	01/23/1905		2.24	Clear Creek (drainage of)		FRANK M.	HOWE	IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
CR CC31/364	Crown Ditch,, Enl.	08/06/1909		1.08	Clear Creek (drainage of)		J. A.	JONES	IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
CR CC34/192	Crown Ditch,, Enl.	01/27/1911		1.58	Clear Creek (drainage of)		WILSON	MCBRIDE	IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
CR CC42/298	Crown Ditch,, Enl.	02/01/1919		0.28	Clear Creek (drainage of)		J. FRANK	COFFEY	IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
CR CC43/553	Crown Ditch,, Enl.	12/05/1919		1.97	Clear Creek (drainage of)		J. FRANK	COFFEY	DOM_SW; IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
CR CC43/554	Crown Ditch,, Enl.	09/23/1920		1.54	Clear Creek (drainage of)		EVA E.	WORKS	IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
CR CC59/026	Crown Ditch,, Enl.	04/24/1935		0.00	Clear Creek (drainage of)		ANNA	MADSEN	DOM_SW; IRR_SW; STO	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
CR CC59/027	Crown Ditch,, Enl.	04/24/1935		0.00	Clear Creek (drainage of)			NORTHER WYOMING LAND COMPANY	DOM_SW; IRR_SW; STO	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
CR CC77/073	Crown Ditch,, Enl.	08/24/1904			Clear Creek (drainage of)		CITY OF	BUFFALO	IRR_SW	050N	082W	05	SE1/4SE1/4			-106.742950	44.326460
P5292.0E	Crown Ditch,, Enlargement of the	04/24/1935	Fully Adjudicated	0.91	Clear Creek (drainage of)		Karl	Madsen	DOM_SW; IRR_SW; STO	050N	082W	05	SE1/4SE1/4		21.25		
P2404.0E	Crown Ditch,, McBride Enlargement of	01/27/1911	Fully Adjudicated	1.58	Clear Creek (drainage of)		Wilson	McBride	IRR_SW	050N	082W	05	SE1/4SE1/4		-1		

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P1269.0E	Crown Ditch,, McNiese Extension	08/24/1904	Fully Adjudicated	0	Clear Creek (drainage of)		Samuel J.	McNeese	IRR_SW	050N	082W	05	SE1/4SE1/4		-1		
P1347.0E	Crown Ditch,, West Extension	01/23/1905	Fully Adjudicated	2.24	Clear Creek (drainage of)		Willard	West	DOM_SW; IRR_SW; STO	050N	082W	05	SE1/4SE1/4		-1		
P4221.0E	Crown Ditch,, Works Enl. of the	09/23/1920	Fully Adjudicated	1.54	Clear Creek (drainage of)		Eva E.	Works	IRR_SW	050N	082W	05	SE1/4SE1/4		-1		
P11417.0D	Cultra Ditch No. 1	07/22/1912	Fully Adjudicated		Lake Draw		THOMAS W.	CULTRA	IRR_SW	055N	077W	07	SW1/4NW1/4			-106.181185	44.758742
P11418.0D	Cultra Ditch No. 2	07/22/1912	Fully Adjudicated	0.41	Cultra Draw		THOMAS W.	CULTRA	IRR_SW	055N	078W	12	SE1/4NE1/4			-106.186260	44.757691
CR CC37/399	Cultra Reservoir	07/22/1912		24.00	Lake Draw		THOMAS W.	CULTRA	IRR_SW	055N	077W	07	SW1/4NW1/4			-106.182460	44.758540
P2391.0E	CUMMINGS ENLARGEMENT OF JOHNSON DITCH	01/25/1911	Fully Adjudicated	2.91	Clear Creek		DAVID	CUMMINGS	IRR_SW	050N	082W	05	NW1/4SW1/4			-106.758089	44.330061
P3896.0E	CUMMNGS THIRD ENLARGEMENT OF JOHNSON DITCH	04/22/1918	Fully Adjudicated	1.58	Clear Creek		DAVID	CUMMINGS	IRR_SW	050N	082W	05	NW1/4SW1/4		17.030	-106.758089	44.330061
P9457.0D	D. M. POOL DITCH NO. 1	11/26/1909	Fully Adjudicated	0.80	Bob's Draw		D.M.	POOL	IRR_SW	056N	078W	21	NW1/4NW1/4			-106.263372	44.819050
P9458.0D	D. M. POOL DITCH NO. 2	11/26/1909	Fully Adjudicated		Dan's Gulch		D.M.	POOL	IRR_SW	056N	078W	21	NE1/4NW1/4			-106.259408	44.818975
OR 02/194	Dalton Ditch	04/30/1884		1.07	Spring Creek	James H. Hopkins			IRR_SW	053N	084W	12	SE1/4SE1/4			-106.914950	44.574250
CR CB02/045	Davis & Spencer Ditch	12/29/1896		4.28	Clear Creek	James L. Davis			IRR_SW	055N	078W	All					
CR CC52/144	Davis & Spencer Ditch	12/29/1896			Clear Creek		WALTER H.	WARFIELD	IRR_SW	055N	078W	All					
CR CC52/146	Davis & Spencer Ditch	12/29/1896			Clear Creek		WALTER H.	WARFIELD	IRR_SW	054N	079W	10	NW1/4SW1/4			-106.365390	44.664450
P1406.0D	Davis & Spencer Ditch	12/29/1896	Fully Adjudicated	5.93	Clear Creek		E.C.	SPENCER	DOM_SW; IRR_SW	055N	078W	15	NE1/4SW1/4			-106.238326	44.738947
P20177.0D	Davis Ditch	03/30/1948	Fully Adjudicated	0.07	Davis Draw		Watler	Davis	DOM_SW; IRR_SW; STO	053N	084W	13	SE1/4NW1/4		0.130	-106.926114	44.566982
CR CC64/279	Davis No. 2 Ditch	09/19/1955		0.06	Davis Draw			R. R. CROW COMPANY	IRR_SW	053N	084W	13	NE1/4SW1/4			-106.924970	44.563350
P21652.0D	Davis No. 2 Ditch	09/19/1955	Fully Adjudicated	0.06	Davis Draw		Walter	Davis	IRR_SW	053N	084W	13	NE1/4SW1/4		0.130	-106.924966	44.563350
P34410.0D	DAWSON PUMP	09/16/2010	Complete	0.06	Clear Creek		JAMES	DAWSON	DOM_SW	050N	082W	05	NE1/4NW1/4		0.056	-106.754767	44.335575
P12150.0D	Day Ditch	10/04/1913	Fully Adjudicated	0.51	Shell Creek		S.J.	GRINNELL	IRR_SW	052N	083W	01	SW1/4SE1/4			-106.789462	44.500137
P1070.0E	Day Ditch {Enl. of}	04/25/1903	Fully Adjudicated	0.00	Shell Creek		Arthur H	Senff	IRR_SW	052N	083W	01	SW1/4SE1/4		-1.000	-106.789405	44.500116
CR CC22/063	Day Ditch,, Enl.	04/25/1903		2.14	Shell Creek		ARTHUR H.	SENFF	IRR_SW	052N	083W	01	SW1/4SE1/4			-106.787300	44.501320
OR 02/189	Dee Ditch	06/15/1883		0.21	Rock Creek	Robert Foote			IRR_SW	051N	082W	23	SE1/4NE1/4			-106.681960	44.377660
P5440.0E	Deeben-Heinze Ditch, 7th Enlargement of	04/02/1947	Fully Adjudicated				James B.	Hulse	DOM_SW; IRR_SW; STO	053N	083W	08	SW1/4SE1/4		41.16		
CR CC82/340	Degel Pipeline	03/13/1995		0.07	Spring Creek	Michael A. and Paul A. Degel			RES	053N	083W	07				-106.902250	44.580050
P31392.0D	Degel Pipeline	03/13/1995	Fully Adjudicated	1.31	Spring Creek				FIS; FTH; RES	053N	083W	07	NW1/4SW1/4		1.310	-106.899696	44.581977
P9689.0D	Democrat Ditch	04/02/1910			Thompson Fork		Donald	Thompson	IRR_SW	053N	079W	03	SE1/4NE1/4			-106.342009	44.599180
OR 02/182	DES MOINES DITCH 1ST APP.	09/15/1884		2.86	Clear Creek (drainage of)		ROGER E. AND MARGUERITTE	TODD	IRR_SW	052N	081W	26	NW1/4SW1/4			-106.575880	44.446830

Clear Creek Watershed Direct Flow Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	TOTAL FLOW	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	TOTAL CAPACITY (AF/Yr)	DIVERSION CAPACITY AT HEAD GATE	LONGITUDE	LATITUDE
OR 15/434	Des Moines Ditch 2 app.	06/01/1885			Clear Creek (drainage of)		DAVID J.	WATT	IRR_SW	052N	081W	26	NW1/4SW1/4			-106.575880	44.446830
CR CC69/246	Des Moines Ditch,, Enl.	10/05/1960		0.16	Clear Creek (drainage of)		DAVID J.	WATT	IRR_SW	052N	081W	26	NW1/4SW1/4			-106.575880	44.446830
CR CC74/175	Des Moines Ditch,, Enl.	05/01/1970		28.80	Clear Creek (drainage of)			UCROSS LAND COMPANY	RES	052N	081W	26	NW1/4SW1/4			-106.575880	44.446830
CR CC74/176	Des Moines Ditch,, Enl.	04/27/1971		2.23	Clear Creek (drainage of)			UCROSS LAND COMPANY	RES	052N	081W	26	NW1/4SW1/4			-106.575880	44.446830
P6270.0E	Des Moines Ditch,, Enlargement	10/05/1960	Fully Adjudicated	0.16	Clear Creek (drainage of)		David J.	Watt	IRR_SW	052N	081W	26	NW1/4SW1/4		28.800	-106.576111	44.447778
P6403.0E	Des Moines Ditch,, Stevens 2nd Enlargement of the	04/27/1971	Fully Adjudicated	0	Clear Creek (drainage of)		Fred I. & Linda S	Dowd	RES	052N	081W	23	NW1/4SE1/4		28.8		
P6350.0E	Des Moines Ditch,, Stevens Enlargement of	05/01/1970	Fully Adjudicated	0.00	Clear Creek (drainage of)		Fred I. & Linda S	Dowd	RES	052N	081W	26	NW1/4SW1/4		28.800	-106.576111	44.447778
P1174.0E	Des Moines Land & Cattle Co. Ditch,, Walter Bros. Ditch {Enl. of} (ENL DES MOINES)	01/19/1904	Fully Adjudicated	2.92	Clear Creek (drainage of)		F.J.	Walters	IRR_SW	052N	081W	26	NW1/4SW1/4		-1		
P12559.0D	Diener No. 1	07/23/1914	Fully Adjudicated	2.28	J. A. Creek		W.E.	Diener	IRR_SW	053N	083W	32	SE1/4NE1/4			-106.873557	44.522635
P1101.0D	Dowling Ditch	12/06/1895		2.26	North Piney Creek		P.S.	Dowling	IRR_SW	053N	084W	12	SE1/4NW1/4			-106.926613	44.580168
OR 02/194	Doyle Ditch	06/20/1889		0.50	South Piney Creek	Alfred T. Bacon			IRR_SW	053N	083W	17	NW1/4NE1/4			-106.879510	44.570750
OR 02/186	Dundee Ditch	06/15/1883		1.00	French Creek	Robert Foote			IRR_SW	051N	082W	21	SE1/4SE1/4			-106.722410	44.370390
OR 02/194	Dunlap Ditch	06/30/1882		2.14	Piney Creek	John H. Dunlap			IRR_SW	053N	081W	10	NW1/4SW1/4			-106.607160	44.576980
OR 19/342	Dunlap Ditch	06/30/1882			Piney Creek		RAYMOND N.	PLANK	IRR_SW	053N	081W	10	NW1/4SW1/4				
OR 19/342	Dunlap Ditch	06/30/1882		6.71	Piney Creek	Cullen Watt			IRR_SW	053N	081W	10	NW1/4SW1/4				
OR 19/342	Dunlap Ditch 2" App.	12/31/1893			Piney Creek		RAYMOND N.	PLANK	IRR_SW	053N	081W	10	NW1/4SW1/4				
OR 19/342	Dunlap Ditch 2" App.	12/31/1893		1.86	Piney Creek	Cullen Watt			IRR_SW	053N	081W	10	NW1/4SW1/4				
CR CC74/177	Dunlap Ditch,, Enl.	07/31/1970		1.11	Piney Creek			UCROSS LAND COMPANY	IRR_SW	053N	081W	10	NW1/4SW1/4			-106.607160	44.576980
P6373.0E	Dunlap Ditch,, Enlargement of	07/31/1970	Fully Adjudicated		Piney Creek				IRR_SW	053N	081W	14	NW1/4SE1/4		110		
P33918.0D	Durrant Pump Diversion	04/28/2008	Unadjudicated		Rock Creek		Sean & Lynette	Durrant	DOM_SW	051N	082W	08	SE1/4NE1/4		0.056	-106.742250	44.406680
CR CC65/443	E L Ditch	09/26/1960		0.28	Lawrence Draw		CHARLES K.	LAWRENCE	IRR_SW	052N	081W	27	SE1/4SW1/4			-106.590280	44.443610
P22068.0D	E L Ditch	09/26/1960	Fully Adjudicated	0.30	Lawrence Draw			Clear Creek Ranch	IRR_SW	052N	081W	27	SE1/4SW1/4		87.400	-106.590278	44.443611
CR CC36/270	Eagle Rock and Moeller No. 3 Ditch	03/03/1913		0.00	French Creek		E. W.	SCOTT	IRR_SW	051N	083W	33	NW1/4NW1/4			-106.858600	44.351800
P11758.0D	Eagle Rock and Moeller No. 3 Ditch	03/03/1913	Fully Adjudicated	0.00	French Creek		E.W.	SCOTT	IRR_SW	051N	083W	33	NW1/4NW1/4		-1.000	-106.858270	44.352079
P11322.0D	Eagle Rock Ditch	06/25/1912	Fully Adjudicated	0.00	Johnson Creek		GEORGE	FAY	IRR_SW	051N	083W	28	SW1/4NW1/4			-106.860096	44.364701
P8662.0D	Eagle Rock Ditch	07/13/1908	Fully Adjudicated	4.23	French Creek		WILLIAM J.	SMITH	DOM_SW; IRR_SW; STO	051N	083W	28	NW1/4SE1/4			-106.860028	44.352194
P4782.0E	Eagle Rock Ditch,, Rothwell Enlargement	08/24/1931	Unadjudicated		French Creek		Paul A.	Rothwell	DOM_SW; IRR_SW; STO	051N	083W	33	NW1/4NW1/4		25.270	-106.860028	44.352194
P4734.0E	Eagle Rock Ditch,, Silva Enlargement	02/02/1931	Fully Adjudicated		French Creek		Antonio	Silva	IRR_SW	051N	083W	28	SW1/4SE1/4		25.27		
OR 02/191	Elbert Ditch	03/28/1884		0.23	Sayles Creek	Lorena McDonald			IRR_SW	051N	083W	05	SE1/4SE1/4			-106.863350	44.414420

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OR 02/191	Elizabeth Ditch	04/20/1885		0.57	North Fork Sayles Creek	Lorena McDonald			IRR_SW	051N	083W	05	SW1/4SE1/4			-106.868310	44.414520
P34235.0D	EMERSON DOMESTIC PUMP	08/10/2009	Complete	0.06	Spring Creek		RUTH	EMERSON	DOM_SW	053N	083W	07	NW1/4SW1/4		0.056	-106.911333	44.577667
P6174.0E	Enl of Little Red Ditch as changed to Little Red Pump and Pipeline	12/22/1965	Unadjudicated		Clear Creek (drainage of)		John L.	Lusher	IRR_SW; RES	053N	080W	17	SE1/4NE1/4		8.53		
P3199.0E	ENL OF WHEDON DITCH NO. 1 ENLARGEMENT OF Whedon Ditch No. 1	07/22/1915	Incomplete		North Whedon Gulch		EARL	WHEDON	IRR_SW	056N	078W	07	SW1/4NE1/4			-106.292856	44.844831
P18557.0D	Ernst Ditch	03/07/1935	Fully Adjudicated	0.03	North Piney Creek		SARAH A.	ERNST	DOM_SW; IRR_SW; STO	053N	084W	12	NE1/4SE1/4		0.250	-106.914974	44.578804
CR CC73/120	Feeger Pipeline	10/22/1970		0.06	Feeger Draw		BETTY A.	KUZARA	STO	051N	082W	22	NW1/4SE1/4			-106.707080	44.374030
P23585.0D	Feeger Pipeline	10/22/1970	Fully Adjudicated	0.06	Feeger Draw		JOHN A.	FEEGER	STO	051N	082W	22	NW1/4SE1/4		0.097	-106.709289	44.372506
CR CC82/328	Felton Ditch,, Enl.				Rock Creek	HF Bar Ranch			IRR_SW	052N	083W	29	NW1/4NW1/4			-106.878100	44.454780
OR 02/189	Fenton Ditch	05/27/1887		0.17	Rock Creek	Wm. H. Fenn			IRR_SW	052N	083W	29	NW1/4NW1/4			-106.878100	44.454780
P1900.0E	Fenton Ditch {Enl. of}	06/01/1908	Fully Adjudicated	1.71	Rock Creek		J.G.	Oliver	IRR_SW	052N	083W	29	NW1/4NW1/4		-1		
P6061.0E	Fenton Ditch {Enl. of}	04/05/1960	Fully Adjudicated	0	Rock Creek		Charles H.	Evitt	RES	052N	083W	29	NW1/4NW1/4		16.26		
CR CC29/331	Fenton Ditch,, Enl.	06/01/1908		0.41	Rock Creek		S. L.	TATHWELL	IRR_SW	052N	083W	29	NW1/4NW1/4			-106.878100	44.454780
CR CC37/390	Fenton Ditch,, Enl.	06/01/1908		1.30	Rock Creek		C. C.	TARBOX	IRR_SW	052N	084W	25	SW1/4SE1/4			-106.908000	44.444240
CR CC66/163	Fenton Ditch,, Enl.	04/05/1960		0.00	Rock Creek		CHAS. H.	EVITT	RES	052N	083W	29	NW1/4NW1/4			-106.878100	44.454780
P24247.0D	Ferriter Sprinkler Pipeline	12/06/1973	Unadjudicated	0.02	North Piney Creek		WALTER L. & MARY E.	FERRITER	DOM_SW	053N	083W	07	NW1/4SE1/4		0.018		
CR CC36/012	Fields Ditch No. 2	08/01/1910		0.26	Middle Fork Arkansas Creek		BYRTIE	FIELDS	IRR_SW	055N	080W	30	SW1/4SW1/4				
P6659.0D	Firnekas Ditch No. 1	04/03/1905	Fully Adjudicated	0.47	Johnson Creek		FRED	FIRNEKAS	DOM_SW; IRR_SW; STO	051N	083W	28	SW1/4NW1/4			-106.861468	44.364869
P6660.0D	Firnekas Ditch No. 2	04/03/1905	Fully Adjudicated	0.31	Johnson Creek		FRED	FIRNEKAS	DOM_SW; IRR_SW; STO	051N	083W	28	NW1/4NE1/4			-106.848051	44.369117
CR CC37/393	Firnekas Ditch No. 3	09/18/1909		2.26	Johnson Creek		FRED	FIRNEKAS	IRR_SW	051N	083W	29	NE1/4NW1/4			-106.873140	44.366770
P9347.0D	Firnekas Ditch No. 3	09/18/1909	Fully Adjudicated	2.26	Johnson Creek		FRED	FIRNEKAS	IRR_SW	051N	083W	29	NE1/4NW1/4			-106.872500	44.366800
CR CC38/629	Flag Ditch	01/08/1916		0.61	Clear Creek		R. C.	MUNKERS	IRR_SW	050N	082W	06	SE1/4NE1/4			-106.763040	44.333670
P13935.0D	Flag Ditch	01/08/1916	Fully Adjudicated	0.60	Clear Creek		R.C.	MUNKERS	IRR_SW	050N	082W	06	SE1/4NE1/4		3.000	-106.765191	44.332516
P4357.0E	Flag Ditch,, I.O.O.F Enlargement	03/07/1923	Fully Adjudicated	5.5	Clear Creek (drainage of)				IRR_SW	050N	082W	06	NE1/4NW1/4		3		
P7028.0D	Flood Ditch	01/12/1906	Fully Adjudicated	0.28	Pasture Creek		David H.	Watt	IRR_SW; STO	056N	077W	02	SW1/4NW1/4			-106.101379	44.860349
P22210.0D	Fort Collins Ditch (As Changed to Cook Ditch)	03/20/1961	Fully Adjudicated	0	Kelley Creek			Folded Hills Ranch	IRR_SW	049N	082W	08	NE1/4SE1/4		28.8		
P6367.0E	Fort Collins Ditch (as changed to Cook Ditch) {Enl. of}	10/29/1970	Fully Adjudicated	0				Folded Hills Ranch	RES	049N	082W	19	SW1/4SW1/4		62.9		
P6368.0E	Fort Collins Ditch (as changed to Cook Ditch) {Enl. of}	10/29/1970	Fully Adjudicated	0				Folded Hills Ranch	RES	049N	082W	08	SE1/4SW1/4		62.9		
OR 04/292	Fort McKinney Ditch	12/20/1878		1.67	Clear Creek		WYO BOARD OF	CHARITIES REFORM	IRR_SW	050N	082W	05	NW1/4NW1/4				
OR 15/257	Fort McKinney Ditch	12/20/1878			Clear Creek			HERSCHLER BUILDING	IRR_SW	050N	082W	04	NW1/4SW1/4				
P5098.0E	Fort McKinney Ditch,, Cra Lu Ditch (Enlargement of the Ft. McKinney Ditch)	02/05/1938	Fully Adjudicated		Clear Creek (drainage of)		F.E.	Lucas	IRR_SW; STO	050N	082W	05	NE1/4NE1/4		5.900	-106.756111	44.336389

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P5099.0E	Fort McKinney Ditch,, Enlargement of	01/12/1938	Fully Adjudicated		Clear Creek (drainage of)			Wyo. Soldiers' & Sailors'Home	IRR_SW; STO	050N	082W	05	NE1/4NW1/4		4.41		
P12168.0D	Foster Ditch	12/01/1913	Fully Adjudicated	0.28	Johns Draw		John T.	Foster	IRR_SW	056N	079W	34	SW1/4NE1/4				
OR 02/182	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884		5.26	North Fork Clear Creek	Peter and Anna Gorgen			IRR_SW	050N	084W	05	SE1/4NW1/4				
OR 02/182	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884		0.86	North Fork Clear Creek	Chas. H. Burritt			IRR_SW	050N	084W	05	SE1/4NW1/4				
OR 02/182	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884		14.28	North Fork Clear Creek	Richard S. Hopkins			IRR_SW	050N	084W	05	SE1/4NW1/4				
OR 02/182	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884		2.86	North Fork Clear Creek	Geo. F. Meyers			IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
OR 02/182	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884		1.73	North Fork Clear Creek	Joseph Speckbacher			IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
OR 02/182	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884		0.43	North Fork Clear Creek	Genafeva Fisher			IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
OR 02/182	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884		1.14	North Fork Clear Creek	Annie Holloway			IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
OR 02/182	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884		1.73	North Fork Clear Creek	Jas. A. Brown			IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
OR 02/186	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884		0.86	North Fork Clear Creek		CHARLES H.	BURRITT	IRR_SW	050N	084W	05	SE1/4NW1/4				
OR 02/186	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884		14.28	North Fork Clear Creek		RICHARD S.	HOPKINS	IRR_SW	050N	084W	05	SE1/4NW1/4				
OR 07/369	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884			North Fork Clear Creek		ANTONIO	SILVA	IRR_SW	050N	084W	05	SE1/4NW1/4				
OR 12/328	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884			North Fork Clear Creek		WILLARD	HAMPTON	IRR_SW	050N	084W	05	SE1/4NW1/4				
T2109.0-	Four Lakes & French Cr. D & F Co. Ditch	06/01/1884			North Fork Clear Creek		MARIE	CAMINO		050N	084W	05	SE1/4NW1/4				
OR 02/182	Four Lakes & French Cr. Ditch	06/01/1886		1.86	North Fork Clear Creek	Merlin J. Whaley			IRR_SW	050N	084W	05	SE1/4NW1/4				
OR 07/364	Four Lakes & French Cr. Ditch	06/01/1886			North Fork Clear Creek		MARIE	CAMINO	IRR_SW	050N	084W	05	SE1/4NW1/4				
CR CC32/113	FOUR LAKES & FRENCH CR. DITCH & FLUME CO. & N. FORK & FRENCH CR. DITCH	06/01/1884	Fully Adjudicated	14.99	North Fork Clear Creek		J. NORMAN	PENROSE	IRR_SW	050N	084W	05	SW1/4NW1/4			-106.998836	44.337575
OR 02/230	Four Lakes & French Cr. Ditch & Flume Co. & N. Fork & French Cr. Ditch	06/01/1884		15	Clear Creek	J. Norman Penrose			IRR_SW	050N	084W	05	SE1/4NW1/4				
OR 40/155	FOUR LAKES & FRENCH CR. DITCH & FLUME CO. & N. FORK & FRENCH CR. DITCH	06/01/1884		-0.01	Clear Creek		J. NORMAN	PENROSE	IRR_SW	050N	084W	05	SE1/4NW1/4				
OR 40/155	Four Lakes & French Cr. Ditch & Flume Co. & N. Fork & French Cr. Ditch	06/01/1884		-0.01	Clear Creek		J. NORMAN	PENROSE	IRR_SW	050N	084W	05	SE1/4NW1/4				
OR 03/151	Four Lakes & French Creek Ditch Company and Mayhew and Gorgen Ditch	06/01/1884		2.11			JOHN H.	SAGE	IRR_SW; STO	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
OR 07/455	Four Lakes & French Creek Ditch Company and Mayhew Ditch	06/01/1884		1.50			JOHN H.	SAGE	DOM_SW; IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
CR CC22/075	Four Lakes & French Creek Ditch,, Enl.	04/07/1905		0.75	North Fork Clear Creek		LEWIS A.	WHALEY	IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
CR CC22/077	Four Lakes & French Creek Ditch,, Enl.	07/17/1905		0.75	North Fork Clear Creek		CHARLES	FOSTER	IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
P1404.0E	Four Lakes & French Creek Ditch,, Foster Ditch {Enl. of}	07/17/1905	Fully Adjudicated	0.75	North Fork Clear Creek		Charles	Foster	IRR_SW	051N	082W	18	SE1/4NE1/4		-1		
P1369.0E	Four Lakes & French Creek Ditch,, Lewis Whaley Enlargement & Ext.	04/07/1905	Fully Adjudicated	0.75	North Fork Clear Creek		Lewis A.	Whaley	IRR_SW	051N	082W	18	NW1/4SW1/4		-1		
P2492.0E	Four Lakes and French Creek Ditch {Enl. of}	08/30/1911	Fully Adjudicated	0.00	North Fork Clear Creek		Charles N.	Robbins	IRR_SW	051N	084W	05	SE1/4NW1/4		-1.000	-106.998889	44.337778
P307.0E	Four Lakes and French Creek Ditch {Enl. of}	01/28/1898	Fully Adjudicated	2.43	North Fork Clear Creek		Merlin J.	Whaley	DOM_SW; IRR_SW	050N	084W	05	SE1/4NW1/4		-1.000	-106.998889	44.337778
P5285.0E	Four Lakes and French Creek Ditch and Flume Company Ditch,, Hampton Enl. of	04/24/1935		0.03	North Fork Clear Creek		Willard	Hampton	IRR_SW	050N	084W	05	SE1/4NW1/4		176.500	-106.998889	44.337778
CR CC14/062	Four Lakes and French Creek Ditch,, Enl.	01/28/1898		1.92	North Fork Clear Creek		MERLIN J.	WHALEY	IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
CR CC34/193	Four Lakes and French Creek Ditch,, Enl.	08/30/1911		0.00	North Fork Clear Creek		C. N.	ROBBINS	IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
CR CC47/612	Four Lakes and French Creek Ditch,, Enl.	01/28/1931		0.00	North Fork Clear Creek		WILBUR F.	WILLIAMS	IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820
CR CC47/613	Four Lakes and French Creek Ditch,, Enl.	01/28/1931		0.00	North Fork Clear Creek		FRANK E.	LAWRENCE	IRR_SW	050N	084W	05	SE1/4NW1/4			-106.995560	44.337820

Clear Creek Watershed Direct Flow Water Rights

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P4731.0E	Four Lakes and French Creek Ditch,, Enl.	01/28/1931	Fully Adjudicated	0.00	North Fork Clear Creek		Wilbur F.	Williams	IRR_SW	051N	083W	27	SW1/4SW1/4		70.400	-106.998889	44.337778
P5308.0E	Four Lakes and French Creek Ditch,, Silva Enl.	01/10/1941		0.00	North Fork Clear Creek		Antonio	Silva	DOM_SW; IRR_SW; STO	050N	084W	05	SE1/4NW1/4		176.500	-106.998889	44.337778
CR CC69/248	Fowler Sprinkler Irrigation Facility No. 4 Pipeline	07/08/1964		0.00	Piney Creek		JOHN H.	FOWLER	IRR_SW	053N	080W	18	NW1/4SE1/4			-106.537340	44.562240
P22999.0D	Fowler Sprinkler Irrigation Facility No. 4 Pipeline	07/08/1964	Fully Adjudicated	0.00	Piney Creek		JOHN H.	FOWLER	IRR_SW	053N	080W	18	NW1/4SE1/4		1.000	-106.538910	44.561252
CR CC69/247	Fowler Sprinkler Irrigation Facility Pipeline	04/17/1964		0.00	Piney Creek		JOHN H.	FOWLER	IRR_SW	053N	080W	18	NE1/4SW1/4			-106.542280	44.562320
P22998.0D	Fowler Sprinkler Irrigation Facility Pipeline	04/17/1964	Fully Adjudicated	0.00	Piney Creek		JOHN H.	FOWLER	IRR_SW	053N	080W	18	NE1/4SW1/4		1.000	-106.542142	44.562082
CR CC38/639	FOX DITCH	06/09/1913	Fully Adjudicated	1.12	Rock Creek		MARTIN	SAFRIET	IRR_SW	052N	083W	34	SW1/4NW1/4			-106.837303	44.438064
P11877.0D	Fox Ditch	06/09/1913	Fully Adjudicated	1.17	Rock Creek		James G.	Childs	IRR_SW	052N	083W	34	SW1/4NW1/4			-106.836389	44.438056
CR CC62/022	Francis No. 1 Ditch	06/29/1949		0.48	Williams Draw		FRANCIS ANNA L.	WOOD	IRR_SW; STO	053N	082W	01	SW1/4NE1/4			-106.677690	44.595320
P20270.0D	Francis No. 1 Ditch	06/29/1949	Fully Adjudicated	0.49	Williams Draw		Francis Anna L.	Wood	IRR_SW; STO	053N	082W	01	SW1/4NE1/4		1.730	-106.677572	44.595062
CR CC62/023	Francis No. 2 Ditch	06/29/1949		0.48	Williams Draw		FRANCIS ANNA L.	WOOD	IRR_SW; STO	053N	082W	01	SW1/4NE1/4			-106.677690	44.595320
P20271.0D	Francis No. 2 Ditch	06/29/1949	Fully Adjudicated	0.47	Williams Draw		Francis Anna L.	Wood	IRR_SW; STO	053N	082W	01	SW1/4NE1/4		1.730	-106.677534	44.595058
P12686.0D	Frank Ditch	09/05/1914	Fully Adjudicated	1.28	Carter Creek		Frank	Dobnik	IRR_SW	054N	081W	06	SE1/4NE1/4				
CR CC22/066	Frank G. Hopkins	11/27/1893		2.39	Clear Creek		JOHN L.	PATE	IRR_SW	051N	081W	04	SE1/4SE1/4			-106.601070	44.413760
P617.0D	Frank G. Hopkins	11/27/1893	Fully Adjudicated	3.43	Clear Creek		FRANK G.	HOPKINS	IRR_SW	051N	081W	04	SW1/4SW1/4		-1.000	-106.617253	44.413253
CR CC44/266	Frank G. Hopkins Ditch,, Enl.	02/01/1918		2.08			C. S.	FIELDGROVE	IRR_SW	051N	081W	04	SE1/4SE1/4			-106.601070	44.413760
CR CC45/298	Frank G. Hopkins Ditch,, Enlargement	05/21/1925		1.64			CHARLES G.	LAWRENCE	IRR_SW	051N	081W	04	SE1/4SE1/4			-106.601070	44.413760
P4463.0E	Frank G. Hopkins Ditch,, Enlargement	05/21/1925	Fully Adjudicated	11.18			Charles C.	Lawrence	IRR_SW	051N	081W	04	SE1/4SE1/4		11.180	-106.601070	44.413760
P3854.0E	Frank G. Hopkins Ditch,, Fieldgrove Extension to	02/01/1918	Fully Adjudicated	6.5			C.S.	Fieldgrove	IRR_SW	051N	081W	04	SE1/4SE1/4		3		
CR CC36/258	Frisbie Ditch	01/06/1912		1.31	Indian Creek		VERNE W.	FRISBIE	IRR_SW	056N	079W	14	NE1/4SW1/4			-106.342380	44.822150
P11472.0D	Frisbie Ditch	01/06/1912	Fully Adjudicated	1.31	Indian Creek		VERNE W.	FRISBIE	IRR_SW	056N	079W	14	NE1/4SW1/4		-1.000	-106.338294	44.823889
P33810.0D	Furman #3 Pump Ditch	06/08/2007	Fully Adjudicated		North Piney Creek		Robert	Furman	DOM_SW	053N	083W	08	NE1/4SW1/4		0.056	-106.884520	44.578180
CR CC86/178	Furman No. 3 Pump	06/08/2007		0.06	North Piney Creek	Robert and Annette Furman Living Trust			DOM_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC47/606	Garrett Hoaglan Ditch	11/19/1932		0.31	Spring Creek		H. O.	STAPLES	IRR_SW; STO	053N	084W	12	SW1/4SE1/4			-106.919980	44.574250
P18177.0D	Garrett Hoaglan Ditch	11/19/1932	Fully Adjudicated	0.31	Spring Creek		H.G.	STAPLES	IRR_SW; STO	053N	084W	12	SE1/4SW1/4		0.800	-106.925015	44.574248
CR CC87/037	GAT No. 1 Pipeline	08/30/2007		0.06	Gat No. 1 Spring	Jerry J. Gatlin			STO	053N	084W	13	NW1/4NW1/4			-106.930050	44.570520
P33817.0D	GAT NO. 1 PIPELINE	08/30/2007	Fully Adjudicated	0.06	Gat No. 1 Spring				STO	053N	084W	13	NW1/4NW1/4		0.056	-106.930050	44.570519
CR CC87/038	GAT No. 2 Pipeline	08/30/2007		0.06	Gat No. 2 Spring	Jerry J. Gatlin			STO	053N	084W	13	NW1/4NW1/4			-106.930050	44.570520
P33818.0D	GAT NO. 2 PIPELINE	08/30/2007	Fully Adjudicated	0.06	Gat No. 2 Spring				STO	053N	084W	13	NW1/4NW1/4		0.056	-106.931667	44.568778
CR CC77/320	Gates Pipeline	12/01/1988		0.02	Gates Drain		L. D.	KENNINGTON	IRR_SW	053N	084W	12	SE1/4SE1/4			-106.914950	44.574250
P30144.0D	Gates Pipeline	12/01/1988	Fully Adjudicated	0.02	Gates Drain				IRR_SW	053N	084W	12	SE1/4SE1/4		0.021	-106.914952	44.574251
P19826.0D	Geier Pipe Line	10/20/1943	Unadjudicated	0.02	SPRING		GEOR. E.	GEIER ESTATE	DOM_SW; STO	053N	083W	27	SW1/4SW1/4		0.016	-106.849253	44.531091

Clear Creek Watershed Direct Flow Water Rights

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P6512.0D	George Ditch	02/17/1905	Fully Adjudicated	1.40	Spring Creek		George	Yarwood	IRR_SW	051N	083W	01	NW1/4SW1/4			-106.797633	44.419437
CR CC35/498	George Ditch,, Enl.	12/05/1908		3.78	Rock Creek		FRANK A.	YARWOOD	IRR_SW	052N	083W	28	SE1/4SW1/4			-106.853050	44.443670
P2034.0E	George Ditch,, Yarwood Ditch Extension	12/05/1908	Fully Adjudicated		Rock Creek		Frank A.	Yardwood	IRR_SW	051N	083W	01	SE1/4SW1/4				
CR CC62/025	Gettys Pipe Line	01/04/1949		0.02	South Piney Creek		JOHN	AESCHBACH	DOM_SW; IRR_SW	053N	083W	17	NW1/4NW1/4			-106.889630	44.570520
P20254.0D	Gettys Pipe Line	01/04/1949	Fully Adjudicated	0.01	South Piney Creek		CLAUDE L.	GETTYS	DOM_SW; IRR_SW	053N	083W	17	NW1/4NW1/4		0.056	-106.889584	44.570953
P14811.0D	Gooseberry Ditch	08/07/1917	Fully Adjudicated	1.92	French Creek		THOMAS P. JR.	HILL	IRR_SW	051N	083W	27	SW1/4SW1/4		10.660	-106.837167	44.356611
CR CC74/241	Gooseberry Ditch,, Enl.	06/12/1973		0.11			MARY ANN	SMITH	IRR_SW	051N	083W	27	SW1/4SW1/4			-106.838430	44.355410
P6485.0E	Gooseberry Ditch,, Smith Enlargement of the	06/12/1973	Fully Adjudicated	0.11			Mary Ann	Smith	IRR_SW	051N	083W	27	SW1/4SW1/4		10.66		
P4708.0E	Gooseberry Ditch,, Williams Enlargement of	01/03/1931	Fully Adjudicated		French Creek		Wilbur F.	Williams	IRR_SW	051N	083W	26	SW1/4SW1/4		10.66		
OR 02/186	Gorgen Ditch	10/31/1883		0.28	French Creek	Peter Gorgen			IRR_SW	051N	082W	30	NW1/4NW1/4			-106.777560	44.366550
P12405.0D	Gough Ditch	05/08/1914		0.00	FLOOD WATER		W. M.	GOUGH	DOM_SW; IRR_SW; STO	052N	083W	24	NW1/4NW1/4		-1.000	-106.797555	44.468558
P9687.0D	GRAVES DITCH	04/01/1910	Fully Adjudicated		South Fork North Buffalo Creek	CHARLES A. GRAVES ESTATE			IRR_SW	057N	078W	35	SW1/4SW1/4			-106.234372	44.868608
CR CC71/080	Gray #2 Pipe Line	05/18/1961		0.08	Trailside Spring		FRED K.	GRAY	DOM_SW	050N	083W	04	SW1/4SW1/4			-106.858580	44.326360
P23201.0D	Gray #2 Pipe Line	05/18/1961	Fully Adjudicated	0.08	Trailside Spring		FRED K.	GRAY	DOM_SW	050N	083W	04	SW1/4SW1/4		0.082	-106.858578	44.326353
CR CC71/079	Gray No. 1 Pipeline	09/17/1969		0.03	Moser Gulch		FRED K.	GRAY	COM; DOM_SW	050N	083W	04	SW1/4SW1/4			-106.858580	44.326360
P23205.0D	Gray No. 1 Pipeline	09/17/1969	Fully Adjudicated	0.03	Moser Gulch		FRED K.	GRAY	COM; DOM_SW	050N	083W	04	SW1/4SW1/4		0.029	-106.858220	44.326218
P11145.0D	Griffith Ditch No. 1	02/13/1912	Fully Adjudicated	0.97	Spring Draw		ROWENA & VERNON	GRIFFITH	IRR_SW	056N	079W	17	NW1/4SW1/4			-106.407254	44.823813
P11146.0D	Griffith Ditch No. 2	02/13/1912	Fully Adjudicated	0.16	SHEEP		ROWENA	GRIFFITH	IRR_SW	056N	079W	21	SW1/4SW1/4			-106.384903	44.804438
P17662.0D	Grinnell Ditch No. 1	05/02/1929	Fully Adjudicated	0.77	Box Elder Creek		John	Belus	IRR_SW	052N	082W	01	NW1/4SE1/4		1.130	-106.665418	44.504722
P5087.0E	Grinnell Ditch No. 1,, Enlargement of	03/07/1935	Fully Adjudicated		Box Elder Creek		John	Belus	IRR_SW	052N	082W	01	SE1/4NE1/4		1.13		
P20314.0D	Gupton Ditch	10/31/1949	Unadjudicated	0.04	Gupton Creek		SAM	GUPTON	IRR_SW	053N	083W	07	SW1/4SW1/4		1.000	-106.909926	44.574247
CR CC72/016	H. I. Scott Spring No. 1 Pipeline	07/20/1972		0.06	H.I. Scott Spring No. 1		INC.	ZEZAS RANCHES	STO	053N	083W	30	SW1/4SW1/4			-106.909630	44.531190
P23915.0D	H. I. Scott Spring No. 1 Pipeline	07/20/1972	Fully Adjudicated	0.06	H.I. Scott Spring No. 1				STO	053N	083W	30	SW1/4SW1/4		0.013	-106.894632	44.538345
P32875.0D	Hall Spring #2 Stock Pipeline	10/03/2003	Unadjudicated		Hall Spring #2				DOM_SW; STO	051N	082W	30			0.033		
OR 02/189	Hallie Ditch	04/10/1886		2.28	Rock Creek	Jennie B. Buell			IRR_SW	052N	083W	29	NW1/4NE1/4				
OR 02/189	Hallie Ditch	04/10/1886		2.28	Rock Creek	Ira C. Buell			IRR_SW	052N	083W	29	NW1/4NE1/4			-106.868070	44.454680
OR 02/189	Hallie Ditch	04/10/1886		11.71	Rock Creek	Geo. P. Hersey			IRR_SW	052N	083W	29	NW1/4NE1/4			-106.868070	44.454680
OR 02/189	Hallie Ditch	04/10/1886		0.07	Rock Creek	Georgia A. Hersey			IRR_SW	052N	083W	29	NW1/4NE1/4			-106.868070	44.454680
OR 04/650	Hallie Ditch	04/10/1886			Rock Creek		GEORGE A.	BUELL	IRR_SW	052N	083W	29	NW1/4NE1/4				
OR 04/650	Hallie Ditch	04/10/1886		3.43	Rock Creek	Geo. A. Buell			IRR_SW	052N	083W	29	NW1/4NE1/4				

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OR 17/410	Hallie Ditch	04/10/1886		0	Rock Creek		SAMUEL HENRY	RITCHEY	IRR_SW	052N	083W	29	NW1/4NE1/4				
CR CC82/329	Hallie Ditch (acf Enlarged Kempton Ditch)				Rock Creek	HF Bar Ranch			IRR_SW	052N	083W	29	NW1/4NE1/4			-106.868070	44.454680
P659.0E	Hallie Ditch {Enl. of and Extension}	05/04/1901	Fully Adjudicated	4.57	Rock Creek		Charles E.	Buell	DOM_SW; IRR_SW; STO	052N	083W	16	SE1/4SE1/4		-1		
CR CC22/084	Hallie Ditch,, Enl.	05/21/1903		2.27	Rock Creek		JOHN H.	PETERSON	IRR_SW	052N	083W	29	NW1/4NE1/4			-106.868070	44.454680
CR CC26/252	Hallie Ditch,, Enl.	05/04/1901		4.57	Rock Creek		CHARLES E.	BUELL	DOM_SW; IRR_SW; STO	052N	083W	29	SE1/4NW1/4			-106.873090	44.451130
P1116.0E	Hallie Ditch,, Fish Ditch {Enl. of}	05/21/1903	Fully Adjudicated	1.59	Rock Creek		John H.	Peterson	IRR_SW	052N	083W	27	NE1/4SW1/4		-1		
DK 2002/2305	Hamilton Ditch	12/31/1889			Piney Creek		NONA	WILLIAMS	IRR_SW	053N	082W	14	SW1/4NW1/4				
OR 02/194	Hamilton Ditch	12/31/1889		0.64	Piney Creek	L.D. Hamilton			IRR_SW	053N	082W	11	SW1/4SE1/4				
OR 09/216	Hamilton Ditch	12/31/1889			Piney Creek			ERNEST BLANCHARD WILLIAMS ESTATE	IRR_SW	053N	082W	12	SE1/4SW1/4				
P15676.0D	Hamilton Ditch	12/22/1919			Cemetery Draw			Northern Wyoming Land Co.	IRR_SW	051N	082W	35	SE1/4SW1/4		5.070	-106.691192	44.340325
CR CC22/054	Hamilton Ditch,, Enl.	11/07/1899		0.71	Piney Creek		HIRAM	STURDEVANT	IRR_SW	053N	082W	11	SW1/4SE1/4			-106.697920	44.574050
CR CC44/423	Hamilton Ditch,, Enl.	11/07/1899			Piney Creek		PAUL	BYRTUS	IRR_SW	053N	082W	12	NW1/4SE1/4			-106.677780	44.577260
CR CC64/366	Hamilton Ditch,, Enl.	11/07/1899			Piney Creek		JENNIE	WILLIAMS	IRR_SW	053N	082W	12	NW1/4SE1/4			-106.677780	44.577260
P495.0E	Hamilton Ditch,, Sturdevant Extension	11/07/1899	Fully Adjudicated	0.43	Piney Creek		Hiram A.	Sturdevant	IRR_SW	053N	082W	11	SW1/4SE1/4		-1		
P15125.0D	Hampton Ditch	06/25/1918	Fully Adjudicated	0.30	Mather Draw		Willard	Hampton	IRR_SW	051N	082W	04	SW1/4SE1/4		1.370	-106.725923	44.411791
P4478.0E	HAMPTON ENLARGEMENT OF SANDY CREEK DITCH	10/23/1920	Fully Adjudicated	0.94	Sandy Creek		WILLARD	HAMPTON	IRR_SW	051N	082W	17	SE1/4NW1/4		8.400	-106.753611	44.390511
P5196.0E	HAMPTON SECOND ENLARGEMENT OF SANDY CREEK DITCH	02/07/1938	Fully Adjudicated		Sandy Creek		WILLARD	HAMPTON	IRR_SW	051N	082W	17	SE1/4NW1/4		3.800	-106.753611	44.390511
P28712.0D	Hando Draw Pipeline No. 1	10/20/1982	Unadjudicated	0.00	Hando Draw				IRR_SW	055N	078W	09	SE1/4SE1/4		1.020	-106.246825	44.751086
P28713.0D	Hando Draw Pipeline No. 2	07/22/1983	Unadjudicated	0.00	Hando Draw				IRR_SW	055N	078W	15	NE1/4NW1/4		0.100	-106.235284	44.747496
P34036.0D	Hannon Domestic Pump	09/08/2008	Unadjudicated		Mill Creek		Marilyn	Hannon	DOM_SW	053N	084W	12	NE1/4SE1/4		0.056	-106.914900	44.578130
P18644.0D	Happersett Ditch	11/22/1935	Unadjudicated	1.25	Johnson Creek		C.F.	HAPPERSETT	DOM_SW; IRR_SW; RES; STO	051N	083W	22	NE1/4NE1/4		1.250	-106.823798	44.379736
P5150.0D	Hard Labor Ditch	11/03/1902	Fully Adjudicated	0.60	Clear Creek		David H.	Watt	IRR_SW	056N	077W	02				-106.114579	44.843562
P5488.0E	Hard Labor Ditch,, First Enlargement of the	12/15/1949	Fully Adjudicated		Clear Creek (drainage of)		Alice M.	Watt	IRR_SW	056N	077W	All			2.250	-106.124119	44.823425
CR CC74/178	Harshfield Sprinkler	11/06/1979		0.04	North Piney Creek		WILLIAM H.	QUINETTE	IRR_SW	053N	083W	07	NW1/4SW1/4			-106.909870	44.578120
P26950.0D	Harshfield Sprinkler	11/06/1979	Fully Adjudicated	0.04	North Piney Creek				IRR_SW	053N	083W	07	NW1/4SW1/4		0.067	-106.899696	44.581977
OR 02/182	Hart No. 4 Ditch	04/01/1883		2.00	Clear Creek (drainage of)	Julia W. Hart, Julia Hart Taylor, Morton K. Hart, Verling K. Hart			IRR_SW	050N	082W	05	NW1/4NW1/4			-106.757850	44.337250
P12079.0D	Hay Creek Ditch No. 1	10/15/1913	Fully Adjudicated	0.73	Hay Creek		OLLIE M.	MAXWELL	IRR_SW	056N	079W	21	SW1/4NW1/4			-106.383295	44.813078

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P12080.0D	Hay Creek Ditch No. 2	10/15/1913	Fully Adjudicated	0.44	Hay Creek		OLLIE M.	MAXWELL	IRR_SW	056N	079W	21	SW1/4NW1/4			-106.383317	44.813101
P3608.0E	Hay Creek Ditch No. 2 {Enl. of}	04/10/1916		7.32	Hay Creek		Georgia	Bently	IRR_SW	056N	079W	21	SW1/4NW1/4		5.650	-106.383276	44.813058
P20202.0D	Hays No. 3 Ditch	03/30/1948	Fully Adjudicated	0.00	West Prong of Hanna Creek		Victor	Garber	IRR_SW	053N	085W	22	NE1/4SW1/4		10.000	-107.087922	44.547885
P7186.0D	Hector Ditch	05/01/1906	Fully Adjudicated		Buffalo Creek		W. A.	POOL	DOM_SW; IRR_SW; STO	056N	079W	25	SE1/4SE1/4			-106.309699	44.792021
P17172.0D	Henry Ditch	11/26/1926	Fully Adjudicated	0.13	Sayles Creek		J.H.	MCDONALD	IRR_SW	051N	083W	04	NW1/4SW1/4		0.750	-106.859264	44.419401
OR 02/194	Hepp No. 1 Ditch	05/02/1884		0.71	Piney Creek	John Geo. Hepp			IRR_SW	053N	083W	26	NE1/4SE1/4				
OR 02/196	Hepp No. 1 Ditch	05/02/1884		0.58	Piney Creek		JOHN GEORGE	HEPP	IRR_SW	053N	083W	26	NE1/4SE1/4				
OR 02/194	Hepp No. 1 Ditch 2nd App.	06/01/1888		0.58		John Geo. Hepp			IRR_SW	053N	083W	26	NE1/4SE1/4			-106.813780	44.534680
P4623.0E	Hersey Hattie Lake DeSmet Ditch,, Walt Enlargement of	09/04/1919			South Fork Shell Creek		Robert A.	Watt	IRR_SW	052N	083W	14	NE1/4NE1/4		3		
P5390.0D	Hesse and Rothwell Pipe Line	03/28/1903			Clear Creek (drainage of)		F. G. S.	HESSE	POW	050N	082W	02	SW1/4SE1/4			-106.687358	44.326956
P17076.0D	Heustis Ditch No. 2	07/26/1920	Fully Adjudicated	0.00	North Fork of Sandy Creek		William H.	Heustis	IRR_SW	051N	082W	17	NE1/4NW1/4		3.800	-106.751900	44.395830
P4477.0E	HEUSTIS ENLARGEMENT OF SANDY CREEK DITCH	07/26/1920	Fully Adjudicated	0.89	Sandy Creek		WILLIAM	HEUSTIS	MIS_SW	051N	082W	17	SE1/4NW1/4		8.400	-106.752488	44.392316
CR CC20/176	Highline Ditch	05/04/1905		2.30	Piney Creek		ELIZABETH	HARRINGTON	IRR_SW	053N	083W	26	NE1/4SE1/4			-106.813780	44.534680
CR CC38/031	Highline Ditch	05/04/1905		0.23	Piney Creek		A. H.	SENEFF	IRR_SW	053N	083W	26	NE1/4SE1/4			-106.813780	44.534680
P6675.0D	Highline Ditch	05/04/1905	Fully Adjudicated	2.58	Piney Creek		ELIZABETH	HARRINGTON	IRR_SW	053N	083W	26	NE1/4SE1/4			-106.816111	44.535000
P6676.0D	Highline Ditch	05/04/1905	Fully Adjudicated	2.40	Piney Creek		Arthur H	Senff	IRR_SW	053N	082W	26	NE1/4SE1/4			-106.816111	44.535000
P3154.0E	Highline Ditch {Enl. of}	01/03/1911	Fully Adjudicated		Piney Creek				IRR_SW	053N	083W	26	NE1/4SE1/4			-106.816111	44.535000
CR CC38/632	HIGHLINE DITCH,, ENL. ENLARGEMENT OF Highline Ditch {Enl. of}	01/03/1911		126.77	Piney Creek		ELIZABETH	HEPP	IRR_SW	053N	083W	25	SW1/4SE1/4			-106.798556	44.530858
P5528.0E	Highline Ditch,, Jeffers 2nd Enlargement of the	02/26/1951	Unadjudicated		Jeffers Draws No. 1-4		Hale C.	Jeffers	IRR_SW	053N	082W	29	SW1/4NE1/4		4.800	-106.757877	44.538304
P5529.0E	Highline Ditch,, Jeffers 3rd Enlargement of the	02/26/1951	Unadjudicated		Jeffers Draws No. 1-4		Hale C.	Jeffers	IRR_SW	053N	082W	29	NW1/4SE1/4		4.8		
P5530.0E	HIGHLINE DITCH,, JEFFERS 4TH ENLARGEMENT OF THE ENLARGEMENT OF First Mesa Canal,, Russell Enlargement of the	02/26/1951	Complete	4.80	Jeffers Draws Nos. 1-4	T CROSS T RANCH, LLC			IRR_SW	053N	082W	29	SW1/4SW1/4		4.800	-106.770225	44.529989
P2675.0E	Highline Ditch,, Senff Extension of	07/18/1912	Unadjudicated		Piney Creek		Arthur H.	Sunff	IRR_SW	053N	082W	21	SW1/4SW1/4				
P23515.0D	Highway Reservoir Sprinkler System	11/20/1970	Fully Adjudicated	0	Shed Draw			Folded Hills Ranch	IRR_SW	049N	082W	24	NE1/4SW1/4		1		
OR 50/176	Hill Ditch	04/09/1886		0.71	Rock Creek	John Hill			IRR_SW	051N	082W	23	NE1/4NW1/4			-106.691780	44.381240
OR 02/182	Hillyer & Onslow Ditch (HILLTER & ONSLOW DITCH)	07/01/1881		6.93	Clear Creek (drainage of)	Lobban & Hine			IRR_SW	051N	081W	16	NW1/4NW1/4				
OR 32/496	Hillyer & Onslow Ditch (HILLTER & ONSLOW DITCH)	07/01/1881			Clear Creek (drainage of)			TEXACO INC.	IRR_SW	051N	081W	09	NW1/4SW1/4				
CR CC86/179	Hodgson Ditch	01/13/1951		0.06	Spruce Creek	LeRoy Van Buggenum			IRR_SW	053N	084W	11	NE1/4SE1/4			-106.935090	44.578110
P20586.0D	Hodgson Ditch	01/13/1951	Fully Adjudicated	0.01	Spruce Creek		Harry C.	Hodgson	DOM_SW; IRR_SW	053N	084W	11	NE1/4SE1/4		0.470	-106.935835	44.578685
CR CC86/181	Hodgson No. 6 Pipeline	01/13/1951		0.06	Hodgson Spring No. 6	LeRoy Van Buggenum			IRR_SW	053N	084W	11	NE1/4SE1/4			-106.935090	44.578110
P20587.0D	Hodgson Pipe Line No. 4	01/13/1951	Fully Adjudicated	0.03	Hodgson Spring No. 4		Harry C.	Hodgson	DOM_SW; IRR_SW	053N	084W	11	NE1/4SE1/4		0.071	-106.935086	44.578106
P20588.0D	Hodgson Pipe Line No. 6	01/13/1951	Fully Adjudicated	0.01	Hodgson Spring No. 6		Harry C.	Hodgson	DOM_SW; IRR_SW	053N	084W	11	NE1/4SE1/4		0.071	-106.935086	44.578106

Clear Creek Watershed Direct Flow Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	TOTAL FLOW	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	TOTAL CAPACITY (AF/Yr)	DIVERSION CAPACITY AT HEAD GATE	LONGITUDE	LATITUDE
P20589.0D	Hodgson Spring No. 1 Pipe Line	01/13/1951	Fully Adjudicated	0.00	Hodgson Spring No. 1,2,3		Harry C.	Hodgson	DOM_SW	053N	084W	11	SE1/4NE1/4		0.071	-106.935346	44.582361
CR CC86/183	Hodgson Spring No. 1 Pipeline	01/13/1951		0.07	Hodgson Spring No. 1,2,3	Jerome M. Mark Trust			DOM_SW	053N	084W	11	SE1/4NE1/4			-106.935030	44.581970
P20591.0D	Hodgson Spring No. 3 Pipe Line	01/13/1951	Unadjudicated	0.00	Hodgson Spring No. 1,2,3		Harry C.	Hodgson	DOM_SW; STO	053N	084W	12	SE1/4NW1/4		0.071	-106.925775	44.581846
P20592.0D	Hodgson Spring No. 5 Pipe Line	01/13/1951	Fully Adjudicated	0.00	HODGSON SPRING No. 5		Harry C.	Hodgson	DOM_SW; STO	053N	084W	11	NE1/4SE1/4		0.071	-106.935086	44.578106
CR CC86/182	Hodgson Spring No. 5 Pipeline	01/13/1951		0.07	HODGSON SPRING No. 5	LeRoy Van Buggenum			DOM_SW	053N	084W	13	NE1/4SE1/4			-106.914900	44.563370
CR CC86/180	HodgsonNo. 4 Pipeline	01/13/1951		0.06	Hodgson Spring No. 4	LeRoy Van Buggenum			IRR_SW	053N	084W	11	NE1/4SE1/4			-106.935090	44.578110
P1334.0E	HOLT DITCH ENLARGEMENT OF JOHNSON DITCH	01/14/1905	Fully Adjudicated		Clear Creek		GEORGE	HOLT	DOM_SW; IRR_SW	050N	082W	05	NW1/4SW1/4		-1.000	-106.758106	44.329853
P1248.0D	Home Ditch	05/11/1896	Fully Adjudicated	0.71	Johnson Creek		John R.	Brown	IRR_SW	051N	083W	12	NE1/4SE1/4			-106.779889	44.402583
P5283.0E	HOPKINS DITCH, HAMPTON ENLARGEMENT ENLARGEMENT OF Four Lakes & French Cr. D & F Co. Ditch	01/05/1931	Partially Adjudicated	0.75	French Creek		WILLARD	HAMPTON	IRR_SW	051N	083W	25	NW1/4NE1/4	0.75		-106.787139	44.366500
CR CC58/244	Hopkins Ditch,, Enl.	04/24/1935		0.00	French Creek		WILLARD	HAMPTON	IRR_SW	051N	083W	25	NW1/4NE1/4			-106.787690	44.366530
CR CC59/030	Hopkins Ditch,, Enl.	01/05/1931		0.00	French Creek		WILLARD	HAMPTON	IRR_SW	051N	083W	25	NW1/4NE1/4			-106.787690	44.366530
P5284.0E	Hopkins Ditch,, Hampton Enl. of	04/24/1935	Fully Adjudicated	0	French Creek		Willard	Hampton	IRR_SW	051N	082W	17	SW1/4NE1/4		22.5		
P13265.0D	Horton Ditch No. 1	08/02/1915	Unadjudicated	0.63	Clear Creek		GRACE C.	HORTON	IRR_SW	054N	079W	10	SE1/4SW1/4			-106.362461	44.660139
CR CC64/358	HOSBURG DITCH	03/17/1954	Fully Adjudicated		West Draw		FRED G. AND NELLIE MAY	HOSBURG	IRR_SW	053N	083W	17	SW1/4NW1/4			-106.889797	44.566628
P21384.0D	Hosburg Ditch	03/17/1954	Fully Adjudicated	0.26	West Draw		FRED & NELLIE MAY	HOSBURG	IRR_SW	053N	083W	17	SW1/4NW1/4		3.360	-106.889786	44.566624
P17979.0D	Hoyt Pipe Line	09/08/1931	Fully Adjudicated	0.07	Spring Creek		JOHN A.	HOYT	DOM_SW; IRR_SW; STO	053N	084W	13	SE1/4NW1/4		0.067	-106.925711	44.567042
P15640.0D	Huggins Ditch	11/24/1919		0.00	Huggins Creek		JOSHUA B.	HUGGINS	DOM_SW; IRR_SW	052N	082W	32	SW1/4SW1/4		6.800	-106.759960	44.428531
CR CC69/360	Hunnell No. 1 Pipeline	09/18/1964		0.00	Hunnell No. 1 Spring		EDMA M.	HUNNELL	DOM_SW; IRR_SW	053N	084W	13	NW1/4NW1/4			-106.930050	44.570520
P23001.0D	Hunnell No. 1 Pipeline	09/18/1964	Fully Adjudicated	0.01	Hunnell No. 1 Spring		Roy E. & Edna M.	Hunnell	DOM_SW; IRR_SW	053N	084W	13	NW1/4NW1/4		0.040	-106.930054	44.570516
CR CC87/039	Hunnell No. 1 Pipeline,, Enl.	08/30/2007		0.00	Hunnell No. 1 Spring	Jerry J. Gatlin			DOM_SW; STO	053N	084W	13	NW1/4NW1/4			-106.930050	44.570520
CR CC69/361	Hunnell No. 2 Pipeline	09/18/1964		0.01	Hunnell No. 2 Spring		EDMA M.	HUNNELL	DOM_SW	053N	084W	13	NW1/4NW1/4			-106.930050	44.570520
P23002.0D	Hunnell No. 2 Pipeline	09/18/1964	Fully Adjudicated	0.01	Hunnell No. 2 Spring		Roy E. & Edna M.	Hunnell	DOM_SW	053N	084W	13	NW1/4NW1/4		0.010	-106.930054	44.570516
P18906.0D	Hunter Ranger Station Irrigation Ditch	02/26/1938	Fully Adjudicated	0.04	North Fork Clear Creek			USDA - Forest Service	IRR_SW	050N	084W	10	NW1/4SE1/4		4.900	-106.948121	44.319595
P18905.0D	Hunter Ranger Station Pipe Line	02/28/1938	Fully Adjudicated	0.03	North Fork Clear Creek			USDA - Forest Service	DOM_SW; IRR_SW	050N	084W	10	SE1/4NW1/4		0.050	-106.950861	44.324754
P34237.0D	HUSMAN DOMESTIC PUMP -	08/14/2009	Complete	0.06	North Piney Creek		LORRAINE	HUSMAN	DOM_SW	053N	083W	08	NE1/4SW1/4		0.056	-106.884892	44.577822
CR CC71/199	Husman Pipeline	06/16/1970		0.01	Stringer Springs		CLIFFORD N.	HUSMAN	IRR_SW; STO	053N	083W	18				-106.902310	44.565150
P23430.0D	Husman Pipeline	06/16/1970	Fully Adjudicated	0.08	Stringer Springs		CLIFF N.	HUSMAN	IRR_SW; STO	053N	083W	18	NW1/4NW1/4		0.082	-106.909928	44.570513
CR CC74/115	Husman Sprinkler No. 1	03/17/1977		0.07	J. M. Creek No. 1		JOHN M.	HUSMAN	IRR_SW	053N	083W	18	SW1/4NW1/4			-106.909890	44.566930

Clear Creek Watershed Direct Flow Water Rights

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P26027.0D	Husman Sprinkler No. 1	03/17/1977	Fully Adjudicated	0.07	J. M. Creek No. 1		JOHN M.	HUSMAN	IRR_SW	053N	083W	18	SW1/4NW1/4		0.121		
CR CC74/116	Husman Sprinkler No. 2	03/17/1977		0.01	J. M. Creek No. 2		JOHN M.	HUSMAN	IRR_SW	053N	083W	18	SW1/4NW1/4			-106.909890	44.566930
P26028.0D	Husman Sprinkler No. 2	03/17/1977	Fully Adjudicated	0.01	J. M. Creek No. 2		JOHN M.	HUSMAN	IRR_SW	053N	083W	18	SW1/4NW1/4		0.121	-106.899792	44.570484
CR CC14/055	Huson Ditch	07/07/1893		1.57	Clear Creek		E. W.	HUSON	IRR_SW	053N	080W	11	NE1/4SW1/4			-106.461930	44.576720
P542.0D	Huson Ditch	07/07/1893	Fully Adjudicated	1.71	Clear Creek		E. W.	HUSON	IRR_SW	053N	079W	06	SE1/4NE1/4		-1.000	-106.402510	44.599485
P1898.0E	Huson Ditch {Enl. of}	06/18/1908	Fully Adjudicated	4.00	Clear Creek (drainage of)		E.J.	Stone	IRR_SW	053N	079W	07	NW1/4NW1/4		-1.000	-106.420199	44.590442
P12599.0D	Ida Ditch	08/03/1914	Fully Adjudicated	0.34	Dead Horse Gulch		IDA B.	STEVENSON	IRR_SW	056N	079W	21	NW1/4NE1/4			-106.375561	44.816356
P22708.0D	Irvine Pump Station and Pipe Line #2	04/13/1962	Unadjudicated	0.54	South Piney Creek		HERMA	WERNER	DOM_SW; IRR_SW; REC	053N	084W	13	SE1/4SW1/4		0.500	-106.925276	44.558977
CR CC37/409	Isabelle Ditch	01/05/1914		0.28	High Meadow Gulch		ISABELLE A.	WHEDON	IRR_SW	056N	078W	05	NE1/4SW1/4				
P12191.0D	ISABELLE DITCH	01/05/1914	Fully Adjudicated	0.28	High Meadow Gulch		ISABELLE	WHEDON	IRR_SW	056N	078W	05	NE1/4SW1/4		-1.000	-106.277237	44.856230
P3153.0E	Island Ditch No. 2 {Enl. of}	01/03/1911	Fully Adjudicated		Little Piney Creek		Elizabeth	Hepp	IRR_SW	053N	083W	36	NE1/4NW1/4			-106.803739	44.527028
P7445.0E	ISLAND ENLARGEMENT OF Watt Ditch	02/23/2005	Fully Adjudicated		Clear Creek				RES	052N	081W	24	NW1/4NW1/4		7.110	-106.555681	44.468431
OR 02/194	J.A. Spring Ditch	05/31/1884		0.07	J. A. Creek	Josef Leitner			IRR_SW	053N	083W	34	NW1/4NW1/4			-106.849240	44.527490
CR CC74/117	J.M. Drainage Ditch Pump Stations	03/17/1977		0.03	Buck Trail Springs Area		JOHN M.	HUSMAN	IRR_SW	053N	083W	18	SW1/4NW1/4			-106.909890	44.566930
P26026.0D	J.M. Drainage Ditch Pump Stations	03/17/1977	Fully Adjudicated	0.03	Buck Trail Springs Area		JOHN M.	HUSMAN	IRR_SW	053N	083W	18	SW1/4NW1/4		0.121	-106.899792	44.570484
P21401.0D	Jacobs Pumping Station No. 1 Pipeline	12/10/1953	Unadjudicated	0.00	Hay Creek		FRANK A.	JACOBS	IRR_SW	056N	079W	26	SE1/4SW1/4		0.380	-106.341324	44.789348
P5527.0E	JEFFERS 1ST ENL OF HIGHLINE DITCH ENLARGEMENT OF Highline Ditch	02/26/1951	Complete		Jeffers Draws Nos. 1-4	T CROSS T RANCH, LLC			IRR_SW	053N	082W	20	SE1/4SE1/4		4.800	-106.754625	44.544550
P9812.0D	Jennie E. Butterfield Ditch	05/18/1910	Fully Adjudicated	0.00	Butterfield Draw		Jennie E.	Butterfield	IRR_SW	054N	081W	29	SE1/4SW1/4		-1.000	-106.641291	44.615750
CR CC36/009	Jennie E. Butterfield Reservoir	05/18/1910		2.50	Butterfield Draw		JENNIE E.	BUTTERFIELD	IRR_SW	054N	081W	29	SE1/4SW1/4			-106.642520	44.616790
OR 02/189	Jennie Mowry Ditch	04/01/1879		0.36	Rock Creek	Andrew S. Brown			IRR_SW	052N	083W	28	SW1/4SE1/4			-106.848050	44.443600
OR 02/189	Jennie Mowry Ditch	08/06/1888		1.14	Rock Creek	A.S. Brown			IRR_SW	052N	083W	28	SW1/4SE1/4			-106.848050	44.443600
P12901.0D	Jennings No. 2 Ditch	12/15/1914	Fully Adjudicated	0.56	Jackalope Draw		CHAS.	FARTHING	IRR_SW; STO	058N	078W	33					
P5393.0D	Jesse Ditch	03/30/1903	Fully Adjudicated	1.14	Sand Creek (36-51-82)		ROBERT	FOOTE	IRR_SW	050N	082W	01	SW1/4SE1/4			-106.668260	44.326192
OR 02/189	Jim Crow Ditch	04/10/1883		0.86	North Fork Rock Creek	Jas. R. Hutton			IRR_SW	052N	084W	24	SW1/4NE1/4			-106.908050	44.465850
OR 02/186	John A. Fisher No. 1 Ditch	05/10/1883		0.50	French Creek	John A. Fisher			IRR_SW	051N	082W	21	NE1/4SW1/4			-106.732650	44.373960
OR 02/186	John A. Fisher No. 2 Ditch	05/10/1883		0.43	French Creek	John A. Fisher			IRR_SW	051N	082W	20	SE1/4SE1/4			-106.742800	44.370290
P20361.0D	John Brug Pump No. 1 Ditch	03/20/1950	Fully Adjudicated	0.40	Clear Creek		John	Brug	IRR_SW	053N	080W	09	SE1/4SE1/4		0.430	-106.491407	44.573070
OR 04/440	John Ditch	05/01/1885			Sayles Creek		J. NORMAN	PENROSE	IRR_SW	051N	083W	03	NE1/4SE1/4				
OR 04/440	John Ditch	05/01/1885		1.25	Sayles Creek	J. Norman Penrose			IRR_SW	051N	083W	03	NE1/4SE1/4				
OR 02/189	Johnny Come Early Ditch	03/31/1880		1.86	Rock Creek	John McRae			IRR_SW	052N	083W	36	SE1/4SW1/4			-106.792630	44.428740
CR CC34/194	JOHNSON & HOLT DITCH,, ENL. ENLARGEMENT OF SECOND CUMMINGS ENLARGEMENT OF JOHNSON DITCH	06/17/1912		2.48			CHARLES W AND SHERRY S	KEFFER	IRR_SW	050N	082W	09	SE1/4SE1/4			-106.723503	44.312203
CR CC34/191	JOHNSON & HOLT DITCHES,, ENL. ENLARGEMENT OF CUMMINGS ENLARGEMENT OF JOHNSON DITCH	01/25/1911		2.91	Clear Creek		CHARLES W. AND SHERRY S.	KEFFER	IRR_SW	050N	082W	10	NW1/4SE1/4			-106.709864	44.316447
CR CC66/368	Johnson (Johnson-Holt) Ditch,, Enl.	02/17/1961		0.00			LEWIS D.	BROCK	RES	050N	082W	05	NW1/4SW1/4			-106.758090	44.330060

Clear Creek Watershed Direct Flow Water Rights

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P7217.0D	Johnson County Farm Ditch	06/08/1906	Fully Adjudicated	1.80	Clear Creek				DOM_SW; IRR_SW; STO	050N	082W	06	SE1/4NE1/4			-106.765000	44.332500
P2621.0E	Johnson County Farm Ditch {Enl. of}	06/17/1912	Fully Adjudicated		Clear Creek (drainage of)			Johnson County	IRR_SW	050N	082W	06	SE1/4NE1/4				
P34316.0D	JOHNSON COUNTY GOVT WATER HAUL	03/05/2010	Complete	1.67	Sand Creek (36-51-82)	JOHNSON COUNTY GOVT			TEM	050N	082W	01	NW1/4NE1/4			-106.668064	44.335964
CR CC43/028	Johnson Creek Ditch No. 1,, Enl.	07/17/1922		0.64	Johnson Creek		FRANK R.	SCHRATER	IRR_SW	051N	083W	14	NW1/4SW1/4			-106.817880	44.388760
P4310.0E	Johnson Creek Ditch No. 1,, Schrater Enlargement	07/17/1922	Fully Adjudicated	13.65	Johnson Creek		Frank R.	Schrater	IRR_SW	051N	083W	14	NW1/4SW1/4		13.650	-106.819639	44.388333
OR 02/192	Johnson Creek Nos. 1 and 2 Ditches	12/31/1884		2.85	Johnson Creek	Robert Foote			IRR_SW	051N	083W	13	NE1/4NE1/4				
OR 47/464	Johnson Creek Nos. 1 and 2 Ditches	12/31/1884		-0.30	Johnson Creek		EARL	HILLARD	IRR_SW	051N	082W	07	NE1/4NW1/4				
P17570.0D	Johnson Ditch	04/11/1922	Fully Adjudicated	0.00	Johnson Creek		Paul A.	Rothwell	IRR_SW	051N	083W	13	NW1/4NE1/4		16.300	-106.789000	44.397611
P5688.0D	JOHNSON DITCH	12/01/1903	Fully Adjudicated	1.94	Clear Creek		DAVID	CUMMINGS	IRR_SW	050N	082W	05	NW1/4SW1/4			-106.758089	44.330061
P591.0E	Jones & Adams Ditch,, Jones Enlargement of the	09/24/1900	Fully Adjudicated		Sand Creek		John A.	Jones	IRR_SW	050N	082W	11	NE1/4SE1/4		-1.000	-106.682250	44.316001
P9162.0D	Jones Ditch	06/24/1909			JONES DRAW		K.C.	JONES	IRR_SW	054N	080W	18	NW1/4NW1/4			-106.547941	44.655822
P2642.0E	Jouvenat Ditch,, Enlargement of the	07/15/1912			Town Draw		Rosa P.	Jorvenat	IRR_SW	054N	080W	12	NW1/4NW1/4				
P17652.0D	Julio Ditch	09/27/1929	Unadjudicated		Supply Draw		LUCIA	JULIO	DOM_SW; IRR_SW	053N	079W	19			2.400	-106.414329	44.554920
P17651.0D	Julio Supply Ditch	09/27/1929	Unadjudicated	11.95	Supply Draw		LUCIA	JULIO	DOM_SW; IRR_SW; RES	053N	079W	19			18.000	-106.414329	44.554920
P676.0E	K. Z. Ditch {Enl. of}	07/09/1901	Fully Adjudicated	1.33	Piney Creek		Arthur H	Senff	IRR_SW	053N	082W	28	NW1/4SW1/4		-1		
CR CA03/394	K. Z. Ditch,, Enl.	07/09/1901		1.33	Piney Creek		ARTHUR H.	SENFF	IRR_SW	053N	082W	32	NW1/4SW1/4			-106.768400	44.519800
OR 02/194	K.Z. Ditch	08/31/1891		0.43	Piney Creek	W.J. Sturgis			IRR_SW	053N	082W	32	SW1/4NW1/4			-106.768430	44.523370
OR 02/194	K.Z. Ditch	08/31/1891		0.50	Piney Creek	T.J. Keesee			IRR_SW	053N	082W	32	SW1/4NW1/4			-106.768430	44.523370
CR CC76/010	K-1 Pipeline,, Enl.	02/12/1979		0	Clear Creek (drainage of)		WYO BOARD	LAND COMMISSIONERS	IRR_SW	057N	076W	31	NE1/4NW1/4				
P6766.0E	K-1 Pipeline,, Kendrick Enlargement of the	02/12/1979	Fully Adjudicated	2.09	Clear Creek (drainage of)			Kendrick Cattle Co.	IRR_SW	057N	076W	31	NE1/4NW1/4		7.77		
CR CC69/136	Kaufmann Ditch	04/30/1968		0.43	Piney Creek		ALEX	KAUFMANN	IRR_SW	053N	082W	22	SW1/4NW1/4			-106.728380	44.551970
P22916.0D	Kaufmann Ditch	04/30/1968	Fully Adjudicated	0.43	Piney Creek		Alex	Kaufmann	IRR_SW	053N	082W	22	SW1/4NW1/4		6.900	-106.730053	44.552792
OR 14/314	Kempton Ditch	05/10/1882		0.86	Rock Creek	Wm. H. Fenn			IRR_SW	052N	083W	29	NW1/4NE1/4			-106.868070	44.454680
P2531.0E	Kempton Ditch {Enl. of}	08/21/1911	Fully Adjudicated	0.34	Rock Creek		Carrie A.	Tathwell	IRR_SW	053N	083W	29	NE1/4NW1/4		-1		
CR CC39/515	Kempton Ditch,, Enl.	08/21/1911		0.34	Rock Creek		CARRIE A.	TATHWELL	IRR_SW	052N	083W	29	NW1/4NE1/4			-106.868070	44.454680
CR CC37/386	Kendrick Canal	10/18/1911		1.93	Clear Creek		NICK	LAUER	IRR_SW	056N	077W	15	SW1/4NE1/4			-106.111950	44.830900
P10735.0D	Kendrick Canal	10/18/1911	Fully Adjudicated	16.00	Clear Creek		J.B.	KENDRICK	IRR_SW	056N	077W	15	SW1/4NE1/4			-106.114167	44.830278
P2763.0E	Kendrick Canal {Enl. of}	05/17/1912	Fully Adjudicated				J.B.	Kendrick	POW	056N	077W	15	NE1/4NW1/4			-106.114630	44.835240
CR CC37/385	Kendrick Canal,, Enl.	05/17/1912		35.00			J. B.	KENDRICK	POW	056N	077W	15	NE1/4NW1/4			-106.114630	44.835240
CR CC62/145	Kendrick Canal,, Enl.	12/27/1949		2.02	Clear Creek (drainage of)		WILLIAM F.	NELSON	IRR_SW	056N	077W	All					
CR CC63/020	Kendrick Canal,, Enl.	02/25/1952		1.48			LOIS R.	MOORE	IRR_SW	056N	077W	15				-106.114600	44.829100
CR CC84/198	Kendrick Canal,, Enl.	08/08/2001		14.16	Clear Creek	Rocking Horse Ranch			RES	056N	077W					-106.124120	44.823240
P5532.0E	Kendrick Canal,, Second Enlargement of	12/27/1949	Fully Adjudicated		Clear Creek (drainage of)		Alice M.	Watt	IRR_SW	056N	077W	All			69.000	-106.114167	44.830278

Clear Creek Watershed Direct Flow Water Rights

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P5604.0E	Kendrick Canal,, Third Enlargement of	02/25/1952	Fully Adjudicated				Esther N.	Rowley	IRR_SW	056N	077W	15			69.000	-106.114600	44.829100
CR CC75/083	Kessler No. 1 Pump Point	03/09/1984		0.01	Kessler Springs Draw		EVERETT GLEN HAZEL E.	KESSLER	IRR_SW	053N	083W	17	NE1/4NW1/4			-106.884570	44.570640
P28405.0D	Kessler No. 1 Pump Point	03/09/1984	Fully Adjudicated	0.05	Kessler Springs Draw		GLEN	KESSLER	DOM_SW; IRR_SW	053N	083W	17	NE1/4NW1/4		0.053	-106.884570	44.570639
CR CC78/289	Kessler Springs Draw Diversion No. 1	08/31/1989		2.96	Kessler Springs Draw		R. CLYDE	ASHWORTH	FIS	053N	083W	17	NE1/4NW1/4			-106.884570	44.570640
P30387.0D	Kessler Springs Draw Diversion No. 1	08/31/1989	Fully Adjudicated	2.96	Kessler Springs Draw		GLEN AND HAZEL	KESSLER	FIS	053N	083W	17	NE1/4NW1/4		2.960	-106.884570	44.570639
P7416.0D	Kilkeney Ditch	09/03/1906	Fully Adjudicated	0.32	Piney Creek		Oren C.	Kilkeney	IRR_SW	053N	082W	31	SE1/4NW1/4			-106.783391	44.523537
CR CC84/109	Kirk Pump	06/24/2002		0.06	South Piney Creek	Robert B.P. and Marci H. Kirk			DOM_SW	053N	083W	17	NE1/4NW1/4			-106.884570	44.570640
P32649.0D	Kirk Pump	05/24/2002	Unadjudicated		South Piney Creek		PAT & MARCI	KIRK	DOM_SW	053N	083W	17	NE1/4NW1/4		0.056	-106.885000	44.571111
CR CC75/068	Klepinger Pump & Pipeline	10/01/1980		0.03	North Piney Creek		DORIS	KLEPINGER	DOM_SW	053N	084W	11	SW1/4NE1/4			-106.940120	44.581960
P27539.0D	Klepinger Pump & Pipeline	10/01/1980	Fully Adjudicated	0.03	North Piney Creek		DONIS	KLEPINGER	DOM_SW	053N	084W	11	SW1/4NE1/4		0.026	-106.939770	44.581919
P20048.0D	Kusel Ditch	04/17/1946	Fully Adjudicated	0.03	South Piney Creek		JOHN	KUSEL	IRR_SW	053N	083W	17	NE1/4NW1/4		0.500	-106.884034	44.571942
P20049.0D	Kusel Ditch	04/17/1946	Fully Adjudicated	0.00	Spring Branch		JOHN	KUSEL	IRR_SW	053N	083W	08	SE1/4SW1/4		0.500	-106.886357	44.576052
P5539.0E	Kusel Ditch,, First Enlargement of the (Changed to Hulse Ditch)	03/01/1951			Spring Branch		Jack	Moody	DOM_SW; IRR_SW; STO	053N	083W	08	SE1/4SW1/4		0.5		
P5540.0E	Kusel Ditch,, Second Enlargement of	03/01/1951			Spring Branch		James B.	Hulse	DOM_SW; IRR_SW; STO	053N	083W	08	SE1/4SW1/4		0.500	-106.886680	44.576003
OR 02/182	L X Ditch	07/31/1883		3.57	Clear Creek (drainage of)	Muphy Cattle Co. Limited			IRR_SW	051N	081W	03	NE1/4NW1/4				
OR 06/139	L X Ditch	07/31/1883			Clear Creek (drainage of)		CHARLES C.	LAWRENCE	IRR_SW	051N	081W	03	NE1/4NW1/4				
P4351.0E	L.X. Ditch {Enl. of}	11/20/1922	Fully Adjudicated	0.63	Clear Creek (drainage of)			Lawrence Brothers	IRR_SW	051N	081W	03	NE1/4NW1/4		7.000	-106.598056	44.420000
CR CC44/267	L.X. Ditch,, Enl.	11/20/1922		0.63	Clear Creek (drainage of)		CHARLES C.	LAWRENCE	IRR_SW	051N	081W	03	NE1/4NW1/4			-106.590910	44.424900
CR CC38/022	Lad Ditch	01/29/1914		1.19	Clear Creek		W. J.	THOM	IRR_SW	050N	082W	04	SW1/4SE1/4			-106.727720	44.326410
CR CC62/353	Lad Ditch	12/04/1950		0.00	Sand Creek (3-50-82)		EARL P.	BOGGS	IRR_SW	050N	082W	04	SW1/4SE1/4			-106.727720	44.326410
P12267.0D	Lad Ditch	01/29/1914	Fully Adjudicated	1.19	Clear Creek		W.J.	Thom	IRR_SW	050N	082W	04	SW1/4SE1/4		-1		
P20546.0D	Lad Ditch	12/04/1950	Fully Adjudicated	0.00	Sand Creek (3-50-82)		Earl P.	Boggs	IRR_SW	050N	082W	04	SW1/4SE1/4		11.320	-106.726919	44.325123
P3607.0E	Lad Ditch {Enl. of}	01/08/1916	Fully Adjudicated	1.81	Clear Creek (drainage of)		W.J.	Thom	IRR_SW	050N	082W	04	SW1/4SE1/4		7.060	-106.725833	44.325000
CR CC38/631	Lad Ditch,, Enl.	01/08/1916		1.81	Clear Creek (drainage of)		W. J.	THOM	IRR_SW	050N	082W	04	SW1/4SE1/4			-106.727720	44.326410
CR CC41/481	Lad Ditch,, Enl.	03/05/1917		0.77	Clear Creek (drainage of)		J. FRANK	COFFEY	IRR_SW	050N	082W	04	SW1/4SE1/4			-106.727720	44.326410
P3771.0E	Lad Ditch,, Enlargement No. 2 of	03/05/1917	Fully Adjudicated	0.77	Clear Creek (drainage of)		J. Frank	Coffey	IRR_SW	050N	082W	09	NW1/4NW1/4		6.06		
CR CC81/097	Ladd Ditch	12/09/1954		0.00	Lanier Draw		BRUSH CREEK	RANCH	IRR_SW	050N	082W	03	SW1/4SW1/4			-106.717700	44.326410
P21541.0D	Ladd Ditch	12/09/1954	Fully Adjudicated	0.00	Lanier Draw		LISLE	LANIER	IRR_SW	050N	082W	03	SW1/4SW1/4		11.350	-106.719846	44.325838

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CR CC83/150	Lake DeSmet Canal (acf Enl, Hallie Ditch)				Rock Creek	Love Land and Cattle Company			IRR_SW	052N	083W	35	SW1/4NW1/4			-106.817840	44.436210
CR CC90/054	LAKE DESMET DITCH	10/31/1884		4.28	Rock Creek		GLEN	RIVARD	IRR_SW	052N	083W	35	SW1/4NW1/4			-106.817883	44.436225
OR 02/189	Lake Desmet Ditch	10/31/1884		9.14	Rock Creek	First National Bank of Buffalo			IRR_SW	052N	083W	25	SW1/4NW1/4			-106.797570	44.450510
OR 02/189	Lake Desmet Ditch	10/31/1884		29.14	Rock Creek	W.J. Thom			IRR_SW	052N	083W	35	SW1/4NW1/4			-106.817840	44.436210
OR 02/189	Lake Desmet Ditch	10/31/1884		7.43	Rock Creek	Chas F. Canterberry			IRR_SW	052N	083W	35	SW1/4NW1/4			-106.817840	44.436210
OR 02/189	Lake Desmet Ditch	10/31/1884		1.00	Rock Creek	Rachel Patch			IRR_SW	052N	083W	35	SW1/4NW1/4			-106.817840	44.436210
OR 02/189	LAKE DESMET DITCH	10/31/1884		4.28	Rock Creek		S.A.	STURGIS	IRR_SW	052N	083W	35	SW1/4NW1/4			-106.817883	44.436225
OR 02/189	Lake Desmet Ditch	10/31/1884		1.43	Rock Creek	I.N. Lane			IRR_SW	052N	083W	35	SW1/4NW1/4			-106.817840	44.436210
OR 02/189	Lake Desmet Ditch	10/31/1884		0.36	Rock Creek	Andrew S. Brown			IRR_SW	052N	083W	35	SW1/4NW1/4			-106.817840	44.436210
OR 04/440	Lake Desmet Ditch	10/31/1884		8.28	Rock Creek	John U. Barkey			IRR_SW	052N	082W	35	SW1/4NW1/4				
OR 04/440	Lake Desmet Ditch	10/31/1884			Rock Creek		STEPHAN L LINDA K	ATKINSON	IRR_SW	052N	083W	35	SW1/4NW1/4				
OR 04/440	Lake Desmet Ditch	10/31/1884			Rock Creek		JOHN U.	BARKEY	IRR_SW	052N	083W	35	SW1/4NW1/4				
OR 04/440	Lake Desmet Ditch	10/31/1884		57.14	Rock Creek	Munkers & Mathers			IRR_SW	052N	083W	35	SW1/4NW1/4				
OR 06/398	Lake Desmet Ditch	10/31/1884			Rock Creek		NORTHERN WYOMING	LAND COMPANY	IRR_SW	052N	083W	35	SW1/4NW1/4				
P5552.0E	Lake Desmet Ditch,, 3rd Enlargement	04/03/1950	Fully Adjudicated	0	Rock Creek			Texaco, Inc.	RES	052N	083W	35	SW1/4NW1/4		100		
P658.0E	Lake DeSmet Ditch,, Bennett Ditch {Enl. of}	04/22/1901	Fully Adjudicated	8.65	Rock Creek		Alvin	Bennett	IRR_SW	052N	083W	25	SE1/4SW1/4		-1		
CR CC08/064	Lake DeSmet Ditch,, Enl.	04/22/1901		5.32	Rock Creek		P. J.	GOUGH	IRR_SW	052N	083W	35	SW1/4NW1/4			-106.817840	44.436210
CR CC70/110	Lake Desmet Ditch,, Enl.	04/03/1950		0.00	Rock Creek			TEXACO INC.	RES	052N	083W	35	SW1/4NW1/4			-106.817839	44.436211
CR CC75/240	Lake DeSmet Ditch,, Enl.	12/20/1979		10.00	Rock Creek			TEXACO INC.	FIS	052N	083W	35	SW1/4NW1/4			-106.817840	44.436210
CR CC76/172	Lake DeSmet Ditch,, Enl.	04/26/1955		8902.00	Rock Creek			TEXACO INC.	RES	052N	083W	35	SW1/4NW1/4			-106.817839	44.436211
P5788.0E	Lake DeSmet Ditch,, Enlargement	04/26/1955	Fully Adjudicated	0	Rock Creek			Texaco, Inc.	RES	052N	083W	35	SW1/4NW1/4		500		
CR CC26/253	Lake DeSmet Ditch,, Royal Ditch	04/19/1902		5.12	Rock Creek		ALVIN	BENNETT	IRR_SW	052N	083W	35	SW1/4NW1/4			-106.817840	44.436210
P815.0E	Lake DeSmet Ditch,, Royal Ditch	04/19/1902	Fully Adjudicated	5.12	Rock Creek		Alvin	Bennett	IRR_SW	052N	083W	35	SW1/4NW1/4		-1		
P6800.0E	Lake DeSmet Ditch,, Texaco Enlargement of the	12/20/1979	Fully Adjudicated	10	Rock Creek			Texaco, Inc.	FIS	052N	083W	35	SW1/4NW1/4		192		
CR CC64/203	LAKE DESMET INTAKE	02/18/1920	Fully Adjudicated	0.00	Piney Creek	LAKE DESMET COUNTIES COALITION JOINT POWERS BOARD			RES	053N	082W	31	SE1/4SW1/4			-106.783400	44.516419
CR CC47/152	Lake DeSmet Intake Canal (CHANGED TO REYNOLDS LAKE DeSMET)	02/18/1920						L. Z. LEITER ESTATE		053N	083W	26	NW1/4SE1/4			-106.818850	44.534670
CR CC63/331	Lake DeSmet Intake Canal (CHANGED TO REYNOLDS LAKE DeSMET)	02/18/1920					J. E.	CABLE	RES	053N	082W	31	SE1/4SW1/4			-106.783400	44.516419
P15779.0D	Lake DeSmet Intake Canal (CHANGED TO REYNOLDS LAKE DeSMET)	02/18/1920	Fully Adjudicated	0				Texaco, Inc.	IRR_SW; RES	053N	083W	25	SW1/4SW1/4		1000		

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CR CC73/156	Lake DeSmet Intake Canal, ENLARGEMENT OF (CHANGED TO REYNOLDS LAKE DeSMET)	04/03/1950	Fully Adjudicated	465.00	Piney Creek	LAKE DESMET COUNTIES COALITION JOINT POWERS BOARD			RES	053N	083W	25	SW1/4SW1/4			-106.808750	44.531000
P5550.0E	Lake DeSmet Intake Ditch (Changed to Reynolds Lake DeSmet Intake Tunnel),, 1st Enlargement	04/03/1950	Fully Adjudicated	0	Piney Creek			Texaco, Inc.	RES	053N	083W	25	NW1/4SE1/4		1833		
P5551.0E	Lake DeSmet Intake Ditch (Changed to Reynolds Lake DeSmet Intake Tunnel),, 2nd Enlargement	04/03/1950	Fully Adjudicated	0	Little Piney Creek			Texaco, Inc.	RES	053N	083W	35	NW1/4NE1/4		183.3		
CR CC66/162	Lake DeSmet Intake Ditch (Changed to Reynolds Lake DeSmet Intake Tunnel),, Enl.	04/03/1950		0.00	Little Piney Creek			TEXACO INC.	RES	053N	083W	35	NW1/4NE1/4			-106.818889	44.527439
CR CC76/166	Lake DeSmet Intake Ditch (Changed to Reynolds Lake DeSmet Intake Tunnel,, Enl.	04/26/1955		865.00	Piney Creek			TEXACO INC.	RES	053N	083W	25	SW1/4SW1/4			-106.808750	44.531000
P5789.0E	Lake DeSmet Intake Ditch (Changed to Reynolds Lake DeSmet Intake Tunnel,, Enlargement	04/26/1955	Fully Adjudicated	0	Piney Creek			Texaco, Inc.	RES	053N	083W	26	NW1/4SE1/4		1018		
CR CC76/167	Lake DeSmet Intake Ditch (changed to the Reynolds Lake DeSmet Intake Tunnel),, Enl.	11/13/1963		865.00	Piney Creek			TEXACO INC.	RES	053N	083W	25	SW1/4SW1/4			-106.808750	44.531000
P6217.0E	Lake DeSmet Intake Ditch (changed to the Reynolds Lake DeSmet Intake Tunnel),, Enlargement of the	11/13/1963	Fully Adjudicated	0.00	Piney Creek			Texaco, Inc.	RES	053N	083W	25	SW1/4SW1/4		1018.000	-106.809392	44.530626
CR CC76/168	Lake DeSmet Intake Ditch,, Enl.	02/21/1968		500.00	Piney Creek			LOWER CLEAR CREEK IRRIGATION DISTRICT	RES	053N	083W	26	NW1/4SE1/4			-106.818850	44.534670
P6352.0E	Lake DeSmet Intake Ditch,, Enlargement of the	02/21/1968	Unadjudicated	0	Piney Creek			Lower Clear Creek Reservoir Co.	RES	053N	083W	26	NW1/4SE1/4		1018		
CR CC76/170	Lake DeSmet Reservoir Supply Ditch,, Enl.	02/25/1955		200.00	French Creek			TEXACO INC.	RES	051N	081W	09	NW1/4SW1/4			-106.616511	44.402981
P22929.0D	LAKE DESMET RESERVOIR SUPPLY DITCH,,3RD ENLARGEMENT	02/25/1955	Fully Adjudicated	200.00	French Creek	M&M RANCH ACQUISITION CO LLC			RES	051N	081W	09	NW1/4SW1/4		580.000	-106.615278	44.402933
CR CC66/094	LAKE DESMET RESERVOIR,,1ST ENLARGEMENT OF THE	04/03/1950	Fully Adjudicated	0.00	Piney Creek	LAKE DESMET COUNTIES COALITION JOINT POWERS BOARD			RES	053N	083W	25	SW1/4SW1/4			-106.808750	44.531000
P21814.0D	Landeck Power Plant Ditch	11/26/1956	Unadjudicated	75.00	Clear Creek			Adam Landeck Estate	POW	053N	080W	12	NE1/4NE1/4		85.900	-106.431691	44.583341
CR CC84/110	Larson Pump	08/07/2000		0.06	North Piney Creek	Kathleen A. and James C. Larson			DOM_SW	053N	083W	07	NE1/4SW1/4			-106.904820	44.578110
P32719.0D	LARSON PUMP	08/07/2000	Unadjudicated		North Piney Creek		RICHARD R.	LARSON	DOM_SW	053N	083W	07	NE1/4SW1/4		0.056	-106.902222	44.579167
OR 01/242	Last Chance Ditch	03/20/1888		4.29	Little Goose Creek	P.H. Gerdel			IRR_SW; STO	053N	085W	01	NW1/4NE1/4				
OR 02/189	Last Chance Ditch	05/06/1885		1.71	Rock Creek	John K. Hardy			IRR_SW	052N	083W	36	SW1/4SE1/4			-106.787530	44.428650
OR 02/189	Last Chance Ditch	05/06/1885		1.07	Rock Creek	Joshua B. Huggins			IRR_SW	052N	083W	36	SW1/4SE1/4			-106.787530	44.428650
OR 02/189	LAST CHANCE DITCH 2" APP.	04/20/1888	Fully Adjudicated	1.07	Rock Creek		CHAS.	FOX	IRR_SW	052N	083W	36	SW1/4SE1/4			-106.787547	44.428828

Clear Creek Watershed Direct Flow Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	TOTAL FLOW	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	TOTAL CAPACITY (AF/Yr)	DIVERSION CAPACITY AT HEAD GATE	LONGITUDE	LATITUDE
P5340.0E	Last Chance Ditch,, Enlargement of the	01/22/1943	Fully Adjudicated	4.04	Little Goose Creek		Allen	Fordyce	IRR_SW	053N	085W	01	NW1/4NE1/4		54		
P5572.0E	Last Chance Ditch,, Fordyce Enlargement	04/26/1951	Fully Adjudicated	6.35	East Fork Big Goose Creek		Allen O.	Fordyce	IRR_SW	053N	085W	01	NW1/4NE1/4		77		
P2324.0E	Last Chance Ditch,, Last Chance and Gross & Cruse Ditch (ENL CROSS & CRUSE & LAST CHANCE)	01/07/1908	Fully Adjudicated	33.93	Cross Creek			Last Chance Ditch Co.	IRR_SW	053N	085W	12	NE1/4NW1/4		-1		
OR 02/194	Leitner Ditch	05/31/1884		0.50	Little Piney Creek	Josef Leitner			IRR_SW	053N	083W	28	NW1/4SE1/4			-106.859350	44.534720
CR CC69/359	Leon Pipe Line #1	11/09/1962		0.12	Leon Spring No. 1		ROY E.	HUNNELL	IRR_SW	053N	083W	18	NW1/4SW1/4			-106.909850	44.563360
P22345.0D	Leon Pipe Line #1	11/09/1962	Fully Adjudicated	0.16	Leon Spring No. 1		MAURICE	LEON JR.	DOM_SW; IRR_SW	053N	083W	18			0.160	-106.902308	44.565153
P20225.0D	Lewis Ditch	06/28/1948	Fully Adjudicated	0.11	Lewis Creek		Gordan & Rosamond	Gordh	IRR_SW	053N	083W	18	NW1/4NW1/4		1.500	-106.894052	44.570975
P20226.0D	LEWIS PIPE LINE	06/28/1948	Fully Adjudicated	0.03	Lewis Spring		GORDAN AND ROSAMOND	GORDH	DOM_SW	053N	083W	18	NW1/4NW1/4		0.030	-106.909928	44.570514
OR 02/189	Lilly Ditch	05/01/1882		1.00	Rock Creek	Andrew S. Brown			IRR_SW	052N	083W	34	SE1/4NW1/4			-106.833000	44.436290
OR 02/189	Lilly Ditch	12/31/1885		2.43	Rock Creek	A.S. Brown			IRR_SW	052N	083W	34	SE1/4NW1/4			-106.833000	44.436290
P1117.0D	Lina Ditch	01/07/1896		1.87	Piney Creek		ALBERT J.	SINSEL	IRR_SW	053N	082W	14	SW1/4NW1/4			-106.708056	44.566745
P1120.0D	Lina Ditch	01/13/1896		3.43	Piney Creek		LEANDER P.	HAMILTON	IRR_SW	053N	082W	14	NE1/4NW1/4			-106.702976	44.570426
P1150.0D	Lina Ditch	02/25/1896		2.28	Piney Creek		HIRAM	STURDENANT	IRR_SW	053N	082W	14	SE1/4NW1/4			-106.702533	44.566639
CR CC29/332	Lincoln Ditch	05/21/1908		0.21	Bryant Gulch		S. J.	LINCOLN	IRR_SW	052N	083W	32	NE1/4NE1/4			-106.863070	44.440200
P8424.0D	Lincoln Ditch	05/21/1908	Fully Adjudicated	0.21	Bryant Gulch		J. S.	LINCOLN	IRR_SW	052N	083W	32	NE1/4NE1/4			-106.862500	44.440230
P169.0E	Little Piney Divide Ditch {Enl. of}	12/05/1895	Fully Adjudicated		South Piney Creek		Samuel J.	Grunell	IRR_SW	053N	083W	19	SE1/4NE1/4		-1.000	-106.894672	44.552642
P170.0E	Little Piney Divide Ditch {Enl. of}	12/05/1895	Fully Adjudicated		Little Piney Creek		Robert W.	Fullerton	IRR_SW	053N	083W	28	NW1/4NW1/4		-1		
P174.0E	Little Piney Divide Ditch {Enl. of}	12/23/1895	Fully Adjudicated		South Piney Creek		Daniel	Poole	IRR_SW	053N	083W	19	SE1/4NE1/4		-1.000	-106.894672	44.552642
P3230.0E	Little Piney Divide Ditch {Enl. of}	07/03/1915	Fully Adjudicated				C.J.	Hepp	IRR_SW	053N	083W	34	NW1/4SE1/4				
P2616.0E	Little Piney Divide Ditch {Enl. of} (ENL PINEY DIVIDE)	08/14/1911	Fully Adjudicated	1.46	Little Piney Creek		William	Deiner	IRR_SW	053N	083W	28	NW1/4NW1/4				
P22649.0D	Little Piney Divide Ditch or Piney Divide Ditch	07/26/1962	Unadjudicated	0.00	South Piney Creek			Texaco, Inc.	IRR_SW	053N	084W	13	SE1/4SE1/4		45.200	-106.914791	44.561185
CR CC65/301	Little Piney Divide Ditch,, Enl (Babcock, Brown, Fullerton Ditch)	01/21/1958		0.00			KARL	HEPP	RES	053N	083W	28	NW1/4NW1/4			-106.869440	44.541920
CR CA03/393	Little Piney Divide Ditch,, Enl.	12/05/1895		4.71	South Piney Creek		SAMUEL J.	GRINNELL	IRR_SW	053N	083W	19	SE1/4NE1/4			-106.894670	44.552640
CR CA03/474	Little Piney Divide Ditch,, Enl.	12/05/1895		1.81	Little Piney Creek		ROBERT W.	FULLERTON	IRR_SW	053N	083W	19	SE1/4NE1/4			-106.894670	44.552640
CR CC37/387	Little Piney Divide Ditch,, Enl.	08/14/1911		1.46	Little Piney Creek		WILLIAM	DIENER	IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
CR CC38/224	Little Piney Divide Ditch,, Enl.	12/23/1895			South Piney Creek		DANIEL J.	POOL	IRR_SW	053N	083W	19	SE1/4NE1/4			-106.894670	44.552640
CR CC75/238	Little Piney Divide Ditch,, Enl.	12/20/1979		5.96				TEXACO INC.	FIS	053N	083W	28	NW1/4NW1/4			-106.869440	44.541920
P5929.0E	Little Piney Divide Ditch,, Enlargement of. (Babcock, Brown, Fullerton Ditch)	01/21/1958	Fully Adjudicated	0.00			Karl	Hepp	RES	053N	083W	28	NW1/4NW1/4		37.000	-106.869440	44.541920
P6802.0E	Little Piney Divide DITch,, Texaco Enlargement of the	12/20/1979	Fully Adjudicated	5.96				Texaco, Inc.	FIS	053N	083W	28	NW1/4NW1/4		5.96		
OR 02/194	Little Piney No. 2 Ditch	04/30/1879		0.11	Little Piney Creek	Christian J. Hepp			IRR_SW	053N	083W	35	NE1/4NW1/4			-106.823930	44.527460
CR CC64/356	Little Red Ditch	05/01/1956		0.00	Clear Creek		JOHN L.	LUSHER	IRR_SW; RES	053N	080W	17	NE1/4NE1/4			-106.512380	44.569270
P21780.0D	Little Red Ditch	05/01/1956	Fully Adjudicated	2.61	Clear Creek		JOHN L.	LUSHER	IRR_SW; RES	053N	080W	17	NE1/4NE1/4		8.530	-106.511910	44.569245
CR CC56/252	Lonabaugh Ditch	04/09/1931		56.72	Pin Head Creek		A. W.	LONABAUGH	IRR_SW	054N	080W	05	SE1/4SE1/4			-106.512820	44.673930
CR CC56/253	Lonabaugh Ditch	04/09/1931		0.87	Pin Head Creek		A. W.	LONABAUGH	IRR_SW	054N	080W	05	SE1/4SE1/4			-106.512820	44.673930
P17963.0D	Lonabaugh Ditch	04/09/1931	Fully Adjudicated	0.88	Pin Head Creek		E.E.	LONABAUGH	IRR_SW	054N	080W	05	SE1/4SE1/4		6.570	-106.512618	44.675333

Clear Creek Watershed Direct Flow Water Rights

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P17964.0D	Lonabaugh Ditch	04/09/1931	Fully Adjudicated	0.00	Pin Head Creek		E.E.	LONABAUGH	IRR_SW	054N	080W	05	SE1/4SE1/4		6.570	-106.512575	44.675335
CR CC41/482	Long Ditch	06/30/1919		0.13	Flying E Draw		A. W.	LONG	IRR_SW; STO	053N	082W	21	NW1/4SE1/4			-106.738430	44.548300
P15517.0D	Long Ditch	06/30/1919	Fully Adjudicated	0.13	Flying E Draw		A. W.	LONG	IRR_SW; STO	053N	082W	21	NW1/4SE1/4		3.000	-106.738586	44.547994
P6257.0D	Lorena Ditch	10/07/1904	Fully Adjudicated	1.20	Sayles Creek		LORENA	MCDONALD	IRR_SW	051N	083W	04	NW1/4SW1/4			-106.859264	44.419401
P12649.0D	Lott Ditch	08/28/1914		0.44	South Fork Sayles Creek		ELLA B.	LOTT	IRR_SW	051N	083W	18	SE1/4NE1/4			-106.882600	44.392750
CR CC72/430	Lowe Sprinkler Lines	10/09/1974		0.09	Spring Creek		CHARLES EDWARD	BURR	MIS_SW	053N	083W	07	NW1/4SW1/4			-106.909870	44.578120
P24729.0D	Lowe Sprinkler Lines	10/09/1974	Fully Adjudicated	0.09	Spring Creek				MIS_SW	053N	083W	07	NW1/4SW1/4		0.087	-106.899696	44.581977
OR 13/469	Lower Flying E. Ditch	09/15/1883			Piney Creek		WALTER C.	CALLAHAN	IRR_SW	053N	082W	11	NW1/4SE1/4				
OR 13/469	Lower Flying E. Ditch	09/15/1883			Piney Creek		LAMAR ALTA	HARDEMAN	IRR_SW	053N	082W	14	SW1/4NW1/4				
OR 15/161	Lower Flying E. Ditch	09/15/1883		1.43	Piney Creek	Robert L. Nix			IRR_SW	053N	082W	22	NW1/4NW1/4			-106.728430	44.555630
OR 18/206	Lower Flying E. Ditch	09/15/1883		3.15	Piney Creek	The Murphy Cattle Co.			IRR_SW	053N	082W	22	NW1/4NW1/4				
OR 02/194	Lower Harvey Ditch	07/31/1883		0.11	South Piney Creek	W.W. Harney {PnNt>Harvey}			IRR_SW	053N	084W	13	SW1/4SE1/4				
OR 07/392	Lower Harvey Ditch	07/31/1883			South Piney Creek		CLEO Z.	SPURRIER	IRR_SW	053N	084W	13	SW1/4SE1/4				
OR 02/194	Lower Harvey Ditch 2" App.	07/31/1884		1	Piney Creek	P & F Cat. Co. Jno Winterling, Mgr.			IRR_SW	053N	084W	13	SW1/4SE1/4				
OR 07/392	Lower Harvey Ditch 2" App.	12/31/1884			Piney Creek		CLEO Z.	SPURRIER	IRR_SW	053N	084W	13	SW1/4SE1/4				
OR 07/392	Lower Harvey Ditch 2" App.	12/31/1884			Piney Creek		GEORGE P.	BUCKINGHAM	IRR_SW	053N	084W	13	SE1/4SW1/4				
OR 07/449	Lower Harvey Ditch 2" App.	12/31/1884		0.63	Piney Creek		CLEO Z.	SPURRIER	IRR_SW	053N	084W	13	SW1/4SE1/4				
P4784.0E	Lower Harvey Ditch,, {Enl. of}	11/12/1931	Fully Adjudicated	0.37	South Piney Creek		Cleo Z.	Spurrier	IRR_SW	053N	084W	13	SW1/4SE1/4		2		
CR CC45/567	Lower Harvey Ditch,, Enl.	08/21/1926		0.27	South Piney Creek		C. Z.	SPURRIER	IRR_SW	053N	084W	13	SW1/4SE1/4			-106.919910	44.559780
CR CC47/207	Lower Harvey Ditch,, Enl.	11/12/1931		0.37	South Piney Creek		CLEO Z.	SPURRIER	IRR_SW	053N	084W	13	SW1/4SE1/4			-106.919910	44.559780
P4502.0E	Lower Harvey Ditch,, Spurrier Enlargement	08/21/1926	Fully Adjudicated	0.27	South Piney Creek		C.Z.	Spurrier	IRR_SW	053N	084W	13	SW1/4SE1/4		1.92		
OR 02/194	Lower Phil Kearney Ditch	07/31/1879		2	Little Piney Creek	T.J. Foster			IRR_SW	053N	083W	27	SW1/4SE1/4				
OR 13/365	Lower Phil Kearney Ditch	07/31/1879			Little Piney Creek		THOMAS F.	KEARNS	IRR_SW	053N	083W	27	SW1/4SE1/4				
OR 02/193	Lower Shell Creek Ditch	12/31/1883		0.38	North Fork Shell Creek	John H. Sturgis			IRR_SW	052N	083W	01	NW1/4SE1/4			-106.787280	44.504980
P10080.0D	LOYD DITCH	08/17/1910	Expired	1.02	High Meadow Gulch		J.C.	LOYD	IRR_SW	056N	078W	05	NW1/4SW1/4		-1.000	-106.283767	44.854682
CR CC37/395	Lucas Ditch	03/13/1911		0.39	French Creek		FRANK E.	LUCAS	IRR_SW	051N	083W	28	SW1/4SE1/4			-106.848500	44.355410
P10555.0D	Lucas Ditch	03/13/1911	Fully Adjudicated	0.47	French Creek		FRANK E.	LUCAS	IRR_SW	051N	083W	28	SW1/4SE1/4			-106.846453	44.353786
P9923.0D	Luman Ditch No. 1	06/27/1910	Unadjudicated		Clearmont Road Gulch		BERT A.	LUMAN	IRR_SW	055N	079W	05	NE1/4NE1/4			-106.390834	44.772536
P9924.0D	Luman Ditch No. 2	06/27/1910	Fully Adjudicated	0.56	Bert's Gulch		BERT A.	LUMAN	IRR_SW	056N	079W	32	NW1/4SE1/4			-106.396920	44.780174
P33008.0D	Maertens Pump #1	06/09/2004	Unadjudicated		Piney Creek		TOM	MAERTENS	DOM_SW	053N	083W	26	SE1/4NW1/4			-106.824656	44.538040
P33004.0D	Maertens Pump #2	06/09/2004	Unadjudicated		Piney Creek		Joel	Maertens	DOM_SW	053N	083W	26	SE1/4NW1/4		0.020	-106.824723	44.538172
CR CC32/110	Maiu Ditch - Prairie Dog Water Supply Co. Ditch,, Enl.	10/18/1897		0.35			MATTIE A.	STOUT	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
P282.0E	Maiu Ditch - Prairie Dog Water Supply Co. Ditch,, Stout Ditch {Enl. of) (ENL PRAIRIE DOG WATER SUPPLY CO.)	10/18/1897	Fully Adjudicated	0.35			Mattie A.	Stout	IRR_SW	053N	083W	08	NE1/4SW1/4		-1		
CR CC83/154	Mann Ditch	04/20/1903			Sand Creek (36-51-82)	Tom D. Rule			IRR_SW	050N	082W	01				-106.669800	44.332260

Clear Creek Watershed Direct Flow Water Rights

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P34233.0D	MARCOUX DOMESTIC PUMP	08/04/2009	Complete	0.06	Spring Creek		GERALD	MARCOUX	DOM_SW	053N	083W	07	NE1/4SW1/4		0.056	-106.904025	44.578272
CR CC22/081	Marin Ditch (MANN)	04/20/1903		1.94	Sand Creek (36-51-82)		S. J.	MCNEESE	IRR_SW	050N	082W	01	NW1/4NE1/4			-106.667270	44.337670
CR CC22/082	Marin Ditch (MANN)	04/20/1903		7.41	Sand Creek (36-51-82)		ALVIN	BENNETT	IRR_SW	050N	082W	01	NW1/4NE1/4			-106.667270	44.337670
CR CC77/072	Marin Ditch (MANN)	04/20/1903			Sand Creek (36-51-82)		CITY OF	BUFFALO	IRR_SW	050N	082W	01	NW1/4NE1/4			-106.667270	44.337670
P5423.0D	Marin Ditch (MANN)	04/20/1903	Fully Adjudicated	8.29	Sand Creek (36-51-82)				IRR_SW	050N	082W	01	NW1/4NE1/4		-1.000	-106.667523	44.337210
P22714.0D	Maroon Sprinkler Irrigatin System	10/02/1962	Fully Adjudicated	0.04	North Piney Creek		SIE	MAROON	IRR_SW	053N	084W	12	NE1/4SW1/4		0.026	-106.924539	44.579268
CR CC79/219	Marshall Supply Pipe Line	04/22/1992		0.81	Johnson Creek		GARY R.	MARSHALL	RES	051N	083W	12	SE1/4SE1/4			-106.782540	44.399510
P30838.0D	Marshall Supply Pipe Line	04/22/1992	Fully Adjudicated	0.00	Johnson Creek				RES	051N	083W	12	SE1/4SE1/4		0.810	-106.781412	44.401083
P7067.0E	Marshall Supply Pipe Line,, Cary Enlargement of the	07/15/1992	Fully Adjudicated	0.17					FIS; FTH; WIL	051N	083W	12	SE1/4SE1/4		0.810	-106.782540	44.399510
CR CC80/073	Marshall Supply Pipe Line,, Enl.	07/15/1992		0.17			GARY R.	MARSHALL	FIS	051N	083W	12	SE1/4SE1/4			-106.782540	44.399510
P21539.0D	Martin Ditch	11/29/1954	Unadjudicated	0.00	Spring Creek		A. A.	MARTIN	IRR_SW; STO	051N	083W	21	NW1/4NE1/4		5.600	-106.847600	44.381910
OR 02/186	Mathew Gorgen Ditch	05/10/1883		0.17	French Creek	John A. Fisher			IRR_SW	051N	083W	25				-106.790370	44.360990
CR CC61/262	Maverick Ditch	09/16/1935		0.76	Piney Creek		NONA	WILLIAMS	IRR_SW; STO	053N	082W	14	SW1/4NW1/4			-106.708060	44.566690
P20000.0D	Maverick Ditch	09/16/1935	Fully Adjudicated	0.76	Piney Creek				IRR_SW; STO	053N	082W	14	SW1/4NW1/4		7.750	-106.705278	44.568333
P2464.0E	Mayhew & Gorgen Ditch,, Gorgen Enlargement of	05/22/1911	Fully Adjudicated	1.48	French Creek		Peter	Gorgen	IRR_SW	051N	083W	25			-1.000	-106.785417	44.365556
P5309.0E	Mayhew and Gorgen Ditch,, Silva Enlargement of	01/10/1941		0.00	French Creek		Antonio	Silva	DOM_SW; IRR_SW; STO	051N	083W	25			14.800	-106.785417	44.365556
P4383.0E	MCBRIDE ENLARGEMENT OF JOHNSON DITCH	06/28/1923	Fully Adjudicated	2.05	Clear Creek		WILLIAM	MCBRIDE	IRR_SW	050N	082W	05	NW1/4SW1/4		18.810	-106.758100	44.330061
P14745.0D	McDonald Ditch	08/28/1916	Fully Adjudicated	0.00	North Fork Sayles Creek		JOHN H.	MCDONALD	IRR_SW	051N	083W	05	SW1/4SE1/4		2.000	-106.868397	44.413712
P12223.0D	McGrath Ditch	01/26/1914	Fully Adjudicated	1.12	Spring Creek		A.R.	MCGRATH	DOM_SW; IRR_SW; STO	051N	083W	15	SW1/4SE1/4			-106.823733	44.379588
P31631.0D	McIntyre Pump and Pipe Line	04/15/1996	Fully Adjudicated	0.17	Sand Creek (3-50-82)				IRR_SW	050N	082W	04	NE1/4SE1/4		0.254	-106.721545	44.329717
P7640.0E	MCKENZIE ENLARGEMENT OF JOHNSON DITCH	04/28/2010	Complete	6.30	Clear Creek		RAYNARD	MCKENZIE	RES	050N	082W	22	NW1/4NE1/4	20.62	25.080	-106.709278	44.293556
P34003.0D	MCMAHAN BOX #1 DIVERSION	08/06/2008	Complete	0.06	Clear Creek		JOHN AND DEE	MCMAHAN	DOM_SW ; DOM_SW	051N	081W	17	SE1/4NE1/4		0.056	-106.620458	44.391039
CR CC35/489	McMeans Ditch	10/09/1911		0.80	Clear Creek		ALEX	MCMEANS	IRR_SW	051N	081W	09	SE1/4SW1/4			-106.611420	44.399320
CR CC76/044	McMeans Ditch	10/09/1911		0.74	Clear Creek			WRIGHT RANCH COMPANY	IRR_SW	051N	081W	09	NW1/4SW1/4			-106.616510	44.402980
P11100.0D	McMeans Ditch	10/09/1911	Fully Adjudicated	0.80	Clear Creek		ALEX	MCMEANS	IRR_SW	051N	081W	09	SE1/4SW1/4		-1.000	-106.612461	44.399619
P18869.0D	McNeese Ditch	02/07/1938	Fully Adjudicated	1.44	Clear Creek		C. A.	MCNEESE	DOM_SW; IRR_SW; STO	050N	083W	01	NE1/4SW1/4		6.750	-106.791111	44.330833
P5105.0E	McNeese Ditch,, City Enlargement	02/14/1938	Fully Adjudicated		Clear Creek (drainage of)			City of Buffalo	DOM_SW; IRR_SW; STO	050N	082W	06	NE1/4NW1/4		6.75		
OR 02/194	Mead Cr. or Coffeen Ditch	05/07/1884		5.71	North Piney Creek	James Terrill			IRR_SW	053N	083W	07	SE1/4NE1/4				

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OR 02/194	Mead Cr. or Coffeen Ditch	05/07/1884		1.21	North Piney Creek	Pulaski Calvert			IRR_SW	053N	083W	07	SE1/4NE1/4				
OR 02/194	Mead Cr. or Coffeen Ditch	05/07/1884		2	North Piney Creek	Emma C. Toland			IRR_SW	053N	083W	07	SE1/4NE1/4				
OR 02/194	Mead Cr. or Coffeen Ditch	05/07/1884		10.71	North Piney Creek	H.A. Coffeen			IRR_SW	053N	084W	23	NE1/4NE1/4				
OR 02/194	Mead Cr. or Coffeen Ditch	05/07/1884		0.36	North Piney Creek	W.O. Goodhue			IRR_SW	053N	084W	23	NE1/4NE1/4				
OR 02/194	Mead Cr. or Coffeen Ditch	05/07/1884		2	North Piney Creek	Geo. C. Moose			IRR_SW	053N	084W	23	NE1/4NE1/4				
OR 02/194	Mead Cr. or Coffeen Ditch	05/07/1884		1.14	North Piney Creek	Mary Terrill			IRR_SW	053N	084W	23	NE1/4NE1/4			-106.934990	44.556160
OR 07/105	Mead Cr. or Coffeen Ditch	05/07/1884			North Piney Creek		JOE	HARATYK	IRR_SW	053N	083W	07	SE1/4NE1/4				
OR 07/360	Mead Cr. or Coffeen Ditch	05/07/1884			North Piney Creek		INC.	MEAD CREEK RANCH	IRR_SW	053N	084W	23	NE1/4NE1/4				
OR 10/512	Mead Cr. or Coffeen Ditch	05/07/1884		0.73	North Piney Creek		EVELYN N.	MOORE	DOM_SW; IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 10/514	Mead Cr. or Coffeen Ditch	05/07/1884		4.55	North Piney Creek		ALLEN O.	FORDYCE	DOM_SW; IRR_SW	053N	083W	07	SE1/4NE1/4				
OR 10/514	Mead Cr. or Coffeen Ditch	05/07/1884		0.28	North Piney Creek		ALLEN O.	FORDYCE	DOM_SW; IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 11/141	Mead Cr. or Coffeen Ditch	05/07/1884			North Piney Creek		GEORGE C.	MOOSE	IRR_SW	053N	084W	13	SE1/4SW1/4				
OR 13/163	Mead Cr. or Coffeen Ditch	05/07/1884			North Piney Creek		JAMES E.	FINERTY	IRR_SW	053N	084W	13	SE1/4SW1/4				
OR 16/134	Mead Cr. or Coffeen Ditch	05/07/1884			North Piney Creek		ORVALLE P.	SNELL	IRR_SW	053N	083W	17	NE1/4NE1/4				
CR CC14/057	Mead Cr. or Coffeen Ditch, ENLARGEMENT OF	11/30/1896	Fully Adjudicated	4.23	North Piney Creek		CATHERINE	HURLBUTT	IRR_SW	053N	083W	07	SE1/4NE1/4			-106.894619	44.581961
CR CC61/263	Mead Cr. or Coffeen Ditch, ENLARGEMENT OF	05/02/1942	Fully Adjudicated		Piney Creek		ALLEN	FORDYCE	IRR_SW	053N	083W	07	SE1/4NE1/4			-106.894617	44.581992
CR CC84/175	Mead Cr. or Coffeen Ditch, ENLARGEMENT OF	11/30/1896	Fully Adjudicated	5.37	North Piney Creek	EAGLESTONE RANCH, INC.			MIS_SW; RES	053N	084W	23	NE1/4NE1/4			-106.934978	44.556156
OR 02/432	Mead Creek or Coffeen Ditch	05/07/1884		1.00			GEORGE C.	MOOSE	IRR_SW	053N	083W	07	SE1/4NE1/4			-106.894620	44.581960
P5579.0E	Mead Creek or Coffeen Ditch,, Burns Enlargement	07/20/1951	Unadjudicated	0	South Piney Creek		Sherman W.	Burns	RES	053N	084W	23	NE1/4NE1/4		58.74		
P234.0E	Meade Creek Ditch (Coffeen Ditch),, Menardi {Enl. of) (ENL COFFEEN)	11/30/1896	Fully Adjudicated	8.7	North Piney Creek		J.B.	Menardi	DOM_SW; IRR_SW	053N	083W	07	SE1/4NE1/4		-1		
P328.0E	Meade Creek Ditch {Enl. Of} (ENL COFFEEN)	03/28/1898	Fully Adjudicated	1	North Piney Creek		Geo. E.	Moose	IRR_SW	053N	083W	07	SE1/4NE1/4		-1		
CR CB02/003	Meade Creek Ditch,, Enl.	12/27/1897		0.78	North Piney Creek		W. H.	BABIONE	IRR_SW	053N	083W	07	SE1/4NE1/4			-106.894620	44.581960
CR CC17/098	Meade Creek Ditch,, Enl.	03/28/1898		1.00	North Piney Creek		E. A.	WHITNEY	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
P3098.0E	Meade of Coffeen Ditch {Enl. of}	12/05/1914	Fully Adjudicated	1.7	North Piney Creek		Fay	Green	IRR_SW	053N	084W	23	NE1/4NE1/4		-1		
CR CC37/389	Meade of Coffeen Ditch,, Enl.	12/05/1914		1.70	North Piney Creek		FAY	GREEN	IRR_SW	053N	084W	23	NE1/4NE1/4			-106.934990	44.556160
P11131.0D	Meehan Ditch	01/23/1912		0.07	Lone Tree Creek		MARGARET G.	MEEHAN	IRR_SW	054N	081W	14	NW1/4SW1/4		-1.000	-106.588349	44.649752
P17092.0D	Metcalf Ditch	04/26/1926	Fully Adjudicated	0.91	South Fork Sayles Creek		HORACE C.	METCALF	IRR_SW	053N	081W	08	NW1/4NE1/4		1.500	-106.868505	44.410768
P22740.0D	Metz Sprinkler Irrigation System	10/02/1962	Fully Adjudicated	0.07	North Piney Creek		WILL G.	METZ	IRR_SW	053N	084W	12	NE1/4SW1/4		0.050	-106.924592	44.579258
P22338.0D	Middle Fork Campground Spring Pipeline	12/07/1962	Unadjudicated	0.12	Middle Fork Campground Spring			USDA - National Forest Service	DOM_SW	050N	084W	15	SE1/4SW1/4		0.122	-106.953509	44.301076

Clear Creek Watershed Direct Flow Water Rights

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CR CC86/184	Middle Fork Summer Home Group Lot C Pump	11/20/2006		0.03	Middle Fork Clear Creek	USDA, Forest Service, Big Horn National Forest			DOM_SW	050N	084W	15	NE1/4SW1/4			-106.953470	44.304800
P33662.0D	MIDDLE FORK SUMMER HOME GROUP LOT C PUMP	11/20/2006	Fully Adjudicated	0.03	Middle Fork Clear Creek				DOM_SW	050N	084W	15	NE1/4SW1/4		0.030	-106.953469	44.304800
OR 02/194	Mill Cr. And Mill Race Ditch	06/20/1881		37.30				C. W. HINE CO.	MIL	053N	084W					-106.972530	44.559140
P17669.0D	Mitten Ditch	02/26/1930	Fully Adjudicated	3.87	Muddy Creek		Ellis	Patch	DOM_SW; IRR_SW; STO	049N	082W	32	NE1/4SW1/4		6.75		
P5639.0E	Mo-Ditch,, First Enlargement of	09/15/1952	Fully Adjudicated				MORRIS	Weinberg	IRR_SW	055N	078W	All	SW1/4NW1/4		4.92		
P2491.0E	Moeller Ditch No. 3 {Enl. of}	02/14/1910	Fully Adjudicated	0.44	French Creek		Charles N.	Robbins	IRR_SW	051N	083W	27	SE1/4SW1/4		-1		
P2899.0E	Moeller Ditch No. 3 {Enl. of}	11/23/1905	Fully Adjudicated		North Fork Clear Creek				IRR_SW	050N	083W	27	SE1/4SW1/4				
CR CC34/190	Moeller Ditch No. 3,, Enl.	02/14/1910		0.44	French Creek		C. N.	ROBBINS	IRR_SW	051N	083W	27	SE1/4SW1/4			-106.833400	44.355410
CR CC66/487	Moeller Ditch No. One,, Enl.	05/22/1911			French Creek		JOE D.	HALL	IRR_SW	051N	083W	26				-106.810550	44.361040
CR CC62/354	Moeller No. 2 Ditch	03/20/1951		0.00	Williams Draw		JOHN W.	WILLIAMS	DOM_SW; IRR_SW; STO	051N	083W	26	SW1/4NE1/4			-106.807860	44.363740
P20716.0D	Moeller No. 2 Ditch	03/20/1951	Fully Adjudicated	0.00	Williams Draw		John W.	Williams	DOM_SW; IRR_SW; STO	051N	083W	26	SW1/4NE1/4		1.210	-106.818220	44.361811
OR 02/186	Moeller No. 3 Ditch	04/30/1883		4.28	French Creek	Alice S. Rapelyea			IRR_SW	051N	083W	27	SE1/4SW1/4			-106.833400	44.355410
P5168.0E	Moeller No. 3 Ditch,, Silva Enlargement	02/02/1931	Unadjudicated	1.36	French Creek		Antonio	Silva	IRR_SW	051N	083W	24	SW1/4NE1/4		14.4		
P5310.0E	Moeller No. One Ditch,, Silva Enl. of	01/20/1941		0.31	French Creek		Antonio	Silva	DOM_SW; IRR_SW; STO	051N	083W	26			3.900	-106.804444	44.366111
P2955.0E	Moore Ditch No. 2 {Enl. of}	05/11/1914		0.71	Rock Creek		Myra M.	Moore	IRR_SW	052N	082W	14	NE1/4SE1/4				
P8460.0D	Moore No. 1 Ditch	08/31/1906	Fully Adjudicated		Box Elder Creek		Myra M.	Moore	DOM_SW; IRR_SW; STO	052N	082W	23	SE1/4SW1/4			-106.691680	44.457227
P8444.0D	Moore No. 2 Ditch	08/31/1906		0.06	Box Elder Creek		MYRA M.	MOORE	DOM_SW; IRR_SW; POW; STO	052N	082W	23	SE1/4SW1/4		-1.000	-106.691637	44.457270
CR CC38/634	Moore Reservoir (CHANGED TO LAKE DeSMETRES)	08/31/1906		875.00	Rock Creek		J. A.	MOORE	IRR_SW	053N	082W	31	SE1/4SW1/4			-106.783400	44.516420
CR CC82/341	MOORE SUPPLY DITCH	06/08/1998		0.02	North Fork Clear Creek		DAN AND JULIA	MOORE	RES	050N	084W	12	NW1/4SW1/4			-106.917700	44.319220
P452.0D	Moore's Ditch	04/04/1893	Fully Adjudicated	2.85	Clear Creek		WILLIAM T.	MOORE	IRR_SW	052N	081W	34	NE1/4NE1/4		-1.000	-106.581667	44.438889
P34024.0D	Moss Domestic Pump	08/27/2008			Mill Creek		William D.	Moss	DOM_SW	053N	084W	12	NE1/4SE1/4			-106.914900	44.578130
OR 02/193	Mountain Ditch	06/15/1880		3.92	Shell Creek	Chas H. Burritt			IRR_SW	052N	083W	07	NE1/4SE1/4			-106.883170	44.490900
OR 02/189	Mowry Basin 2" App.	12/31/1887		0.5	South Fork	Cora Warburton			IRR_SW	052N	084W	25	SW1/4SE1/4				
OR 02/189	Mowry Basin 2" App.	12/31/1887		2.53	South Fork	Warburton & Bryant			IRR_SW	052N	084W	25	SW1/4SE1/4				
OR 02/189	Mowry Basin 2" App.	12/31/1887		0.57	South Fork	Henry Wice			IRR_SW	052N	084W	25	SW1/4SE1/4				

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OR 02/189	Mowry Basin 2" App.	12/31/1887		0.86	South Fork	Jas. H. McDonald			IRR_SW	052N	084W	25	SW1/4SE1/4			-106.908000	44.444240
OR 04/473	Mowry Basin 2" App.	12/31/1887			South Fork		CORA	WARBURTON	IRR_SW	052N	084W	25	SW1/4SE1/4				
OR 04/473	Mowry Basin 2" App.	12/31/1887			South Fork			WARBURTON BRYANT	IRR_SW	052N	084W	25	SW1/4SE1/4				
OR 04/473	Mowry Basin 2" App.	12/31/1887			South Fork		HENRY	WICE	IRR_SW	052N	084W	25	SW1/4SE1/4				
OR 02/189	Mowry Basin Ditch	10/20/1884		0.14	South Fork	Warburton & Bryant			IRR_SW	052N	084W	25	SW1/4SE1/4				
OR 04/473	Mowry Basin Ditch	10/20/1884			South Fork			WARBURTON BRYANT	IRR_SW	052N	084W	25	SW1/4SE1/4				
OR 04/685	Mowry Basin Ditch	10/20/1884		1.00	South Fork	J.S. Lincoln			IRR_SW	052N	083W	29	NE1/4NW1/4			-106.873090	44.454730
P2390.0E	Mowry Basin Ditch {Enl. of}	07/25/1910	Fully Adjudicated	5.46	South Fork		William	Bryant	IRR_SW	052N	084W	25	SW1/4SE1/4		-1		
P4015.0E	Mowry Basin Ditch {Enl. of}	06/30/1919	Fully Adjudicated	0	South Fork		F.O.	Horton	DOM_SW; IRR_SW; STO	052N	084W	25	SW1/4SE1/4		15		
CR CC32/234	Mowry Basin Ditch,, Enl.	07/25/1910		5.46	South Fork		J. G.	OLIVER	IRR_SW	052N	084W	25	SW1/4SE1/4			-106.908000	44.444240
CR CC82/200	Mowry Basin Ditch,, Enl.	06/30/1919		0.00	South Fork	Love Land & Cattle Company			DOM_SW; IRR_SW; STO	052N	084W	25	SW1/4SE1/4			-106.908000	44.444240
CR CC81/029	MUELLER & LEITNER DITCH	05/15/1885	Fully Adjudicated	0.86	South Piney Creek		CLARENE	LAW	IRR_SW	053N	084W	13	SE1/4SE1/4			-106.913061	44.561106
OR 02/194	Mueller & Leitner Ditch	05/15/1885		0.19	South Piney Creek	Rudolph Mueller			IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
OR 02/194	MUELLER & LEITNER DITCH	05/15/1885		0.86	South Piney Creek		JOHN	LEITNER	IRR_SW	053N	084W	13	SE1/4SE1/4			-106.913061	44.561106
OR 56/095	Mueller & Leitner Ditch	05/15/1885			South Piney Creek		JACK	HOWELL	IRR_SW	053N	084W	13	SE1/4SE1/4				
CR CC81/030	MUELLER & LEITNER DITCH 2" APP.	05/15/1889	Fully Adjudicated	0.57	South Piney Creek		JOHN	LEITNER	IRR_SW	053N	083W	18	NW1/4SW1/4			-106.909858	44.563367
OR 02/194	MUELLER & LEITNER DITCH 2" APP.	05/15/1889	Fully Adjudicated	0.58	South Piney Creek		JOHN	LEITNER	IRR_SW	053N	083W	18	NW1/4SW1/4			-106.909858	44.563367
OR 56/095	Mueller & Leitner Ditch 2" App.	05/15/1889			South Piney Creek		JACK	HOWELL	IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 56/095	Mueller & Leitner Ditch 2" App.	05/15/1889		0.03	South Piney Creek	Alfred T. Bacon			IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
OR 02/194	Mueller (Miller) Ditch	08/15/1888		0.21	South Piney Creek	Rudolph Mueller			IRR_SW	053N	083W	18	SE1/4NW1/4			-106.904830	44.566910
CR CC64/357	Mueller and Leitner Ditch	06/30/1953		50.00	South Piney Creek		CRAWFORD CATHERINE	GORDON	IRR_SW	053N	083W	18	NW1/4SW1/4			-106.909850	44.563360
CR CC81/031	Mueller and Leitner Ditch	06/30/1953			South Piney Creek		JACK	HOWELL	IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
P21210.0D	Mueller and Leitner Ditch	06/30/1953	Fully Adjudicated		South Piney Creek		FRED G. & NELLIE MAY	HOSBURG	IRR_SW	053N	084W	13	SE1/4SE1/4		2.08		
CR CC76/013	Mueller and Leitner Ditch - Hanft Spring No. 1 Diversion	05/28/1985		0.00	Hanft Spring No. 1		DALE M.	WILLAVIZE	IRR_SW	053N	083W	18	NE1/4SW1/4			-106.904790	44.563330
P29272.0D	Mueller and Leitner Ditch - Hanft Spring No. 1 Diversion	05/28/1985	Fully Adjudicated	0.00	Hanft Spring No. 1			JOHN E. HANFT REVOCABLE TRUST	IRR_SW	053N	083W	18	NE1/4SW1/4		2.080	-106.904575	44.564666
OR 02/194	Mueller Ditch 2" App.	05/31/1891		0.07		E.B. Williams			IRR_SW	053N	083W	18	NW1/4SW1/4			-106.909850	44.563360
P18175.0D	Mueller Pipe Line	10/10/1932	Fully Adjudicated	0.06			Rudolph	Mueller	DOM_SW; IRR_SW; STO	053N	083W	22	SE1/4SE1/4		0.055	-106.834190	44.545420
P21088.0D	Mueller Pumping Station No. 1 Sprinkler Irrigation System	10/14/1952	Unadjudicated	0.01	Clear Creek		PHILIP F.	MUELLER	IRR_SW	054N	079W	31	NE1/4SE1/4		0.030	-106.411505	44.606883
P21089.0D	Mueller Pumping Station No. 2 Sprinkler Irrigation System	10/14/1952	Unadjudicated	0.06	Clear Creek		PHILIP F.	MUELLER	IRR_SW	054N	079W	31	NE1/4SE1/4		0.060	-106.411396	44.606904
P21090.0D	Mueller Pumping Station No. 3 Sprinkler Irrigation System	10/14/1952	Unadjudicated	0.10	Clear Creek		PHILIP E.	MUELLER	IRR_SW	054N	079W	31	NE1/4SE1/4		0.100	-106.411293	44.606925

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CR CC83/153	Nelson Ditch	01/28/1919			Bull Creek	Tome D. Rule			IRR_SW	050N	082W	13	NE1/4NW1/4			-106.672170	44.308680
P15358.0D	Nelson Ditch	01/28/1919	Fully Adjudicated	1.13	Bull Creek		Oscar	Nelson	IRR_SW	050N	082W	13	NE1/4NW1/4		1.640	-106.671946	44.308849
P19288.0D	Nelson Pipe Ditch	12/15/1939	Fully Adjudicated	0.03			E.B.	NELSON	DOM_SW	053N	083W	18	NE1/4NE1/4		0.028	-106.894700	44.570470
CR CC74/239	Nelson Sprinkler	03/03/1980		0.08	North Piney Creek		LEO C. MARY A.	NELSON	MIS_SW	053N	083W	08	SW1/4SE1/4			-106.879490	44.574470
P27592.0D	Nelson Sprinkler	03/03/1980	Fully Adjudicated	0.08	North Piney Creek				MIS_SW	053N	083W	08	SW1/4SE1/4		0.078	-106.878252	44.574879
CR CC76/169	Neltje No. 1 Pump and Pipeline	11/05/1986		0.00	Piney Creek			NELTJE	IRR_SW	053N	082W	11	SW1/4SE1/4			-106.697920	44.574050
P29704.0D	Neltje No. 1 Pump and Pipeline	11/05/1986	Fully Adjudicated	0.11	Piney Creek				IRR_SW	053N	082W	11	SW1/4SE1/4		0.111	-106.699167	44.579444
CR CC38/078	Neva Ditch	05/23/1913		1.14	Little North Fork Shell Creek		DOUGLAS B.	SPARKS	IRR_SW	052N	083W	10	SE1/4SE1/4			-106.822810	44.486800
P11823.0D	Neva Ditch	05/23/1913	Fully Adjudicated	1.14	Little North Fork Shell Creek		DOUGLAS B.	SPARKS	IRR_SW	052N	083W	10	SE1/4SE1/4			-106.822130	44.485748
P9348.0D	No Name Provided	09/18/1909	Fully Adjudicated	0.00	Johnson Creek		FRED	FIRNEKAS	IRR_SW	051N	083W	29	NE1/4NW1/4			-106.872500	44.366800
CR CC31/365	No. 2 Reservoir	10/24/1908		25.50	Number Two Draw		DONALD	THOMSON	STO	054N	078W	30	NW1/4SW1/4			-106.301510	44.621650
P12149.0D	North Ditch	10/04/1913	Fully Adjudicated	1.69	North Prong Shell Creek		S.J.	GRINNELL	IRR_SW	052N	083W	02	SE1/4NW1/4			-106.812902	44.508169
OR 02/182	North Fork & French Cr. Ditch	12/31/1885		0.86	North Fork Clear Creek	Alfred T. Bacon			IRR_SW	050N	084W	06	NE1/4NE1/4				
OR 02/182	North Fork & French Cr. Ditch	12/31/1885		2.56	North Fork Clear Creek	Alfred T. Bacon			IRR_SW	050N	084W	06	NE1/4NE1/4				
OR 02/182	North Fork & French Cr. Ditch	12/31/1885		1.43	North Fork Clear Creek	Robert Foote			IRR_SW	050N	084W	06	NE1/4NE1/4				
OR 02/182	North Fork & French Cr. Ditch	12/31/1885		0.86	North Fork Clear Creek	Robert Foote			IRR_SW	050N	084W	06	NE1/4NE1/4			-107.005960	44.341760
OR 02/182	North Fork & French Cr. Ditch	12/31/1885		1.78	North Fork Clear Creek	Church H. Cooke			IRR_SW	050N	084W	06	NE1/4NE1/4			-107.005960	44.341760
OR 10/331	North Fork & French Cr. Ditch	12/31/1885			North Fork Clear Creek		ANTONIO	SILVA	IRR_SW	050N	084W	06	NE1/4NE1/4				
OR 10/332	North Fork & French Cr. Ditch	12/31/1885			North Fork Clear Creek		ANTONIO	SILVA	IRR_SW	050N	084W	06	NE1/4NE1/4				
OR 15/437	North Fork & French Cr. Ditch	12/31/1885			North Fork Clear Creek		JOE D.	HALL	IRR_SW	050N	084W	06	NE1/4NE1/4				
T2123.0-	North Fork & French Cr. Ditch	12/31/1885			North Fork Clear Creek		EARL	HILLARD		050N	084W	06	NE1/4NE1/4				
OR 02/182	North Fork & French Cr. Ditch 3rd App.	10/31/1889		4.28	North Fork Clear Creek	E.A. Whitney			IRR_SW	050N	084W	06	NE1/4NE1/4			-107.005960	44.341760
OR 02/182	North Fork & French Cr. Ditch 3rd App.	12/31/1889		2.28	North Fork Clear Creek	Annie Holloway			IRR_SW	050N	084W	06	NE1/4NE1/4			-107.005960	44.341760
P6730.0E	North Fork Ditch,, 2nd Enlargement of the	11/19/1974	Fully Adjudicated	0	Burnett Creek				IRR_SW	049N	082W	28	SE1/4SE1/4		54.36		
P5917.0E	North Fork Ditch,, Enlargement of	11/04/1957	Fully Adjudicated	0	North Fork Crazy Woman Creek		George H.	Nimick	RES	049N	082W	33	NW1/4NW1/4		39.8		
P6356.0E	North Fork Ditch,, Nimick Enlargement of	04/06/1970	Fully Adjudicated	0.87	North Fork Crazy Woman Creek		George H.	Nimick	IRR_SW	049N	082W	33	NW1/4NW1/4		39.8		
P31743.0D	Old Stockyard Pipeline	03/25/1997	Fully Adjudicated	4.00	Sand Creek (36-51-82)		Wayne	Nelson	FIS; FTH; RES	051N	082W	36	SE1/4SW1/4		4.000	-106.672300	44.345748
OR 02/189	Ono Ditch	04/30/1880		1.14	Rock Creek	Robert Foote			IRR_SW	051N	082W	24	SE1/4SW1/4				
OR 02/189	Ono Ditch	04/30/1880		2.07	Rock Creek	Cullen Watt			IRR_SW	051N	082W	24	SE1/4SW1/4				
OR 10/075	Ono Ditch	04/30/1880			Rock Creek		ROBERT C.	WATT	IRR_SW	051N	082W	24	SE1/4SW1/4				
OR 11/596	Ono Ditch	04/30/1880			Rock Creek		RALPH	ROBINSON	IRR_SW	051N	082W	24	SE1/4SW1/4			-106.674417	44.368894
P18673.0D	Otto Ditch	04/06/1936	Fully Adjudicated	0.03	Spring Creek		SARA A.	ERNST	IRR_SW	053N	083W	07	NW1/4SW1/4		0.280	-106.899696	44.581977
P18674.0D	Otto Pipe Line	04/06/1936	Fully Adjudicated	0.01	Spring Creek		SARA A.	ERNST	DOM_SW	053N	083W	07	NW1/4SW1/4		0.010	-106.909646	44.578076
P5828.0E	P X Ditch,, 1st Enlargement of	11/15/1955	Fully Adjudicated	0			Richard E. & Patricia D.	Tass	RES	049N	082W	32	SW1/4SE1/4		17.39		
P7081.0E	P X Ditch,, McPhee/Patch Pipeline Enlargement of the	12/08/1993	Unadjudicated	4.57					IRR_SW	049N	082W	32	SW1/4SE1/4		17.39		

Clear Creek Watershed Direct Flow Water Rights

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CR CC44/621	P.D.-3 Ditch	12/06/1920		0.00	Jenks Creek		PETER	DEMPLE	IRR_SW	053N	083W	08	SW1/4SW1/4			-106.889610	44.574260
CR CC79/279	Paradise No. 1 Pipeline	02/13/1989		0.08	French Creek		WOODLAND HILLS IMPR.	SERV DIST.	DOM_SW	051N	084W	34	SW1/4SW1/4			-106.959830	44.343310
P30420.0D	Paradise No. 1 Pipeline	02/13/1989	Fully Adjudicated	0.09	French Creek				DOM_SW	051N	084W	34	SW1/4SW1/4		0.085	-106.959649	44.343323
CR CC76/331	Pence Ditch	12/01/1952		1.04	Lone Tree Creek		LOIS	WILLIAMS	IRR_SW	054N	080W	23	NW1/4SW1/4			-106.466680	44.634650
P21113.0D	Pence Ditch	12/01/1952	Fully Adjudicated	1.04	Lone Tree Creek		ERNEST M.& AUDRA I.	PENCE	IRR_SW	054N	080W	23	NW1/4SW1/4		12.460	-106.465462	44.633658
CR CC71/200	PENROSE DITCH	01/31/1931	Fully Adjudicated	0.00	French Creek		OWEN	MILLER	IRR_SW	051N	083W	27	NW1/4SW1/4			-106.836461	44.357294
CR CC71/201	Penrose Ditch	01/31/1931		0.00	French Creek		NIELS P.	NIELSON	IRR_SW	051N	083W	27	NE1/4SW1/4			-106.833360	44.359020
CR CC71/202	Penrose Ditch	01/31/1931		0.00	French Creek		HAZEL A.	PATTERSON	IRR_SW	051N	083W	27	NE1/4SW1/4			-106.833360	44.359020
P17927.0D	Penrose Ditch	01/31/1931	Fully Adjudicated	0.00	French Creek		A.C.	Andersen	IRR_SW	051N	083W	27	NE1/4SW1/4		17.330	-106.835111	44.357694
OR 39/096	Peralta Ditch	11/01/1885			Cross Creek		ELDON	SANDBERG	IRR_SW	053N	085W	01	SW1/4NE1/4				
OR 39/096	Peralta Ditch	11/01/1885			Cross Creek		ORLA K	ALLEN	IRR_SW	053N	085W	01	SW1/4NE1/4				
P4298.0E	Peralta Ditch {Enl. of}	11/07/1921	Fully Adjudicated	18.48	Little Goose Creek		Emma W.	Sackett	DOM_SW; IRR_SW; STO	053N	085W	01	SW1/4NE1/4		51.43		
P5601.0E	Peralta Ditch,, Enlargement	02/07/1952	Unadjudicated	0	Little Goose Creek		Otto	Kusel	IRR_SW	053N	085W	01	SW1/4NE1/4		72		
P5979.0E	Peralta Ditch,, Enlargement of the	04/14/1952	Fully Adjudicated	0	Little Goose Creek		S. Watts	Smyth	IRR_SW	053N	085W	01	SW1/4NE1/4		65		
P6340.0D	Peterson Ditch No. 1	11/21/1904	Fully Adjudicated	0.43	H. A. Creek		John H.	Peterson	DOM_SW; IRR_SW; STO	052N	083W	22	SE1/4NE1/4			-106.823015	44.464454
P6341.0D	Peterson Ditch No. 2	11/21/1904	Fully Adjudicated	0.43	Spring Creek		John H.	Peterson	DOM_SW; IRR_SW; STO	052N	083W	23	NE1/4SW1/4			-106.810871	44.460101
OR 02/189	Pheasant Ditch	12/31/1884		0.43	North Fork Rock Creek	James R. Hutton			IRR_SW	052N	084W	23	SE1/4NE1/4			-106.922860	44.465970
CR CC35/499	Pierson Ditch	02/13/1912		0.44	Johnson Creek		CHARLES	PIERSON	IRR_SW	051N	083W	22	SW1/4SW1/4			-106.838150	44.370480
P11152.0D	Pierson Ditch	02/13/1912	Fully Adjudicated	0.44	Johnson Creek		CHAS.	PIERSON	IRR_SW	051N	083W	10	NE1/4NW1/4			-106.814334	44.394971
CR CC74/240	Pierson Ditch JM Draw Diversion	01/24/1966		0.00	J M Draw			LOVE LAND CATTLE COMPANY	IRR_SW	051N	083W	14	NE1/4NW1/4			-106.812810	44.396030
P23051.0D	Pierson Ditch JM Draw Diversion	01/24/1966	Fully Adjudicated	0.00	J M Draw			Rentuer, Inc.	IRR_SW	051N	083W	14	NE1/4NW1/4		5.920	-106.811532	44.397413
P1434.0E	Piney & Cruse Cr. Ditch also Robinson & Zullig Ditch,, A. W. Butterfield Ditch {Enl. of}	06/24/1905	Fully Adjudicated	0.5	South Piney Creek		A.W.	Butterfield	IRR_SW	053N	084W	13	SE1/4SW1/4		-1		
CR CC22/060	Piney & Cruse Cr. Ditch also Robinson & Zullig Ditch,, Enl.	06/24/1905		0.52	South Piney Creek		A. W.	BUTTERFIELD	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
CR CC63/180	Piney & Cruse Creek Ditch	09/02/1952		200.00	South Piney Creek		GEORGE W.	DAVIS	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
P21032.0D	Piney & Cruse Creek Ditch	09/02/1952	Fully Adjudicated	0.00	South Piney Creek		Houston & Iris	Duncan	IRR_SW	053N	084W	13	SE1/4SW1/4		94.360	-106.925278	44.558333
CR CC22/058	Piney & Cruse Creek Ditch,, Enl.	12/12/1902		0.50	South Piney Creek		CLARA P.	SURRENA	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
CR CC39/516	Piney & Cruse Creek Ditch,, Enl.	06/10/1918		1.14			HERBERT E.	ZULLIG	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
P3927.0E	Piney & Cruse Creek Ditch,, Robinson - Zullig Ditch,, Extension No. 2 (ENL PINEY & CRUSEENL ROBINSON-ZULLIG)	06/10/1918	Fully Adjudicated	1.14			Herbert E.	Zullig	IRR_SW	053N	083W	08	NE1/4SW1/4		-1		
P1086.0E	Piney & Cruse Creek Ditch,, Surrena Lateral	12/12/1902	Fully Adjudicated	0.5	South Piney Creek		Clara B.	Surrena	IRR_SW	053N	083W	08	NE1/4SW1/4		-1		
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.64	North Piney Creek	Geo. J. Harper			IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.86	North Piney Creek	David J. Larison			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		1.00	North Piney Creek	Geo. C. Moose			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180

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OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.57	North Piney Creek	Rebecca Orr			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.57	North Piney Creek	Helen Hollingsworth			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.36	North Piney Creek	Campbell W. Stroud			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		1.29	North Piney Creek	William Sherman			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.60	North Piney Creek	John M. Burnside			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.57	North Piney Creek	Benjamin F. Perkins			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		1.00	North Piney Creek	Ethelbert Hollingsworth			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.71	North Piney Creek	Andrew Harper			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.57	North Piney Creek	Wm. F. Brittian			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.53	North Piney Creek	Margaret Hutsonpiller			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.01	North Piney Creek	Robt. J. Payne			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.86	North Piney Creek	Henry Sollenbach			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.29	North Piney Creek	Dell M. Ray			DOM_SW; IRR_SW; STO	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		0.14	North Piney Creek	Perry Duncan			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 1st App.	07/20/1885		1.43	North Piney Creek	Cornwall B. Stroud			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 10/073	Piney & Cruse Ditch 1st App.	07/20/1885			North Piney Creek		MINNIE M.	STOVER	IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 10/442	Piney & Cruse Ditch 1st App.	08/03/1885					EVELYN N.	MOORE	DOM_SW; IRR_SW; STO	053N	083W	18	NE1/4NE1/4				
OR 10/442	Piney & Cruse Ditch 1st App.	08/03/1885					EVELYN N.	MOORE	DOM_SW; IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 18/372	Piney & Cruse Ditch 1st App.	08/03/1885					EDITH	BROKAW	DOM_SW; IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.86	North Piney Creek	Martin L. Holcomb			IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.71	North Piney Creek	Rebecca Orr			IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.71	North Piney Creek	Rebecca Orr			IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		2	North Piney Creek	David J. Larison			IRR_SW	053N	084W	13	SE1/4SW1/4				
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		2	North Piney Creek	David J. Larison			IRR_SW	053N	084W	13	SE1/4SW1/4				
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		2.29	North Piney Creek	Geo. C. Moose			IRR_SW	053N	084W	13	SE1/4SW1/4				
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		2.29	North Piney Creek	Geo. C. Moose			IRR_SW	053N	084W	13	SE1/4SW1/4				
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.37		Martin L. Holcomb			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180

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OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.07		Andrew Harper			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.71	North Piney Creek	Amy F. Hopkins			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.00	North Piney Creek	Andrew J. Edwards			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.71	North Piney Creek	Perry Surrena			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.79	North Piney Creek	Pinkney T. Barnes			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.14	North Piney Creek	Perry Duncan			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		4.43		Robt. B. Robinson			IRR_GW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.14	North Piney Creek	Levi Wood			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.58	North Piney Creek	Matt & C.H. Oser			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.34		Geo. J. Harper			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.00		Pulaski Calvert			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.93		Margaret Hutsonpillar			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.47		Wm. F. Brittian			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.14	North Piney Creek	Mattie Starr			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.99		Campbell W. Stroud			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.14		Robert J. Payne			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.21		Henry Sollenbach			DOM_GW; IRR_GW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.43		Ellen Hollingsworth			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.43	North Piney Creek	John F. Jennings			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.57		John M. Burnside			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.26		Wm. Sherman			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		0.04		Chas. W. Bard			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.14	North Piney Creek	Frank J. Wood			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		3.14	North Piney Creek	John F. Robertson			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/194	Piney & Cruse Ditch 2nd App.	12/31/1891		1.14	North Piney Creek	Clinton D. Day (Rev.)			IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 07/102	Piney & Cruse Ditch 2nd App.	12/31/1891			North Piney Creek		SARAH ANNA	BABIONE	IRR_SW	053N	084W	23	NE1/4NE1/4				
OR 07/105	Piney & Cruse Ditch 2nd App.	12/31/1891			North Piney Creek		JOE	HARATYK	IRR_SW	053N	083W	07	SE1/4NE1/4				
OR 10/073	Piney & Cruse Ditch 2nd App.	12/31/1891			North Piney Creek		MINNIE M.	STOVER	IRR_SW	053N	083W	08	NE1/4SW1/4				
T2341.0-	Piney & Cruse Ditch 2nd App.	12/31/1891			North Piney Creek	Ethelbert Hollingsworth				053N	084W	13	SE1/4SW1/4				
T2347.0E	Piney & Cruse Ditch 2nd App.	12/31/1891				Dell M. Ray				053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
CR CC22/059	Piney & Cruse Ditch,, Enl.	02/16/1903		1.04			ELIAS S.	LEECH	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
OR 02/520	Piney and Cruse Creek Ditch	07/20/1885		1.29			WILLIAM	SHERMAN	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180

Clear Creek Watershed Direct Flow Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	TOTAL FLOW	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	TOTAL CAPACITY (AF/Yr)	DIVERSION CAPACITY AT HEAD GATE	LONGITUDE	LATITUDE
P359.0E	Piney and Cruse Creek Ditch {Enl. of} (ENL PINEY & CRUSE)	08/12/1898	Fully Adjudicated	1.37	North Piney Creek		Elizabeth	Mumper	IRR_SW	053N	083W	08	NE1/4SW1/4		-1		
CR CC22/052	Piney and Cruse Creek Ditch,, Enl.	08/12/1898		1.37	North Piney Creek		S. J.	DUNCAN	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
CR CC76/333	Piney and Cruse Creek Ditch,, Enl.	07/08/1988		2.31	South Piney Creek		DELORES A.	NOLAN	FIS; RES	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
P6893.0E	Piney and Cruse Creek Ditch,, Spielman Enlargement of the	07/08/1988	Fully Adjudicated	2.31	South Piney Creek		Ann	Spielman	FIS; RES	053N	084W	13	SE1/4SW1/4		89.7		
CR CC14/058	Piney and Cruse Ditch,, Enl.	08/07/1903		1.88			ELIZABETH	ZULLIG	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC22/057	Piney and Dutch Creek Ditch & Mead Cr. Ditch (ENL MEAD CREEK ENL COFFEEN)	08/02/1902		1.42	North Piney Creek		MALCOLM	MONCREIFFE	IRR_SW	053N	083W	07	SE1/4NE1/4			-106.894620	44.581960
P891.0E	Piney and Dutch Creek Ditch & Mead Cr. Ditch (ENL MEAD CREEK ENL COFFEEN)	08/02/1902	Fully Adjudicated	1.71	North Piney Creek		Martha J.	White	IRR_SW	053N	083W	07	SE1/4NE1/4		-1		
P4365.0E	Piney Cruse Creek Ditch,, Duncan Enlargement No. 2	06/25/1923	Fully Adjudicated	0			S.J.	Duncan	IRR_SW	053N	083W	08	NE1/4SW1/4		-1		
CR CC43/557	Piney Cruse Creek Ditch,, Enl.	06/15/1923		0.97	South Piney Creek		S. J.	DUNCAN	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
CR CC43/558	Piney Cruse Creek Ditch,, Enl.	06/25/1923		0.00			MRS. S. J.	DUNCAN	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Piney Divide 1st App. Ditch	05/01/1886		0.86	South Piney Creek	Theo Kutcher			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 02/194	Piney Divide 1st App. Ditch	05/01/1886		0.57	South Piney Creek	S.I. Brown			IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
OR 02/194	Piney Divide 1st App. Ditch	05/01/1886		0.24	South Piney Creek	Jas. R. Babcock			IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
OR 02/200	Piney Divide 1st App. Ditch	05/01/1886		0.4	South Fork South Piney Creek	W.W. Harvey			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 07/126	Piney Divide 1st App. Ditch	05/01/1886			South Fork South Piney Creek		CLEO Z.	SPURRIER	IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 07/126	Piney Divide 1st App. Ditch	05/01/1886			South Fork South Piney Creek		CLEO Z.	SPURRIER	IRR_SW	053N	084W	13	SW1/4SE1/4				
OR 07/230	Piney Divide 1st App. Ditch	05/01/1886			South Fork South Piney Creek		CLEO Z.	SPURRIER	IRR_SW	053N	084W	13	SW1/4SE1/4				
OR 48/123	Piney Divide 1st App. Ditch	05/01/1886			South Piney Creek		JACK	HOWELL	IRR_SW	053N	084W	13	SE1/4SE1/4				
CR CC63/181	Piney Divide Ditch	08/02/1951		50.00	South Piney Creek		RUBY	MERCHANT	IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
CR CC63/291	Piney Divide Ditch	10/10/1950			South Piney Creek		LUCY G.	LEACH	IRR_SW; STO	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
CR CC64/433	Piney Divide Ditch	05/13/1955		50.00	South Piney Creek		THOMAS F.	KEARNS	IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
P20616.0D	Piney Divide Ditch	10/10/1950	Fully Adjudicated	0.00	South Piney Creek		Lucy G.	Leach	IRR_SW; STO	053N	084W	13	SE1/4SE1/4		38.060	-106.913056	44.561111
P21080.0D	Piney Divide Ditch	08/02/1951	Fully Adjudicated	0.00	South Piney Creek		BELL	SCOTT	IRR_SW	053N	084W	13	SE1/4SE1/4		38.060	-106.913056	44.561111
P21340.0D	Piney Divide Ditch	12/21/1953	Unadjudicated	0.00	South Piney Creek		Erle & Edith Ann	Simpson	IRR_SW	053N	084W	13	SE1/4SE1/4		38.060	-106.913056	44.561111
P21606.0D	Piney Divide Ditch	05/13/1955	Fully Adjudicated	0.00	South Piney Creek		D. ORREL	GEIER	IRR_SW	053N	084W	13	SE1/4SE1/4		38.060	-106.913056	44.561111
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		0.86	South Piney Creek	Rudolph Mueller			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		0.86	South Piney Creek	Rudolph Mueller			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		1.07	South Piney Creek	Horace Brown			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		1.57	South Piney Creek	T.M. Dodge			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		1.57	South Piney Creek	T.M. Dodge			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		0.5	South Piney Creek	G.A. Sonnamaker			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		1.21	South Piney Creek	Clara B. Hosburgh			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		1.86	South Piney Creek	S.I. Brown			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		1.86	South Piney Creek	S.I. Brown			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 02/194	PINEY DIVIDE DITCH 2ND APP.	12/31/1887		3.57	South Piney Creek		CHRISTIAN	HEPP	IRR_SW	053N	083W	34	NW1/4SE1/4			-106.841464	44.522094
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		1.50	South Piney Creek	Mary J. Brown			IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		1.14	South Piney Creek	Fred Hosburgh			IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790

Clear Creek Watershed Direct Flow Water Rights

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OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		0.14	South Piney Creek	Howard A. West			IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		1.00	South Piney Creek	Gilbert H. Dodge			IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		2.29	South Piney Creek	Robert W. Fullerton			IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
OR 02/194	Piney Divide Ditch 2nd App.	12/31/1887		0.58	South Piney Creek	Moses Dodge			IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
OR 02/200	Piney Divide Ditch 2nd App.	05/01/1886		0.4	South Fork South Piney Creek	W.W. Harvey			IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 04/608	Piney Divide Ditch 2nd App.	12/31/1887			South Piney Creek		HORACE	BROWN	IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 07/190	Piney Divide Ditch 2nd App.	12/31/1887			South Piney Creek		GEORGE C.	PILLEY	IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 12/344	Piney Divide Ditch 2nd App.	12/31/1887			South Piney Creek		RUBY	MERCHANT	IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 13/112	Piney Divide Ditch 2nd App.	12/31/1887			South Piney Creek		LUCY G.	LEACH	IRR_SW	053N	084W	13	SE1/4SE1/4				
OR 48/123	Piney Divide Ditch 2nd App.	12/31/1887			South Piney Creek		JACK	HOWELL	IRR_SW	053N	084W	13	SE1/4SE1/4				
T2323.0-	Piney Divide Ditch 2nd App.	12/31/1887			South Piney Creek		G. A.	SONNAMAKER		053N	084W	13	SE1/4SE1/4				
P5616.0E	Piney Divide Ditch,, Brown No. 1 Lateral Extension of	03/31/1952	Fully Adjudicated	0	South Fork South Piney Creek		Lucy G.	Leach	IRR_SW	053N	083W	29	SW1/4NW1/4		38.06		
CR CC22/051	Piney Divide Ditch,, Enl.	10/06/1896		1.30	South Piney Creek		RUDOLPH	MUELLER	IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
CR CC62/405	Piney Divide Ditch,, Enl.	03/31/1952		50.00	South Fork South Piney Creek		LUCY G.	LEACH	IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
CR CC63/292	Piney Divide Ditch,, Enl.	03/31/1952			South Fork South Piney Creek		LUCY G.	LEACH	IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
CR CC64/278	Piney Divide Ditch,, Enl.	02/07/1955		1.90	South Piney Creek		LUCY G.	LEACH	IRR_SW	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
CR CC75/239	Piney Divide Ditch,, Enl.	12/20/1979		5.96				TEXACO INC.	FIS	053N	084W	13	SE1/4SE1/4			-106.914870	44.559790
P5795.0E	Piney Divide Ditch,, Goodwin Enl.	02/07/1955	Fully Adjudicated	1.19	South Piney Creek		Lucy G.	Leach	IRR_SW	053N	084W	13	SE1/4SE1/4		45.2		
P248.0E	Piney Divide Ditch,, Little Piney Divide Ditch {Enl. of)	10/06/1896	Fully Adjudicated	1.31	South Piney Creek		Rudolph	Mueller	IRR_SW	053N	083W	18	SE1/4SE1/4		-1		
P6801.0E	Piney Divide Ditch,, Texaco Enlargement of the	12/20/1979	Fully Adjudicated	5.96				Texaco, Inc.	FIS	053N	084W	13	SE1/4SE1/4		40.26		
CR CC69/450	Piney-Cruse Creek Ditch	10/18/1961		600.00	South Piney Creek		LAURA	WILCOXSON	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
CR CC74/314	Piney-Cruse Creek Ditch	10/18/1961		35.00	South Piney Creek		LTD.	KIRVEN RANCH	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
CR CC75/377	Piney-Cruse Creek Ditch	10/18/1961			South Piney Creek		LTD.	KIRVEN RANCH	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
P16769.0D	Piney-Cruse Creek Ditch	12/06/1920	Unadjudicated	0.00	South Piney Creek		W.S.	METZ	IRR_SW	053N	083W	08	NW1/4SW1/4		50.000	-106.887778	44.578611
P22782.0D	Piney-Cruse Creek Ditch	10/18/1961	Fully Adjudicated	0.00	South Piney Creek		WILLIAM J.	KIRVEN	IRR_SW	053N	084W	13	SE1/4SW1/4		89.700	-106.925278	44.558333
OR 02/193	Pioneer Ditch	04/15/1879		0.86	Little N Fk Shell Creek	Chas H. Burritt			IRR_SW	052N	083W	15	NW1/4NW1/4			-106.837990	44.483080
CR CC57/343	Pipe Line Ditch	12/07/1939		2.00	Clear Creek			TOWN OF BUFFALO	DOM_SW; IND_SW; IRR_SW; MUN_SW	050N	082W	05	NE1/4SE1/4			-106.742840	44.330030
CR CC65/146	Pipe Line Ditch	06/20/1883			Clear Creek			JOHNSON COUNTY	IRR_SW	050N	082W	05	NE1/4SE1/4			-106.742840	44.330030
P19276.0D	Pipe Line Ditch	12/07/1939	Fully Adjudicated	2	Clear Creek			City of Buffalo	DOM_SW; IND_SW; IRR_SW; MUN_SW	050N	082W	06	SE1/4NE1/4		2		
P7221.0E	Pipe Line Ditch,, 1st Enlargement of the	06/13/1996	Fully Adjudicated	10.34				City of Buffalo	FTH; RES; WET	050N	082W	06	SE1/4NE1/4		2		

Clear Creek Watershed Direct Flow Water Rights

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CR CC81/442	Pipe Line Ditch,, Enl.	06/13/1996		0.69		City of Buffalo			WET	050N	082W	06	SE1/4NE1/4			-106.763040	44.333670
OR 48/183	Pollock Ditches No. 1&2	06/20/1888			Little Laramie River		TONGUE RIVER	MIDDLE SCHOOL	IRR_SW	051N	082W	36	SE1/4SW1/4				
CR CC66/096	Pond Ditch	09/03/1957		0.00	Lillian Springs		CHARLES E.	CORMANY	IRR_SW	053N	083W	18	NW1/4NW1/4			-106.909930	44.570520
P21901.0D	Pond Ditch	09/03/1957	Fully Adjudicated	0.02	Lillian Springs		CHARLES E. & LILLIAN E.	CORMANY	IRR_SW	053N	083W	18	NW1/4NW1/4		2.100	-106.909928	44.570513
CR CC66/095	Pond Pipe Line and Pump	09/03/1957		0.00	Cormany Springs		CHARLES E.	CORMANY	DOM_SW; IRR_SW	053N	083W	18	NE1/4NW1/4			-106.904870	44.570500
P21902.0D	Pond Pipe Line and Pump	09/03/1957	Fully Adjudicated	0.20	Cormany Springs		CHARLES E. & LILLIAN E.	CORMANY	DOM_SW; IRR_SW	053N	083W	18	NE1/4NW1/4		0.222	-106.904874	44.570499
P13928.0D	Pope Ditch No. 1	12/03/1915		0.70	Gulch		MARY S.	POPE	IRR_SW	056N	079W	11	SE1/4SW1/4		6.000	-106.340920	44.834161
P13929.0D	Pope Ditch No. 1	12/31/1915		0.47	Gulch		MARY S.	POPE	IRR_SW	056N	079W	11	SE1/4SW1/4		6.000	-106.340961	44.834221
CR CC35/494	Post Ditch	05/25/1910		0.73	Post Draw		NIELS C.	SORENSON	IRR_SW	057N	077W	28	SE1/4NE1/4			-106.138560	44.892080
P9858.0D	Post Ditch	05/25/1910	Fully Adjudicated	0.94	Post Draw		NIELS C.	SORENSON	IRR_SW	057N	077W	28	SE1/4NE1/4				
P10478.0D	Post Island Ditch No. 2	02/23/1911	Fully Adjudicated	0.11	Spring		WINONA	GATCHELL	IRR_SW	050N	082W	06	SE1/4NE1/4		-1.000	-106.763040	44.333674
CR CC44/541	Power Ditch	10/23/1916		188.20	Piney Creek			KEARNEY CO-OPERATIVE CO.	POW	053N	083W	26	NW1/4NW1/4			-106.829040	44.541850
P14606.0D	Power Ditch	10/23/1916	Fully Adjudicated	188.20	Piney Creek			Kearney Cooperative Co.	POW	053N	083W	26	NW1/4NW1/4		188.200	-106.828828	44.542382
P4224.0E	Prairie Dog Cut-off Ditch {Enl. of}	07/30/1921	Fully Adjudicated	9.60	South Piney Creek		S.H.	Smith	POW	053N	083W	18	NE1/4NE1/4		66.000	-106.893950	44.569641
P4225.0E	Prairie Dog Cut-off Ditch {Enl. of}	07/30/1921	Fully Adjudicated	0.46	South Piney Creek		S.H.	Smith	DOM_SW	053N	083W	18	NE1/4NE1/4		66.000	-106.893913	44.569642
CR CC43/555	Prairie Dog Cut-off Ditch,, Enl.	07/30/1921		9.60	South Piney Creek		S. H.	SMITH	POW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC43/556	Prairie Dog Cut-off Ditch,, Enl.	07/30/1921		0.46	South Piney Creek		S. H.	SMITH	DOM_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		5.14	North Piney Creek	Estate of Thos. M. Cotton			IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		2.5	North Piney Creek	Jos. Harper			IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		2.5	North Piney Creek	Jos. Harper			IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.43	North Piney Creek	Alexander H. Robinson			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.64	North Piney Creek	Oscar Nelson & M.A. Newell			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.19	North Piney Creek	Clara Perkins			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.95	North Piney Creek	Horatio Burns			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.00	North Piney Creek	Daniel Harris			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		2.14	North Piney Creek	Alfred Bishop, Sr			DOM_SW; IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.43	North Piney Creek	Hamilton S. Robertson			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.43	North Piney Creek	Virginia V. Scrutchfield			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470

Clear Creek Watershed Direct Flow Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	TOTAL FLOW	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	TOTAL CAPACITY (AF/Yr)	DIVERSION CAPACITY AT HEAD GATE	LONGITUDE	LATITUDE
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.27	North Piney Creek		JOHN	CALLOWAY	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.79	North Piney Creek	Frederick H. Weltner			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.00		Jas. W. Kirkpatrick			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.71		Jas. H. Hopkins			DOM_SW; IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.29		Stephen George			IRR_GW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.29	North Piney Creek	Matt & C. H. Oser			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.36	North Piney Creek	Chas. P.P. Story			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.50	North Piney Creek	Jas. Kirkpatrick Sr.			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.29	North Piney Creek	W.J. Stover			DOM_SW; IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.57	North Piney Creek	Jas. Carroll			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.86	North Piney Creek	Thos. A. Stout			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		3.24	North Piney Creek		C	BOULWARE	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.43	North Piney Creek	Cameron W. Garbutt			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.36	North Piney Creek	Allen L. Willey			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.43	North Piney Creek	Jas. Burns			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.36	South Piney Creek	William A. Roberts			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.36	North Piney Creek	Marcellus L. Sawins			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		1.14	North Piney Creek	Chas. George			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		2.86	North Piney Creek	Ezekiel M. Weltner			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		2.86	North Piney Creek	John C. Weltner			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.50	North Piney Creek	James Thurmond			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.07	North Piney Creek	Geo. W. Hardin			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.21	North Piney Creek	Cornwall B. Stroud			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.29	North Piney Creek	T.A. Stout			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.06	North Piney Creek	John F. Kirkpatrick			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 06/489	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884			North Piney Creek			SHERIDAN BANKING CO.	DOM_SW; IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 06/495	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884			North Piney Creek			MATTIE A. STOUT ESTATE	IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 10/442	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884			North Piney Creek		EVELYN N.	MOORE	DOM_SW; IRR_SW	053N	084W	13	SE1/4SW1/4				

Clear Creek Watershed Direct Flow Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	TOTAL FLOW	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	TOTAL CAPACITY (AF/Yr)	DIVERSION CAPACITY AT HEAD GATE	LONGITUDE	LATITUDE
OR 18/372	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884			North Piney Creek		EDITH	BROKAW	DOM_SW; IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 18/373	Prairie Dog W.S. Co. Ditch 2" App. (PRAIRIE DOG WATER SUPPLY CO DITCH)	05/01/1884		0.07	North Piney Creek	John Rose			DOM_SW; IRR_SW	053N	083W	08	NE1/4SW1/4				
P346.0E	Prairie Dog Water Supply Co. Ditch {Enl. of}	06/13/1898	Fully Adjudicated	2.14	South Piney Creek		Carrie	Wiltner	IRR_SW	053N	083W	08	NE1/4SW1/4		-1		
OR 02/194	Prairie Dog Water Supply Co. Ditch 1st App.	10/01/1880		1.14	North Piney Creek	James Terrill			IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 02/194	Prairie Dog Water Supply Co. Ditch 1st App.	10/01/1880		0.71	North Piney Creek	Jas. W. Kirkpatrick			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog Water Supply Co. Ditch 1st App.	10/01/1880		0.43	North Piney Creek	Joseph Harper			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog Water Supply Co. Ditch 1st App.	10/01/1880		0.04	North Piney Creek	James H. Hopkins			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 10/442	Prairie Dog Water Supply Co. Ditch 1st App.	10/01/1880			North Piney Creek		EVELYN N.	MOORE	DOM_SW; IRR_SW	053N	084W	13	SE1/4SW1/4				
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		0.37	North Piney Creek	John F. Kirkpatrick			DOM_SW; IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		0.37	North Piney Creek	John F. Kirkpatrick			DOM_SW; IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		1.29	North Piney Creek	Joseph Harper			DOM_SW; IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		1.29	North Piney Creek	Joseph Harper			DOM_SW; IRR_SW	053N	083W	08	NE1/4SW1/4				
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		9.1	North Piney Creek	James Kirkpatrick			IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		9.1	North Piney Creek	James Kirkpatrick			IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		0.71	North Piney Creek	Sidney P. Smith			DOM_SW; IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		1.65	North Piney Creek	Robt. B. Robinson			DOM_SW; IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		1.07	North Piney Creek	Elmer Surenna			DOM_SW; IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		1.29	North Piney Creek	Fred F. Newcomer			DOM_SW; IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		0.36	North Piney Creek	Andrew Harper			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		1.21	North Piney Creek	Wm. O'Neal			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		2.57	North Piney Creek	Otto Hanschka			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		3.93	North Piney Creek	Geo. L. Smith			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 02/194	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885		1.77	North Piney Creek	Cross Cattle Co.			IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
OR 06/493	Prairie Dog Water Supply Co. Ditch 3rd App.	08/03/1885					FRANK P.	STOUT	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog Water Supply Co. Ditch 4" App.	12/31/1894		1.14	North Piney Creek	Geo. Surenna			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
OR 02/194	Prairie Dog Water Supply Co. Ditch 4" App.	12/31/1894		1.00	North Piney Creek	Wilbur King			IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180

Clear Creek Watershed Direct Flow Water Rights

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CR CB01/266	Prairie Dog Water Supply Co. Ditch,, Enl.	06/13/1898		2.14	South Piney Creek		CARRIE	WELTNER	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC17/099	Prairie Dog Water Supply Co. Ditch,, Enl.	01/02/1903		1.20	North Piney Creek		JESSE C.	WELTNER	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/543	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.19			JOHN	HAMMOND	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC44/544	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.29			J. F.	KIRKPATRICK	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC44/545	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.14			GEORGE	SIEWEKE	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC44/546	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.07			H. F.	HEADLEY	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC44/547	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.11			H. A.	MC LIMANS	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC44/548	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.10			GEORGE A.	LUCAS	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC44/550	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.10			E. V.	NEWCOMER	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC44/551	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.06			GRACE	MORROW	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/552	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.18			G. W.	STROUD	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC44/553	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.32				WELTNER BROS.	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC44/554	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.02			A. B.	WILLEY	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC44/555	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		JOHN	HAMMOND	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/558	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		SADIE L.	HEADLEY	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/559	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		H. A.	MCLIMANS	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/560	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		GEORGE A.	LUCAS	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/561	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		GRACE	MORROW	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/562	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		E. V.	NEWCOMER	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/563	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		C. E.	STEVENSON	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/564	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		G. W.	STROUD	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/565	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek			WELTNER BROS.	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC44/566	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		A.B.	WILLEY	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC45/075	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00			BERTHA C.	KAHN	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC45/076	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		BERTHA C.	KAHN	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC45/440	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.00	North Piney Creek		ARTHUR	DOLAN	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
CR CC45/441	Prairie Dog Water Supply Co. Ditches	05/15/1922		0.67			ARTHUR	DOLAN	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
P16791.0D	Prairie Dog Water Supply Co. Ditches	05/15/1922	Fully Adjudicated	6.42			Zack	Burris	IRR_SW	053N	083W	18	NE1/4NE1/4		150.000	-106.894700	44.570470
P1370.0E	Prairie Dog Water Supply Company and Nine Mile Lateral Ditch,, Ext. of Nine Mile Lateral	01/24/1905	Fully Adjudicated	1.1	North Piney Creek		Walter N.	True	IRR_SW	053N	083W	08	NE1/4SW1/4		-1		
CR CC67/012	Prairie Dog Water Supply Company Ditch	10/17/1955		50.00	South Piney Creek		JOSEPH	PILCH	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
P22280.0D	Prairie Dog Water Supply Company Ditch	10/17/1955	Fully Adjudicated	0.00	South Piney Creek		JOSEPH & ANNA	PILCH	IRR_SW	053N	083W	18	NE1/4NE1/4		153.000	-106.895000	44.569722
P16765.0D	Prairie Dog Water Supply Company's Ditches	12/06/1920	Unadjudicated	0.00	South Piney Creek			AC Ranch, Inc.	IRR_SW	053N	083W	18	NE1/4NE1/4		150.000	-106.895000	44.569722
CR CB02/061	Prairie Dog Water Supply Co's. Ditch,, Enl.	04/27/1897		0.78	North Piney Creek		J. M.	ENOCHS	IRR_SW	053N	083W	08	NE1/4SW1/4			-106.884520	44.578180
P264.0E	Prairie Dog Water Supply Co's. Ditch,, Enoch's Lateral 1-2-3	04/27/1897	Fully Adjudicated	0.78	North Piney Creek		J.M.	Enochs	IRR_SW	053N	083W	18	NE1/4NE1/4		-1		
CR CC72/380	Prather Pipeline No. 1	08/13/1973		0.06	Prather No. 1 Draw		PHIL JANE C.	YECKEL	STO	053N	083W	07	SE1/4NW1/4			-106.904770	44.581990
P24203.0D	Prather Pipeline No. 1	08/13/1973	Fully Adjudicated	0.06	Prather No. 1 Draw		FRANK	PRATHER	STO	053N	083W	07	SE1/4NW1/4		0.065	-106.904773	44.581991
P3872.0E	Pratt & Ferris Ditch No. 3 {Enl. of}	02/13/1918	Unadjudicated	4.19	Clear Creek (drainage of)			L.Z. Leiter Estate	IRR_SW	054N	079W	10	NW1/4SW1/4		84.52		
CR CC65/300	Pratt - Ferris Ditch No. 1,, Enl.	04/18/1947		0.00	Piney Creek		JOHN H.	FOWLER	IRR_SW	053N	081W	13	SW1/4NE1/4			-106.557160	44.566060
P5438.0E	Pratt - Ferris Ditch No. 1,, Fowler Enlargement of	04/18/1947	Fully Adjudicated	0.00	Piney Creek		John H.	Fowler	IRR_SW	053N	081W	13	SW1/4NE1/4		28.500	-106.558889	44.566944
P1039.0E	Pratt & Ferris Ditch No. 1 {Enl. of}	05/09/1903	Fully Adjudicated	4.28	Piney Creek			Pratt & Leiter	IRR_SW	053N	080W	16	NE1/4NW1/4		-1		
CR CC18/002	Pratt & Ferris Ditch No. 1,, Enl.	05/09/1903		4.28	Piney Creek			ESTATE OF L.Z. LEITER	IRR_SW	053N	081W	13	SW1/4NE1/4			-106.557160	44.566060
P1040.0E	Pratt & Ferris Ditch No. 2 {Enl. of}	05/09/1903	Fully Adjudicated	1.71	Clear Creek (drainage of)			Leiter & Pratt	IRR_SW	054N	079W	29	SE1/4SW1/4		-1.000	-106.401944	44.616667
P1853.0E	Pratt & Ferris Ditch No. 2 {Enl. of}	01/10/1908	Fully Adjudicated	8.79	Clear Creek (drainage of)				IRR_SW	054N	079W	29	SE1/4SW1/4		-1		
P966.0E	Pratt & Ferris Ditch No. 2 {Enl. of}	01/09/1903	Fully Adjudicated		Clear Creek (drainage of)		Fredrick	Rider	IRR_SW	054N	079W	09	NE1/4NE1/4		-1		

Clear Creek Watershed Direct Flow Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	TOTAL FLOW	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	TOTAL CAPACITY (AF/Yr)	DIVERSION CAPACITY AT HEAD GATE	LONGITUDE	LATITUDE
CR CB03/394	Pratt & Ferris Ditch No. 2,, Enl.	01/09/1903		1.64	Clear Creek (drainage of)		FREDRIC	RIDER	IRR_SW	054N	079W	29	SE1/4SW1/4			-106.400690	44.617090
CR CC18/003	Pratt & Ferris Ditch No. 2,, Enl.	05/09/1903		1.71	Clear Creek (drainage of)			ESTATE OF L.Z. LEITER	IRR_SW	054N	079W	29	SE1/4SW1/4			-106.400690	44.617090
CR CC64/355	Pratt & Ferris Ditch No. 2,, Enl.	01/10/1908		0.28	Clear Creek (drainage of)		FRED G.	HOSBURG	IRR_SW	054N	079W	29	SE1/4SW1/4			-106.400690	44.617090
CR CC80/072	Pratt & Ferris Ditch No. 2,, Enl.	01/10/1908		1.50	Clear Creek (drainage of)		STEPHEN L RUTH D	ARTHUR	IRR_SW	054N	079W	29	SE1/4SW1/4			-106.400690	44.617090
P1041.0E	Pratt & Ferris Ditch No. 3 {Enl. of}	05/09/1903	Fully Adjudicated	18.63	Clear Creek (drainage of)			Leiter & Pratt	IRR_SW	054N	079W	10	NW1/4NW1/4		-1		
CR CC27/288	Pratt & Ferris Ditch No. 3,, Enl.	05/09/1903		19.28	Clear Creek (drainage of)			ESTATE OF L. Z. LEITER	IRR_SW	054N	079W	10	NW1/4SW1/4			-106.365390	44.664450
CR CC49/350	Pratt & Ferris Ditch No. 3,, Enl.	05/09/1903			Clear Creek (drainage of)		MARGARET J.	WHITAKER	IRR_SW	054N	079W	10	NW1/4SW1/4			-106.365390	44.664450
CR CC49/351	Pratt & Ferris Ditch No. 3,, Enl.	05/09/1903			Clear Creek (drainage of)			ESTATE OF L. Z. LEITER	IRR_SW	054N	079W	10	NW1/4SW1/4			-106.365390	44.664450
CR CC49/352	Pratt & Ferris Ditch No. 3,, Enl.	05/09/1903			Clear Creek (drainage of)		JAMES IRA	JACOBS	IRR_SW	054N	079W	10	NW1/4SW1/4			-106.365390	44.664450
CR CC36/254	Pratt & Ferris Ditch,, Enl.	11/06/1912		8.17	Clear Creek (drainage of)			ESTATE OF L. Z. LEITER	IRR_SW	054N	079W	29	SE1/4SW1/4			-106.400690	44.617090
P2672.0E	Pratt & Ferris Ditch,, Pratt & Ferris Ditch No. 2 {Enl. of}	11/06/1912	Fully Adjudicated	8.17	Clear Creek (drainage of)		John	Blair	IRR_SW	054N	079W	03	NW1/4NW1/4		-1		
OR 02/194	Pratt & Ferris No. 1 Ditch	07/31/1884		1	Piney Creek	P & F Cat. Co. Jno Winterling, Mgr.			IRR_SW	053N	084W	13	SW1/4SE1/4				
CR CC64/111	Pratt & Ferris No. 1 Ditch,, Enl.	03/20/1950		0.48	Piney Creek		HAROLD J.	WOOSLEY	IRR_SW	053N	081W	13	SW1/4NE1/4			-106.557160	44.566060
CR CC64/112	Pratt & Ferris No. 1 Ditch,, Enl.	03/06/1952		0.68	Piney Creek		HAROLD J.	WOOSLEY	IRR_SW	053N	081W	13	SW1/4NE1/4			-106.557160	44.566060
P5606.0E	Pratt & Ferris No. 1 Ditch,, Enlargement	03/06/1952	Fully Adjudicated	0.68	Piney Creek		Robert E.	Mitchell	IRR_SW	053N	080W	02	SW1/4SW1/4		36		
P5516.0E	Pratt & Ferris No. 1 Ditch,, Enlargement of	03/20/1950	Fully Adjudicated	0.48	Piney Creek		Robert E.	Mitchell	IRR_SW	053N	080W	02	SW1/4SW1/4		36		
OR 15/443	Pratt & Ferris No. 2 Ditch	09/21/1884		10.71	Clear Creek (drainage of)	Pratt & Ferris Cattle Company			IRR_SW	054N	079W	21	NE1/4NE1/4			-106.370390	44.642610
P6532.0E	Pratt & Ferris No. 2 Ditch {Enl. of}	07/02/1973	Fully Adjudicated	2.97	Clear Creek (drainage of)		Earl & Margaret	Boardman	IRR_SW	054N	079W	29	SE1/4SW1/4		36.3		
CR CC78/177	Pratt & Ferris No. 2 Ditch,, Enl.	07/02/1973		2.53	Clear Creek (drainage of)		WARD V. MARY LOU	RUMPLER	IRR_SW	054N	079W	24	SE1/4SW1/4			-106.319300	44.632160
OR 02/182	Pratt & Ferris No. 3 Ditch	09/21/1884		21.43	Clear Creek (drainage of)	Pratt & Ferris Cattle Company			IRR_SW	054N	079W	10	NW1/4SW1/4			-106.365390	44.664450
CR CC62/404	Pratt & Ferris No. 3 Ditch,, Enl.	11/13/1951		0.21	Clear Creek (drainage of)		D. G.	MACLEOD	IRR_SW; STO	054N	079W	10	NW1/4SW1/4			-106.365390	44.664450
P6757.0E	Pratt & Ferris No. 3 Ditch,, Trebelock 1st Enlargement of the	10/20/1982	Unadjudicated	1.13	Clear Creek (drainage of)				IRR_SW	055N	078W	15	NW1/4NW1/4		63.68		
P6758.0E	Pratt & Ferris No. 3 Ditch,, Trebelock 2nd Enlargement of the	07/22/1983	Unadjudicated	0.11	Clear Creek (drainage of)				IRR_SW	055N	078W	15	NE1/4NW1/4		63.68		
P5593.0E	Pratt & Ferris No. 3 Ditch,, Warfield Enlargement	11/13/1951	Fully Adjudicated	2.10	Clear Creek (drainage of)		Walter H.	Warfield	IRR_SW; STO	054N	079W	10	NW1/4SW1/4		63.680	-106.366667	44.663056
P3244.0E	Pratt and Ferris Ditch No. 3 {Enl. of}	07/12/1915	Fully Adjudicated	2.46	Clear Creek (drainage of)			L.Z. Leiter Estate	IRR_SW	054N	079W	03	SE1/4NE1/4		-1		
CR CC38/630	Pratt and Ferris Ditch No. 3,, Enl.	07/12/1915		2.45	Clear Creek (drainage of)			ESTATE OF L. Z. LEITER	IRR_SW	054N	079W	10	NW1/4SW1/4			-106.365390	44.664450
CR CC83/095	Pratt and Ferris No. 1 Ditch				Piney Creek	Ucross Land Company			FTH; RES	053N	081W	13	SW1/4NE1/4			-106.557160	44.566060
OR 56/430	Pratt and Ferris No. 1 Ditch	07/01/1884			Piney Creek	Ucross Land Company			FTH; RES	053N	081W	13	SW1/4NE1/4				

Clear Creek Watershed Direct Flow Water Rights

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P6533.0E	Pratt and Ferris No. 2 Ditch,, 6th Enlargement of the	05/24/1974	Fully Adjudicated	1.26	Clear Creek (drainage of)				IRR_SW	054N	079W	29	SE1/4SW1/4		38.37		
CR CC62/403	Pratt and Ferris No. 2 Ditch,, Enl.	07/20/1951		0.21	Clear Creek (drainage of)		WALTER H.	WARFIELD	DOM_SW; IRR_SW; STO	054N	079W	29	SE1/4SW1/4			-106.400690	44.617090
CR CC72/378	Pratt and Ferris No. 2 Ditch,, Enl.	05/24/1974		1.25	Clear Creek (drainage of)			PRATHER ENTERPRISES	IRR_SW	054N	079W	29	SE1/4SW1/4			-106.400690	44.617090
P5580.0E	Pratt and Ferris No. 2 Ditch,, Fourth Enlargement	07/20/1951	Fully Adjudicated	0.21	Clear Creek (drainage of)		Philip S.	Little	DOM_SW; IRR_SW; STO	054N	079W	29	SE1/4SW1/4		38.370	-106.401944	44.616667
OR 02/189	Pride of the Valley Ditch	07/10/1879		1.43	Rock Creek	Andrew S. Brown			DOM_SW; IRR_SW	052N	083W	34	SE1/4NE1/4			-106.822890	44.436240
OR 02/189	Pride of the Valley Ditch	12/31/1885		2.00	Rock Creek	A.S. Brown			IRR_SW	052N	083W	34	SE1/4NE1/4			-106.822890	44.436240
OR 02/189	Prince Albert Ditch	06/10/1883		0.11	Rock Creek	Robert Foote			IRR_SW	051N	082W	24	NW1/4SW1/4			-106.677050	44.374040
OR 02/189	PRINCE ALBERT DITCH	06/10/1883	Fully Adjudicated	7.43	Clear Creek		WM.	HOLLAND	IRR_SW	051N	082W	24	SE1/4SW1/4			-106.674178	44.371458
OR 02/189	Prince Albert Ditch 2nd App.	06/30/1885		2.57	Rock Creek	Lobban & Hine			IRR_SW	051N	082W	24	NW1/4SW1/4			-106.677050	44.374040
P32941.0D	Probasco Lawn Pump	04/19/2002	Unadjudicated		Piney Creek				DOM_SW	053N	082W	22	NE1/4NW1/4		0.050	-106.721771	44.555531
CR CC76/332	Pump Ditch	12/01/1952		0.90	Lone Tree Creek		ANN	SPIELMAN	IRR_SW	054N	080W	23	SW1/4SW1/4			-106.463560	44.633810
P21114.0D	Pump Ditch	12/01/1952	Fully Adjudicated	0.90	Lone Tree Creek		ERNEST M. & AUDRA I.	PENCE	IRR_SW	054N	080W	23	SW1/4SW1/4		12.460	-106.463556	44.633806
CR CC87/034	Rafter Y Pump 1	10/12/2005		0.06	Rafter Y Draw	Leon E. and Doris L. Pehringer			DOM_SW	053N	083W	27	SW1/4NW1/4			-106.849290	44.538300
P33351.0D	RAFTER Y PUMP 1	10/12/2005	Fully Adjudicated	0.06	Rafter Y Draw		LEON	PEHRINGER	DOM_SW	053N	083W	27	SW1/4NW1/4			-106.849289	44.538300
CR CC87/035	Rafter Y Pump 2	10/12/2005		0.06	Rafter Y Draw	Leon E. and Doris L. Pehringer			DOM_SW	053N	083W	27	SW1/4NW1/4			-106.849290	44.538300
P33352.0D	RAFTER Y PUMP 2	10/12/2005	Fully Adjudicated	0.06	Rafter Y Draw		LEON	PEHRINGER	DOM_SW	053N	083W	27	SW1/4NW1/4		0.056	-106.849289	44.538300
CR CC34/201	Rate & Huson Reservoir	07/27/1909		72.00	Pin Head Creek		H. W.	RATE	IRR_SW	054N	080W	14	NW1/4SW1/4			-106.462690	44.648670
CR CC34/202	Rate and Huson Ditch	07/27/1909		1.50	Pin Head Creek		H. W.	RATE	IRR_SW	054N	080W	14	NW1/4SW1/4			-106.466790	44.648970
P9286.0D	Rate and Huson Ditch	07/27/1909	Fully Adjudicated	0.00	Pin Head Creek		Orr A.	Baker	IRR_SW	054N	080W	14	NW1/4SW1/4		-1.000	-106.466524	44.649329
P2504.0E	Rate and Huson Ditch {Enl. of}	06/28/1911	Fully Adjudicated	0.07				Rate	IRR_SW	054N	080W	24	NE1/4SE1/4		-1		
CR CC34/203	Rate and Huson Ditch,, Enl.	06/28/1911		0.07			H. W.	RATE	IRR_SW	054N	080W	14	NW1/4SW1/4			-106.466790	44.648970
CR CC74/179	Rauch Sprinkler	02/16/1977		0.14	Johnson Creek		HELEN K.	KENNEY	IRR_SW	051N	083W	14	NE1/4NW1/4			-106.812810	44.396030
P25577.0D	Rauch Sprinkler	02/16/1977	Fully Adjudicated	0.14	Johnson Creek		Helen	Rauch	IRR_SW	051N	083W	14	NE1/4NW1/4		1.110	-106.814267	44.394776
OR 11/019	Red Hill Ditch	11/14/1887					MALCOLM	MONCREIFFE	IRR_SW	053N	085W	01	SW1/4NE1/4				
OR 33/207	Red Hill Ditch	04/30/1883					S. WATTS	SMYTH	IRR_SW	053N	085W	01	SW1/4NE1/4				
CR CC75/114	Red Hill Extension of Splasher Ditch - Field Draw Diversion	07/12/1979		0.00	Field Draw		CHARLES W.	HOLLAND	IRR_SW	051N	081W	31	NE1/4NW1/4			-106.651860	44.352170
P27610.0D	Red Hill Extension of Splasher Ditch - Field Draw Diversion	07/12/1979	Fully Adjudicated	0.00	Field Draw		CHARLES W. & KAREN A.	HOLLAND	IRR_SW	051N	081W	31	NE1/4NW1/4		2.500	-106.650802	44.352485
P19437.0D	Redman Ditch	09/05/1940	Fully Adjudicated	0.02	Story Draw		George	Redman	DOM_SW; IRR_SW; STO	053N	083W	08	SE1/4SW1/4		0.307	-106.885958	44.576113
CR CC88/119	Redman Homestead Ditch	05/01/1878			Clear Creek (drainage of)	Manlius T. Redmond			IRR_SW	051N	081W	17	NE1/4SE1/4			-106.621700	44.388580

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OR 57/502	Redman Homestead Ditch	05/01/1878		0.38	Clear Creek (drainage of)	Manlius T. Redmond			IRR_SW	051N	081W	17	NE1/4SE1/4			-106.621700	44.388580
CR CC41/131	Redman Homestead Ditch,, Enl.	03/30/1914		0.00	Clear Creek (drainage of)		NORTHERN WYOMING	LAND COMPANY	IRR_SW	051N	081W	17	SE1/4SW1/4			-106.631800	44.385040
P2941.0E	Redman Homestead Ditch,, Healey Bros. Extension of	03/30/1914	Fully Adjudicated	1.62	Clear Creek (drainage of)			Northern Wyoming Land Co.	IRR_SW	051N	081W	17	SE1/4SW1/4		-1		
P19818.0D	Redman No. 2 Ditch	09/16/1943	Fully Adjudicated	0.01	Story Draw		Geo.	Redman	DOM_SW; IRR_SW; STO	053N	083W	08	SE1/4SW1/4		0.307	-106.886680	44.576003
CR CC88/120	Redmond Ditch (REDMAN DITCH)	03/20/1884			Clear Creek (drainage of)	Manlius T. and Rebecca Redmond			IRR_SW	051N	081W	30	SE1/4NW1/4			-106.651900	44.363090
CR CC88/121	Redmond Ditch (REDMAN DITCH)	03/20/1884			Clear Creek (drainage of)	M.T. Redmond			IRR_SW	051N	081W	17	NE1/4SE1/4			-106.621700	44.388580
OR 02/182	Redmond Ditch (REDMAN DITCH)	03/20/1884		9.40	Clear Creek (drainage of)	Manlius T. and Rebecca Redmond			IRR_SW	051N	081W	30	SE1/4NW1/4			-106.651900	44.363090
OR 02/182	Redmond Ditch (REDMAN DITCH)	03/20/1884		4.86	Clear Creek (drainage of)	M.T. Redmond			IRR_SW	051N	081W	17	NE1/4SE1/4			-106.621700	44.388580
OR 02/182	Redmond Ditch (REDMAN DITCH)	03/20/1884		2.36	Clear Creek (drainage of)	Wm. H. Holland			IRR_SW	051N	081W	30	SE1/4NW1/4			-106.651900	44.363090
OR 02/182	Redmond Ditch (REDMAN DITCH)	03/20/1884		0.78	Clear Creek (drainage of)	Chas. Carter			IRR_SW	051N	081W	30	SE1/4NW1/4			-106.651900	44.363090
CR CC72/097	Reece Sprinkler System	04/24/1970		0	Clear Creek		RICHARD W.	REECE	IRR_SW	055N	078W	All					
CR CC74/242	Rehm Ditch	02/19/1976		0.03	Lanier Draw		GARY W. BETTY L.	MORRIS	IRR_SW	050N	082W	03	NW1/4SW1/4			-106.719300	44.331650
P24993.0D	Rehm Ditch	02/19/1976	Fully Adjudicated	0.03	Lanier Draw		Richard	Rehm	IRR_SW	050N	082W	03	NW1/4SW1/4		0.650	-106.719581	44.329648
P7066.0E	Rehm Ditch,, 1st Enlargement of the	06/07/1993	Fully Adjudicated	0.65	Lanier Draw		Thomas K.	Carpenter	FIS; FTH; RES	050N	082W	03	NW1/4SW1/4		0.650	-106.719300	44.331650
CR CC80/297	Rehm Ditch,, Enl.	06/07/1993		0.09	Lanier Draw		DEBBIE A.	AXTELL	FIS; RES	050N	082W	03	NW1/4SW1/4			-106.719300	44.331650
P17125.0D	Reimann Ditch	06/15/1926	Unadjudicated	0.09	Spring Branch		Joe M.	Reimann, Jr.	IRR_SW	050N	083W	23	NE1/4SE1/4		1.120	-106.803303	44.286730
P20076.0D	Reimann Ditch	08/19/1946	Fully Adjudicated	0.04	Post Flat Draw		J.M.	Reimann	IRR_SW	051N	082W	34	SW1/4SW1/4		0.490	-106.716325	44.340499
P6770.0D	Republican Ditch	06/17/1905	Fully Adjudicated		Town Gulch/Thompson Draw		Ronald	Thomson	IRR_SW	053N	079W	10	NW1/4NE1/4				
P19169.0D	Reservoir Ditch	05/17/1939	Fully Adjudicated	14.20			John C.	Thom, III	IRR_SW	050N	082W	08	NW1/4NE1/4		3.800	-106.748120	44.322890
P352.0D	Reservoir Ditch	10/17/1892	Fully Adjudicated	1.71	Bush Creek		ROBERT C.	HAYS	DOM_SW; IRR_SW	053N	085W	21	SW1/4SE1/4		-1.000	-107.101409	44.545837
CR CC76/174	Reynolds Box Elder Ditch	02/04/1955		0.00	Shell Creek			TEXACO INC.	RES	052N	082W	28	NE1/4NE1/4			-106.721740	44.453710
P21580.0D	Reynolds Box Elder Ditch	02/04/1955	Fully Adjudicated	0.00	Shell Creek			Texaco, Inc.	RES	052N	082W	28	NE1/4NE1/4		360.000	-106.720384	44.452506
CR CC86/177	Reynolds Lake DeSmet Intake Tunnel,,Enl.	06/19/2003		0.00	Piney Creek	Lake DeSmet Counties Coalition Joint Powers Board			RES	053N	083W	25	SW1/4SW1/4			-106.808750	44.531000
P34238.0D	RICE DOMESTIC PUMP	08/24/2009	Complete	0.06	North Piney Creek		EMERY	RICE	DOM_SW	053N	083W	08	NE1/4SW1/4		0.056	-106.885183	44.577883
P17833.0D	Ritchey Ditch	06/23/1930	Fully Adjudicated	0.23	Middle Prong South Fork Shell Creek		Samuel H.	Ritchey	IRR_SW	052N	083W	23	NE1/4SW1/4		1.680	-106.813963	44.462659
CR CC34/206	Robbins Ditch	02/14/1910		0.83	French Creek and Two Draws		C. N.	ROBBINS	IRR_SW	051N	083W	26	NE1/4NE1/4			-106.802880	44.366570

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P10782.0D	Robbins Ditch	02/14/1910	Fully Adjudicated	0.83	French Creek and Two Draws		Charles N.	Robbins	IRR_SW	051N	083W	26	NE1/4NE1/4			-106.801167	44.365583
P4813.0E	Robbins Ditch,, Williams Enlargement of	12/26/1930	Fully Adjudicated		French Creek		John W.	Williams	IRR_SW	051N	083W	26	NE1/4NE1/4		1.750	-106.801167	44.365583
P710.0D	Robert Ditch	05/04/1894	Fully Adjudicated	4.50	Clear Creek		George	Roberts	IRR_SW	053N	080W	12	NW1/4SW1/4		-1.000	-106.459167	44.577778
P1705.0E	Roberts Ditch {Enl. of}	04/23/1907	Fully Adjudicated	1.29	Clear Creek (drainage of)			L.Z. Leiter Estate	IRR_SW	053N	080W	12	NW1/4SW1/4		-1.000	-106.459167	44.577778
P3076.0E	Roberts Ditch {Enl. of}	12/07/1914	Fully Adjudicated	0.79	Clear Creek (drainage of)		H.W.	Rate	IRR_SW	053N	080W	11	NW1/4SW1/4		-1		
CR CC18/004	Roberts Ditch No. 1,, Enl.	08/24/1899		0.14	Clear Creek (drainage of)			ESTATE OF L.Z. LEITER	IRR_SW	053N	080W	11	NE1/4SW1/4			-106.461930	44.576720
P466.0E	Roberts Ditch No. 1,, First Enlargement	08/24/1899	Fully Adjudicated	0.24	Clear Creek (drainage of)		G.A.	Roberts	IRR_SW	053N	080W	12	NW1/4SW1/4		-1		
P465.0E	Roberts Ditch No. 1,, Second Enlargement	08/24/1899		0.43			W.T.	Roberts	IRR_SW	053N	080W	12	NW1/4SW1/4		-1.000	-106.446780	44.576830
P1054.0D	Roberts Ditch No. 2	09/16/1895	Fully Adjudicated	1.70	Clear Creek		W.T.	Roberts	DOM_SW; IRR_SW	054N	079W	29	NW1/4SE1/4			-106.397381	44.620377
P1038.0E	Roberts Ditch No. 2 {Enl. of}	05/09/1903	Fully Adjudicated	0	Clear Creek (drainage of)		Jake	Lang	DOM_SW; IRR_SW	054N	079W	29	NW1/4SE1/4		-1		
P3871.0E	Robert's Ditch No. 2 {Enl. of}	02/13/1918	Fully Adjudicated	0.78	Clear Creek (drainage of)			L.Z. Luter Estate	IRR_SW	054N	079W	29	NW1/4SE1/4		2.85		
CR CC38/023	Roberts Ditch,, Enl.	12/07/1914		0.78	Clear Creek (drainage of)		CARL J.	SMITH	IRR_SW	053N	080W	11	NW1/4SW1/4			-106.466930	44.576700
CR CC39/513	Roberts Ditch,, Enl.	04/23/1907		1.29	Clear Creek (drainage of)			ESTATE OF L. Z. LEITER	IRR_SW	053N	080W	11	NE1/4SW1/4			-106.461930	44.576720
CR CC71/078	Roberts Ditch,, Enl.	01/09/1958		0.63	Clear Creek (drainage of)		WILLIAM EDNA ELIZABETH	LANDECK	IRR_SW	053N	080W	11	NE1/4SW1/4			-106.461930	44.576720
P4596.0E	Roberts Ditch,, Enlargement of	05/21/1917		0.00				L.Z. Leiter Estate	IRR_SW; RES	053N	080W	12	NW1/4SW1/4		7.100	-106.446780	44.576830
P5947.0E	Roberts Ditch,, Landeck Enlargement of	01/09/1958	Fully Adjudicated	0.76	Clear Creek (drainage of)		Adam	Landeck	IRR_SW	053N	080W	11	NE1/4SW1/4		22.23		
P1556.0E	Roberts No. 2 Ditch,, Lathrop Lateral	05/02/1906	Fully Adjudicated				Marenerite	Lathrop	IRR_SW	054N	079W	29	SE1/4NE1/4				
P34315.0D	ROCK CREEK - JOHNSON COUNTY GOVT WATER HAUL	03/05/2010	Complete	1.67	Rock Creek	JOHNSON COUNTY GOVT			TEM	052N	083W	34	SW1/4NE1/4			-106.830389	44.435778
P22648.0D	Rock Creek & Piney Reservoir & Ditch Company's Canal	07/26/1961	Unadjudicated	0.00	South Fork South Piney Creek			Reynolds Mining Corp.	IRR_SW	052N	085W	13	SW1/4SE1/4		107.250	-107.029578	44.474541
CR CC45/221	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		J. B.	HUGGINS	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/222	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek			MCRAE BROS.	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/223	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		I. C.	BUELL	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/224	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		J. H.	MCDONALD	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/225	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		GEORGE A.	BUELL	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/226	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		JOHN U.	BARKEY	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/227	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		T. J.	HAYNES	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/228	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		PERCIVAL J.	GOUGH	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/229	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		I. N.	LANE	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/230	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		J. W.	MOONEY	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540

Clear Creek Watershed Direct Flow Water Rights

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CR CC45/231	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		CHARLES E.	BUELL	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/232	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		A. C.	WARBURTON	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/233	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek		GEO. P.	HERSEY	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/234	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek			FIRST NATIONAL BANK OF BUFFALO	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
CR CC45/235	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896		0.00	South Piney Creek			MUNKRES MATHER	IRR_SW	052N	085W	13	SW1/4SE1/4			-107.029580	44.474540
P1291.0D	Rock Creek & Piney Reservoir and Ditch Company Canal	07/13/1896	Unadjudicated		South Piney Creek			Rock Creek & Piney Reservoir & Ditch Co.	DOM_SW; IRR_SW	052N	085W	13	SW1/4SE1/4			-107.028567	44.474681
P1323.0D	Rock Creek & Piney Reservoir and Ditch Company Canal	10/01/1896	Fully Adjudicated	178.57	South Piney Creek			Rock Creek & Piney Reservoir & Ditch Co.	DOM_SW; IRR_SW	052N	085W	13	SW1/4SE1/4			-107.028726	44.474671
CR CC79/034	Rock Creek Diversion	11/29/1990		0.33	North Fork Rock Creek		RESERVE COAL	PROPERTIES	DOM_SW; STO	052N	084W	24	NE1/4SE1/4			-106.903130	44.462210
P30737.0D	Rock Creek Diversion	11/29/1990	Fully Adjudicated	0.33	North Fork Rock Creek		Margi	Bliss	DSP; STO	052N	084W	24	NE1/4SE1/4		0.327	-106.903279	44.462202
P7399.0E	ROCKING HORSE ENL KENDRICK CANAL	08/08/2001	Fully Adjudicated		Clear Creek				RES	056N	077W	All			69		
P34270.0D	ROCKY L B PUMP	10/19/2009	Complete	0.06	Rock Creek		LONNY	MCGEE	DOM_SW	051N	082W	08	NE1/4SE1/4	0.06	0.056	-106.740944	44.403972
P22303.0D	Roebling Ditch and Pipe Line	12/07/1961	Unadjudicated	0.07	Clear Creek		Arthur L. & Frances E.	Roebling	IRR_SW	054N	079W	21	NE1/4NE1/4		0.200	-106.370986	44.642874
CR CC22/056	Rogers Ditch	07/29/1902		1.42	Piney Creek		DANIEL	ROGERS	IRR_SW	053N	081W	09	NW1/4SW1/4			-106.627460	44.577330
P4074.0D	Rogers Ditch	07/29/1902	Fully Adjudicated	1.42	Piney Creek		Daniel	Rogers	DOM_SW; IRR_SW	053N	081W	08	SW1/4NE1/4			-106.636182	44.581750
CR CC70/112	Rogers Ditch,, Enl.	01/07/1971		0.06	Piney Creek		ALFRED J.	COOKSLEY	DOM_SW; STO	053N	081W	08	SW1/4NE1/4			-106.637350	44.580840
P6380.0E	Rogers Ditch,, Enlargement of the	01/07/1971	Fully Adjudicated		Piney Creek		Alfred J.	Cooksley	DOM_SW; IRR_SW; STO	053N	081W	08	SW1/4NE1/4		3.900	-106.636111	44.581704
P13181.0D	Roll Ditch and Lateral	02/26/1915	Fully Adjudicated		Davis Draw		E.F.	Roll	IRR_SW	055N	078W	26	SW1/4NE1/4			-106.212851	44.713429
CR CC37/391	Roll Reservoir	02/26/1915		10.59	Davis Draw		E. F.	ROLL	IRR_SW	055N	078W	26	SE1/4NW1/4			-106.216150	44.714890
P13182.0D	Rosa L. Ditch	05/17/1915	Unadjudicated	0.11	Buffalo Creek		Rosa L.	Baker	IRR_SW	056N	079W	25	SW1/4SE1/4			-106.312932	44.790685
P7388.0D	Rose Brier Ditch	09/03/1906	Fully Adjudicated	0.58	Little Piney Creek		J.E.	Greub	IRR_SW	053N	083W	36	SE1/4NE1/4			-106.793077	44.523426
CR CC66/432	Rose Ditch	11/26/1956		0.03	Beaver Springs		CLARAENCE J.	ROSE	IRR_SW	053N	083W	18	NW1/4NW1/4			-106.909930	44.570520
P21812.0D	Rose Ditch	11/26/1956	Fully Adjudicated	0.03	Beaver Springs		Clarence J.	Rose	IRR_SW	053N	083W	18	NW1/4NW1/4		0.620	-106.909928	44.570513
CR CC43/560	Rothwell Pipeline No. 1	10/11/1921		0.10	Red Creek		PAUL A.	ROTHWELL	STO	051N	083W	06	NW1/4NW1/4			-106.898210	44.426120
P16329.0D	Rothwell Pipeline No. 1	10/11/1921	Fully Adjudicated		Red Creek		Paul A.	Rothwell	STO	051N	083W	06	NW1/4NW1/4		0.640	-106.897600	44.426150
CR CC43/561	Rothwell Pipeline No. 2	10/11/1921		0.10	Sayles Creek		PAUL A.	ROTHWELL	DOM_SW; STO	051N	083W	04	NE1/4SE1/4			-106.843060	44.418100
P16330.0D	Rothwell Pipeline No. 2	10/11/1921	Fully Adjudicated		Sayles Creek		Paul A.	Rothwell	DOM_SW; STO	051N	083W	05	NE1/4SE1/4		0.260	-106.862716	44.417864
P12598.0D	Rough Ditch	08/01/1914		0.14	Skull Gulch		JAMES M.	MAXWELL	IRR_SW	056N	079W	35	SE1/4NE1/4			-106.331044	44.783072
CR CC42/500	Rounder Ditch	08/03/1920		0.00	Sandy Creek		I. W.	BLAKE	IRR_SW	051N	082W	08	NE1/4SE1/4			-106.742300	44.403040
OR 02/189	Rounder Ditch	04/15/1886		1.00	Rock Creek	Chas. W. Rounds			IRR_SW	051N	082W	08	SE1/4NE1/4			-106.742250	44.406680

Clear Creek Watershed Direct Flow Water Rights

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P15939.0D	Rounder Ditch	08/03/1920	Fully Adjudicated	0.00	Sandy Creek		I.W.	Blake	IRR_SW	051N	082W	08	NE1/4SE1/4		7.650	-106.743892	44.405852
P4060.0E	Rounder Ditch {Enl. of}	07/08/1919	Unadjudicated	0	Rock Creek		Ferdinand	Gerer	IRR_SW	051N	082W	15	SE1/4SW1/4		6.4		
P4061.0E	Rounder Ditch,, Blake Enlargement of the	12/16/1919	Fully Adjudicated	0	Rock Creek		I.W.	Blake	IRR_SW	051N	082W	08	SE1/4NE1/4		7.65		
P6163.0E	Rounder Ditch,, Eddy Enlargement of	08/07/1964	Fully Adjudicated	0	Rock Creek		C.E.	Huson	RES	051N	082W	08	SE1/4NE1/4		7.65		
CR CC42/501	Rounder Ditch,, Enl.	12/16/1919		0.00	Rock Creek		I. W.	BLAKE	IRR_SW	051N	082W	08	SE1/4NE1/4			-106.742250	44.406680
CR CC61/177	Rounder Ditch,, Enl.	06/30/1931		0.00	Rock Creek		RALPH	ROBINSON	IRR_SW	051N	082W	08	SE1/4NE1/4			-106.742250	44.406680
CR CC69/004	Rounder Ditch,, Enl.	12/16/1919			Rock Creek		CHARLES E.	HUSON	IRR_SW	051N	082W	08	SE1/4NE1/4			-106.742250	44.406680
CR CC69/138	Rounder Ditch,, Enl.	08/07/1964		0.00	Rock Creek		C. E.	HUSON	RES	051N	082W	08	SE1/4NE1/4			-106.742250	44.406680
P4781.0E	Rounder Ditch,, Hampton Enl.	06/30/1931	Fully Adjudicated	0.37	Rock Creek		Willard H.	Hampton	IRR_SW	051N	082W	08	SE1/4NE1/4		7.650	-106.743250	44.405889
P34231.0D	ROURKE DOMESTIC PUMP	08/03/2009	Complete	0.06	Spring Creek		ANNE ROSE	ROURKE	DOM_SW	053N	084W	12	SE1/4SE1/4		0.056	-106.916000	44.574333
OR 02/189	Russell Ditch	11/01/1883		2.57	Rock Creek	John McRae			IRR_SW	051N	082W	06	NE1/4NW1/4			-106.772200	44.424890
OR 02/189	RUSSELL DITCH 2ND APP.	12/31/1886	Fully Adjudicated	1.07	Rock Creek		CHARLES	FOX	IRR_SW	051N	082W	06	SW1/4NW1/4			-106.777503	44.420667
CR CC76/164	Sanders Pump Pipeline	06/05/1970		0.00	Clear Creek		HERMAN ELAINE	SANDERS	IRR_SW	055N	079W	35	NE1/4SW1/4			-106.339770	44.694120
P23429.0D	Sanders Pump Pipeline	06/05/1970	Fully Adjudicated	0	Clear Creek		HERMAN L.	SANDERS	IRR_SW	055N	079W	35	SW1/4SE1/4		2.67		
P10376.0D	SANDY CREEK DITCH	12/28/1910	Fully Adjudicated	0.88	Sandy Creek		JAMES	BROWN	IRR_SW	051N	082W	17	SE1/4NW1/4			-106.753611	44.390511
P10376.1D	SANDY CREEK DITCH	12/28/1910	Fully Adjudicated	0.89	Sandy Creek		JAMES	BROWN	MIS_SW	051N	082W	08	SW1/4SE1/4		0.890	-106.744817	44.400953
CR CC46/021	Sandy Creek Ditch,, Enl.	07/26/1920		0.00	Sandy Creek		W. H.	HEUSTIS	IRR_SW	051N	082W	17	SE1/4NW1/4			-106.752540	44.392160
CR CC46/255	Sandy Creek Ditch,, Enl.	10/23/1920		0.00	Sandy Creek		WILLARD	HAMPTON	IRR_SW	051N	082W	17	SE1/4NW1/4			-106.752540	44.392160
P34271.0D	SANDY L B PUMP	10/19/2009	Complete	0.06	Sandy Creek		LONNY	MCGEE	DOM_SW	051N	082W	08	NE1/4SE1/4	0.06	0.056	-106.740639	44.402806
CR CC46/256	Sarah Ditch	08/27/1926		0.99	Sayles Creek		A. C.	ANDERSON	IRR_SW; STO	051N	083W	04	SW1/4NE1/4			-106.848080	44.421840
CR CC46/257	Sarah Ditch	08/27/1926		1.13	Sayles Creek		NIELS P.	NIELSEN	IRR_SW; STO	051N	083W	04	SW1/4NE1/4			-106.848080	44.421840
CR CC46/348	Sarah Ditch	08/27/1926		0.27	Sayles Creek		EJNAR	ANDERSEN	IRR_SW	051N	083W	04	SW1/4NE1/4			-106.848080	44.421840
OR 02/191	Sarah Ditch	05/31/1881		0.43	Sayles Creek	J. Norman Penrose			IRR_SW	051N	083W	04	SW1/4NE1/4				
OR 04/440	Sarah Ditch	05/31/1881			Sayles Creek		J. NORMAN	PENROSE	IRR_SW	051N	083W	04	SW1/4NE1/4				
P17132.0D	Sarah Ditch	08/27/1926	Fully Adjudicated	2.40	Sayles Creek		NIELS P.	NIELSON	DOM_SW; IRR_SW; STO	051N	083W	04	SW1/4NE1/4		4.560	-106.847775	44.422653
OR 04/440	Sarah Ditch 2nd App.	05/31/1885		4.42	Sayles Creek	J. Norman Penrose			IRR_SW	051N	083W	04	SW1/4NE1/4			-106.848080	44.421840
OR 02/191	Sayels No. 2 Ditch	04/30/1884		0.14	North Fork Sayles Creek	Frank Sayles			IRR_SW	051N	083W	05	SW1/4SE1/4			-106.868310	44.414520
OR 02/191	Sayles No. 1 Ditch (Canyon Ditch)	10/31/1882		0.43	North Fork Sayles Creek	Frank Sayles			IRR_SW	051N	083W	07	NW1/4NE1/4			-106.888190	44.411180
OR 02/191	Sayles South Fork Ditch	05/31/1885		0.07	South Fork Sayles Creek	Frank Sayles			IRR_SW	052N	084W	25	SW1/4SE1/4			-106.908000	44.444240
P7038.0D	Sayles South Fork Ditch No. 2	01/24/1906	Fully Adjudicated	0.27	South Fork Sayles Creek		NANCY	SAYLES	IRR_SW	051N	083W	08	SE1/4NW1/4			-106.872600	44.407320
P5733.0D	Schultz Ditch	12/19/1903	Fully Adjudicated		Clear Creek		LOUIS	SCHULTZ	IRR_SW	054N	079W	29	SW1/4SW1/4			-106.405943	44.616333
P18637.0D	Scott Ditch	12/20/1935	Unadjudicated	0.36	Finney Draw		JAMES S.	SCOTT	DOM_SW; IRR_SW; STO	051N	082W	12	SE1/4SW1/4		5.450	-106.671717	44.399406
P34232.0D	SCOTT DOMESTIC PUMP	08/03/2009	Complete	0.06	Spring Creek		ROY AND LENORA	SCOTT	DOM_SW	053N	084W	12	SE1/4SE1/4		0.056	-106.914167	44.575333
CR CC63/262	Scott No. 1 Ditch	05/19/1952		1.59	Little Piney Creek		RUBY	MERCHANT	IRR_SW	053N	083W	19	NW1/4SW1/4			-106.909770	44.549070

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P20954.0D	Scott No. 1 Ditch	05/19/1952	Fully Adjudicated	1.58	Little Piney Creek		BELLE	SCOTT	MIS_SW	053N	083W	19	NW1/4SW1/4		2.330	-106.907778	44.546667
P22217.0D	Scott No. 1 Ditch	02/08/1960	Unadjudicated		Little Piney Creek		HAROLD I.	SCOTT	IRR_SW	053N	083W	19	NW1/4SW1/4		2.330	-106.907778	44.546667
CR CC63/263	Scott No. 2 Ditch	05/19/1952		0.78	Little Piney Creek		RUBY	MERCHANT	IRR_SW	053N	084W	24	SE1/4SE1/4			-106.914750	44.545480
P20955.0D	Scott No. 2 Ditch	05/19/1952	Fully Adjudicated	0.78	Little Piney Creek		BELLE	SCOTT	IRR_SW	053N	084W	24	SE1/4SE1/4		2.330	-106.914596	44.545329
P1806.0D	Scullen Ditch	04/20/1898	Fully Adjudicated	1.51	J. A. Creek		NICK	SCULLENS	IRR_SW	053N	083W	32	NE1/4SW1/4			-106.884540	44.519738
P2627.0E	SECOND CUMMINGS ENLARGEMENT OF JOHNSON DITCH	06/17/1912	Fully Adjudicated	2.48	Clear Creek		DAVID	CUMMINGS	IRR_SW	050N	082W	05	NW1/4SW1/4			-106.758089	44.330061
OR 02/194	Senff Ditch	07/15/1883		3.14	Piney Creek	Pauline Senff			IRR_SW	053N	082W	32	SE1/4NE1/4				
OR 13/119	Senff Ditch	07/15/1883			Piney Creek		L. A.	WUTHIER	IRR_SW	053N	082W	32	SE1/4NE1/4				
OR 19/451	Senff Ditch	07/15/1883			Piney Creek		L. A.	WUTHIER	IRR_SW	053N	082W	32	SE1/4NE1/4				
P5211.0E	Senff Ditch,, 2nd Enlargement	11/02/1939	Fully Adjudicated	1.48	Piney Creek		Alex	Kaufmann	IRR_SW	053N	082W	32	SE1/4NE1/4		6.66		
CR CC22/061	Senff Ditch,, Enl.	07/31/1905		0.61	Piney Creek		HARRY L.	SENFF	IRR_SW	053N	082W	32	SE1/4NE1/4			-106.753290	44.523130
CR CC58/241	Senff Ditch,, Enl.	11/02/1939		1.48	Piney Creek		ALEX	KAUFMAN	IRR_SW	053N	082W	32	SE1/4NE1/4			-106.753290	44.523130
P1411.0E	Senff Ditch,, Harry Ditch {Enl. of}	07/31/1905	Fully Adjudicated	0.61	Piney Creek		Harry L.	Senff	IRR_SW	053N	082W	32	SE1/4NE1/4		-1		
CR CC77/321	Shambaugh Supply Ditch	12/03/1987		2.82	Bull Creek		DOUBLE EAGLE	RANCH CORP.	RES	050N	082W	26	SW1/4SE1/4			-106.687140	44.268850
P29953.0D	Shambaugh Supply Ditch	12/03/1987	Fully Adjudicated	0.00	Bull Creek			Reeves, Inc.	RES	050N	082W	26	SW1/4SE1/4		2.820	-106.687059	44.269031
P5434.0D	Shell Ditch No. 1	04/27/1903		0.54	Shell Creek		Susie	Fullerton	IRR_SW	052N	083W	01	NW1/4SE1/4			-106.785579	44.503495
P11298.0D	Sheperd Ditch	06/08/1912		0.41	SPRING		M. J.	SHEPERD	DOM_SW; IRR_SW; STO	052N	082W	03	NW1/4SE1/4			-106.706199	44.505065
P5904.0D	Sherman Ditch	07/20/1903		3.94	Bear Gulch		HARRY	SHERMAN	IRR_SW	053N	083W	31	NW1/4NW1/4			-106.909435	44.527743
CR CC67/178	Shreve Ditch	02/28/1964		0.00	Clear Creek		MARIAN M.	LESTER	IRR_SW	050N	082W	06	NE1/4NE1/4			-106.762920	44.337270
P22480.0D	Shreve Ditch	02/28/1964	Fully Adjudicated	0.00	Clear Creek		FRANK	SHREVE	IRR_SW	050N	082W	06	NE1/4NE1/4		1.680	-106.763579	44.335994
P16196.0D	Silo Ditch	06/01/1921	Unadjudicated	0.57	North Fork Johnson Creek		Paul A.	Rothwell	DOM_SW; IRR_SW; STO	051N	083W	16	NE1/4NW1/4		1.340	-106.852835	44.396333
2120	Six Mile Ditch	07/12/1884			Clear Creek (drainage of)			WYOMING LAND CATTLE COMPANY	STO	050N	082W	05	SE1/4SW1/4				
CR CC82/333	SIX MILE DITCH	09/19/1955	Fully Adjudicated	907.00	Clear Creek	CROSS H. RANCH, INC. ET AL.	WAYNE AND JANICE	NELSON	IRR_SW	050N	082W	05	NE1/4SW1/4			-106.754178	44.329183
DK 2001/1115	Six Mile Ditch	07/12/1884			Clear Creek (drainage of)			WYOMING LAND CATTLE COMPANY	IRR_SW; STO	050N	082W	05	SE1/4SW1/4				
OR 02/182	Six Mile Ditch	07/12/1884		7.14	Clear Creek (drainage of)	Wyoming Land & Cattle Company			IRR_SW	050N	082W	05	SE1/4SW1/4				
OR 56/087	Six Mile Ditch	07/12/1884			Clear Creek (drainage of)	Cross H. Ranch, Inc.			IRR_SW; STO	050N	082W	05	NE1/4SW1/4				
P21703.0D	Six Mile Ditch	09/19/1955	Fully Adjudicated	0.00	Clear Creek			Northern Wyoming Land Co.	IRR_SW	050N	082W	05	NE1/4SW1/4		51.000	-106.754167	44.329167
P6531.0E	Six Mile Ditch (as changed to Clear Creek Supply Canal),, 3rd Enlargement of the	09/19/1956		0	Clear Creek (drainage of)			City of Buffalo	RES	050N	083W	02	NW1/4SE1/4		51.04		
P1899.0E	Six Mile Ditch {Enl. of}	03/02/1908	Fully Adjudicated	16.57	Clear Creek (drainage of)			Wyoming Land & Cattle Co.	IRR_SW; STO	050N	082W	05	SE1/4SW1/4		-1		

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P4177.0E	Six Mile Ditch,, Burger Enlargement of	01/15/1921	Fully Adjudicated	1.44	Clear Creek (drainage of)		Leonard	Burger	DOM_SW; IRR_SW	050N	082W	05	SE1/4SW1/4		-1		
CR CC35/011	Six Mile Ditch,, Enl.	03/02/1908		16.57	Clear Creek (drainage of)			WYOMING LAND CATTLE COMPANY	IRR_SW	050N	082W	05	NE1/4SW1/4			-106.753000	44.330050
CR CC43/025	Six Mile Ditch,, Enl.	01/15/1921		1.44	Clear Creek (drainage of)		LEONARD	BURGER	DOM_SW; IRR_SW	050N	082W	05	SE1/4SW1/4			-106.753120	44.326460
CR CC22/069	Smith Ditch	05/07/1903		1.00	Clear Creek		GEORGE	SMITH	IRR_SW	051N	081W	04	SE1/4SE1/4			-106.601070	44.413760
P10556.0D	Smith Ditch	03/13/1911	Fully Adjudicated	0.24	French Creek		FRANK E.	LUCAS	IRR_SW	051N	083W	33	NW1/4NW1/4			-106.858284	44.352071
P5455.0D	Smith Ditch	05/07/1903	Fully Adjudicated	1.00	Clear Creek		George	Smith	IRR_SW	052N	081W	34	SE1/4SE1/4			-106.600902	44.413877
CR CC69/005	Smith Spring Ditch No. 2	08/02/1920			Sandy Creek		CHARLES E.	HUSON	IRR_SW	051N	082W	08	NE1/4SE1/4			-106.742300	44.403040
P12086.0D	Snead Ditch	10/24/1913		0.60	Well		TARLTON	SNEAD	IRR_SW	054N	079W	15	NW1/4SW1/4			-106.365359	44.649883
OR 02/186	Sneider No.1 Ditch	03/31/1879		0.71	French Creek	Mary L. Carpenter			IRR_SW	051N	082W	26	SW1/4NW1/4			-106.697200	44.363290
OR 02/186	Sneider No.1 Ditch	03/31/1879		0.93	French Creek	Julia Hart Taylor, Morton K. Hart, Verling K. Hart			IRR_SW	051N	082W	26	SW1/4NW1/4			-106.697200	44.363290
OR 03/151	Snider No. 3 and 1 Ditch	06/20/1883		0.84			JAMES D.	GALLUP	IRR_SW	050N	082W	04	NE1/4SE1/4			-106.722400	44.329910
OR 14/448	Snider No. 3 and 1 Ditch	06/20/1883		1.43				FARM INVESTMENT CO.	MUN_SW	051N	082W	04	NE1/4SE1/4			-106.721960	44.417580
OR 29/344	Snider No. 4 Ditch	04/30/1883					THOMAS	HAMILTON	MUN_SW	050N	082W	06	SE1/4NE1/4			-106.763040	44.333670
P5890.0E	Snider Nos. 1 & 3 Ditch,, 1st Enlargement of	05/31/1956			Clear Creek (drainage of)				IRR_SW	050N	082W	04	NE1/4SE1/4		7.940	-106.722222	44.331667
CR CC65/437	Snider Pumping Station No. 1 Pipeline	10/14/1952		10.95	Whitmire Creek		WILLIAM L.	PEASE	IRR_SW	055N	080W	35	NW1/4SE1/4			-106.453330	44.691940
P21315.0D	Snider Pumping Station No. 1 Pipeline	10/14/1952	Fully Adjudicated	0.00	Whitmire Creek		Mark S. & Shelly	Kirby	IRR_SW	055N	080W	35	NW1/4SE1/4		0.940	-106.453333	44.691944
CR CC65/438	Snider Pumping Station No. 2 Pipeline	10/14/1952		28.90	Whitmire Creek		WILLIAM L.	PEASE	IRR_SW	055N	080W	35	NW1/4SE1/4			-106.456120	44.693930
P21316.0D	Snider Pumping Station No. 2 Pipeline	10/14/1952	Fully Adjudicated	0.00	Whitmire Creek		Mark S. & Shelly	Kirby	IRR_SW	055N	080W	35	NW1/4SE1/4		0.980	-106.454246	44.692724
CR CC65/439	Snider Pumping Station No. 3 Pipeline	10/14/1952		16.87	Whitmire Creek		WILLIAM L.	PEASE	IRR_SW	055N	080W	35	SE1/4NW1/4			-106.461230	44.697330
P21317.0D	Snider Pumping Station No. 3 Pipeline	10/14/1952	Fully Adjudicated	0	Whitmire Creek		Mark S. & Shelly	Kirby	IRR_SW	055N	080W	35	SE1/4NW1/4		0.19		
CR CC65/440	Snider Pumping Station No. 4 Pipeline	10/14/1952		15.85	Whitmire Creek		WILLIAM L.	PEASE	IRR_SW	055N	080W	35	SW1/4SW1/4			-106.466390	44.690220
P21318.0D	Snider Pumping Station No. 4 Pipeline	10/14/1952	Fully Adjudicated	0	Whitmire Creek		Mark S. & Shelly	Kirby	IRR_SW	055N	080W	34	NE1/4NE1/4		0.57		
P21319.0D	Snider Pumping Station No. 5 Pipeine	10/14/1952	Fully Adjudicated	0	Whitmire Creek		Mark S. & Shelly	Kirby	IRR_SW	055N	080W	27	SW1/4SE1/4		0.45		
CR CC65/441	Snider Pumping Station No. 5 Pipeline	10/14/1952		13.70	Whitmire Creek		WILLIAM L.	PEASE	IRR_SW	055N	080W	27	SW1/4SE1/4			-106.476500	44.704050
CR CC65/442	Snider Pumping Station No. 6 Pipeline	10/14/1952		30.85			WILLIAM L.	PEASE	IRR_SW	055N	080W	26	SW1/4SW1/4			-106.466320	44.704310
P21320.0D	Snider Pumping Station No. 6 Pipeline	10/14/1952	Fully Adjudicated	0.00			Mark S. & Shelly	Kirby	IRR_SW	055N	080W	26	SW1/4SW1/4		0.340	-106.466320	44.704310
P17569.0D	Soldier Park Ditch	01/05/1923		0.00	North Fork Clear Creek		Paul A.	Rothwell	RES	051N	085W	36	NW1/4SE1/4		100.000	-107.031486	44.349671
OR 02/194	Sollars Bros. N. Side Ditch	05/31/1888		0.14	Piney Creek	W.H. Sollars			IRR_SW	053N	083W	21	NE1/4NE1/4			-106.854440	44.556320
OR 02/194	Sollars Bros. N. Side Ditch	05/31/1888		0.17	Piney Creek	J.J. Sollars			IRR_SW	053N	083W	21	NE1/4NE1/4			-106.854440	44.556320
OR 02/194	Sollars Bros. S. Side Ditch	06/01/1885		0.64	Piney Creek	W.H. Sollars			IRR_SW	053N	083W	16	SE1/4SW1/4			-106.864460	44.559970
OR 02/194	Sollars Bros. S. Side Ditch	06/01/1885		0.14	Piney Creek	J.J. Sollars			IRR_SW	053N	083W	16	SE1/4SW1/4			-106.864460	44.559970
OR 02/194	Sollars Bros. S. Side Ditch	06/01/1885		0.23	Piney Creek	Leonora Sollars			IRR_SW	053N	083W	16	SE1/4SW1/4			-106.864460	44.559970
P214.0E	Sollars Bros. South Side Ditch {Enl. of}	09/15/1896	Fully Adjudicated	0.12	Piney Creek		William H.	Sollars	IRR_SW	053N	083W	21	NE1/4SE1/4		-1		

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CR CC31/366	Sollars Bros. South Side Ditch,, Enl.	09/15/1896		0.12	Piney Creek		HORACE	SOLLARS	IRR_SW	053N	083W	16	SE1/4SW1/4			-106.864460	44.559970
P1852.0E	Sonnamaker Ditch {Enl. of}	03/30/1908	Fully Adjudicated	1.14	South Piney Creek		F.A.	Senff	IRR_SW	053N	083W	17	NW1/4SE1/4		-1		
CR CC33/480	Sonnamaker Ditch,, Enl.	03/30/1908		1.14	South Piney Creek		F. A.	SENFF	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
CR CC43/027	Sonnamaker No. 2 Ditch	08/12/1919		0.57	Sonnamaker Creek		GEORGE	SONNAMAKER	IRR_SW	053N	083W	17	NE1/4SE1/4			-106.874480	44.563580
P15635.0D	Sonnamaker No. 2 Ditch	08/12/1919	Fully Adjudicated	0.57	Sonnamaker Creek		GEORGE	SONNAMAKER	IRR_SW	053N	083W	17	NE1/4SE1/4		1.370	-106.874482	44.563591
OR 02/194	Sonnemaker Ditch	05/31/1887		0.86	South Piney Creek	G.A. Sonnemaker			IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 02/194	Sonnemaker Ditch	05/31/1887		0.36	South Piney Creek	W.O. Goodhue			IRR_SW	053N	083W	18	NE1/4NE1/4				
OR 16/137	Sonnemaker Ditch	05/31/1887			South Piney Creek		DAVE	FIELDS	IRR_SW	053N	083W	17	NW1/4NE1/4				
OR 56/095	Sonnemaker Ditch	05/31/1887			South Piney Creek		G. A.	SONNAMAKER	IRR_SW	053N	083W	18	NW1/4SW1/4				
OR 02/189	Sonnesberger Ditch	06/01/1883		1.86	North Fork Rock Creek	Thos. J. Haynes			IRR_SW	052N	084W	24	SW1/4NE1/4			-106.908050	44.465850
OR 02/189	South Fork Rock Creek Ditch	05/31/1885		1.64	South Fork	T.J. & Clara L. Haynes			IRR_SW	052N	084W	25	SW1/4SE1/4			-106.908000	44.444240
P17852.0D	South Shell Creek Ditch	10/02/1930	Fully Adjudicated	1.31	South Fork Shell Creek		GEORGE P.	HERSEY	IRR_SW	052N	083W	12	SW1/4SW1/4		2.960	-106.797510	44.485439
P11842.0D	Sparks Ditch	05/20/1913	Fully Adjudicated		North Fork Shell Creek		DOUGLAS B.	SPARKS	IRR_SW; RES	052N	083W	09	SE1/4NE1/4				
CR CC41/463	Sparks Reservoir	05/20/1913		42.00	North Fork Shell Creek		DOUGLAS B.	SPARKS	IRR_SW; STO	052N	083W	09	NE1/4SE1/4			-106.843020	44.490420
CR CC75/067	Spiro Pump & Pipeline	10/01/1980		0.03	North Piney Creek		PEGGY C.	SPIRO	DOM_SW	053N	084W	11	SW1/4NE1/4			-106.940120	44.581960
P27540.0D	Spiro Pump & Pipeline	10/01/1980	Fully Adjudicated	0.03	North Piney Creek		PEGGY CRAWFORD	SPIRO	DOM_SW	053N	084W	11	SW1/4NE1/4		0.030	-106.939692	44.581894
OR 02/182	Splasher Ditch 1st App.	05/31/1880		2.28	Clear Creek (drainage of)	Cullen Watt			IRR_SW	051N	082W	36	NE1/4NW1/4			-106.672270	44.352270
OR 02/182	Splasher Ditch 2nd App.	06/20/1881		0.07	Clear Creek (drainage of)	Chas Carter			IRR_SW	051N	082W	36	NE1/4NW1/4			-106.672270	44.352270
OR 02/182	Splasher Ditch 3" app.	03/15/1884		1.00	Clear Creek (drainage of)	Wm. H. Holland			IRR_SW	051N	082W	36	NE1/4NW1/4			-106.672270	44.352270
OR 02/182	Splasher Ditch 3" app.	03/15/1884		0.36	Clear Creek (drainage of)	Chas. Carter			IRR_SW	051N	082W	36	NE1/4NW1/4			-106.672270	44.352270
CR CC14/063	Splasher Ditch,, Enl.	03/19/1903		0.75	Clear Creek (drainage of)		C. H.	PARMALEE	IRR_SW	051N	082W	36	NE1/4NW1/4			-106.672270	44.352270
CR CC75/113	Splasher Ditch,, Enl.	07/12/1979		1.07	Clear Creek (drainage of)		CHARLES W.	HOLLAND	IRR_SW	051N	082W	36	NE1/4NW1/4			-106.672270	44.352270
P6713.0E	Splasher Ditch,, Holland Sprinkler Enlargement of the	07/12/1979	Fully Adjudicated	1.07	Clear Creek (drainage of)		William c.	Holland	IRR_SW	051N	082W	36	NE1/4NW1/4		9.26		
P1004.0E	Splasher Ditch,, Red Hill Ditch {Enl. of}	03/19/1903	Fully Adjudicated	0.81	Clear Creek (drainage of)		Albert C.	Holland	IRR_SW; STO	051N	081W	31	NE1/4NW1/4		-1		
P9163.0D	Spracklen Ditch	07/03/1909	Fully Adjudicated	1.21	Spring Draw		NELLIE E.	SPRACKLEN	IRR_SW	054N	081W	28	NE1/4NW1/4			-106.624284	44.626817
CR CC35/014	Spracklen Ditch No. 2	07/03/1909		0.58	Spring Draw		ANNA B.	GRANGER	IRR_SW	054N	081W	28	NW1/4NW1/4			-106.627470	44.627520
P9164.0D	Spracklen Ditch No. 2	07/03/1909	Fully Adjudicated	0.58	Spring Draw		NELLIE E.	SPRACKLEN	IRR_SW	054N	081W	28	NW1/4NW1/4			-106.625018	44.628508
P2769.0E	Spring Ditch	03/18/1913	Fully Adjudicated				Etta	Sayles	IRR_SW	051N	083W	18	SE1/4NE1/4			-106.883190	44.392720
P7034.0D	Spring Ditch	01/24/1906	Fully Adjudicated	0.50	South Fork Sayles Creek		Joseph E.	Sayles	IRR_SW	051N	083W	18	NE1/4NE1/4			-106.882600	44.396430
P7135.0D	Spring Ditch	03/23/1906	Fully Adjudicated	0.15	Spring Draw		Harry L.	Senff	DOM_SW; IRR_SW; STO	053N	082W	27	SW1/4SE1/4			-106.717683	44.530104
P1948.0E	Spring Ditch {Enl. of}	09/12/1908	Fully Adjudicated		South Fork Sayles Creek		Joseph E.	Sayles	IRR_SW	051N	083W	18	SE1/4NE1/4				
CR CC62/408	Springer Ditch	12/31/1951		7.87			ELZA	SPRINGER	IRR_SW	050N	082W	02	SW1/4SE1/4			-106.687360	44.326950

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P19280.0D	Springer Ditch	11/10/1939		0.00	Springer Draw		ELZA	SPRINGER	IRR_SW	050N	082W	02	SW1/4SE1/4		1.130	-106.687481	44.326586
P20894.0D	Springer Ditch	12/31/1951	Fully Adjudicated	0			ELZA	SPRINGER	IRR_SW	050N	082W	02	SW1/4SE1/4		1.21		
OR 02/189	Stanley Ditch	05/01/1879		0.17	Rock Creek	Munkers & Mathers {PcNt>Monkres}			IRR_SW	051N	082W	15	NW1/4SW1/4			-106.717080	44.388520
CR CC47/605	Staples Lihgtand Power Ditch	11/19/1932		8.75	Spring Creek		H. G.	STAPLES	POW	053N	084W	12	SW1/4SE1/4			-106.919980	44.574250
P18176.0D	Staples Lihgtand Power Ditch	11/19/1932	Fully Adjudicated	8.75	Spring Creek		H.G.	STAPLES	DOM_SW; IRR_SW; POW; STO	053N	084W	12	SW1/4SE1/4		10.600	-106.918689	44.573563
CR CC38/635	State Ditch	08/08/1912		0.43	Big Spring		JNO J.	LENIHAN	DOM_SW; FIS; IRR_SW	053N	084W	13	NW1/4SW1/4			-106.930000	44.563340
P11444.0D	State Ditch	08/08/1912	Fully Adjudicated	3.43	Big Spring				DOM_SW; FIS; IRR_SW	053N	084W	13	NW1/4SW1/4			-106.929998	44.563341
CR CC38/636	State Pipe Line	08/08/1912		10.00	Little Spring Creek		JNO J.	LENIHAN	DOM_SW	053N	084W	13	NW1/4SW1/4			-106.930000	44.563340
CR CC75/003	State Pipe Line	08/08/1912			Little Spring Creek		WYOMING GAME	FISH COMMISSION	FIS	053N	084W	13	NW1/4SW1/4			-106.930000	44.563340
P11445.0D	State Pipe Line	08/08/1912	Fully Adjudicated		Little Spring Creek				DOM_SW	053N	084W	13	NW1/4SW1/4			-106.928666	44.563275
OR 02/189	Steady Run Ditch	04/30/1883		0.86	Rock Creek	C.W. Rounds			IRR_SW	051N	082W	09	NW1/4SW1/4			-106.737240	44.403040
OR 02/194	Steinbach Ditch	05/01/1884		1.43	Piney Creek	Helena Mayer			IRR_SW	053N	083W	22	NW1/4SE1/4			-106.839330	44.549010
OR 02/194	STEINBACH DITCH 2ND APP.	12/31/1886		0.28	Piney Creek	Helena Mayer			IRR_SW	053N	083W	25	NE1/4SW1/4			-106.801194	44.536272
OR 02/194	Steinbach Ditch 2nd App.	12/31/1886		0.23	Piney Creek	J.J. Sollars			IRR_SW	053N	083W	22	NW1/4SE1/4			-106.839330	44.549010
OR 02/194	Steinbach Ditch 2nd App.	12/31/1886		0.14	Piney Creek	Lenora Sollars			IRR_SW	053N	083W	22	NW1/4SE1/4			-106.839330	44.549010
P7201.0D	Stevenson Ditch	05/17/1906	Fully Adjudicated	2.14	Clear Creek		JOHN W.	STEVENSON	IRR_SW	050N	083W	01	SW1/4NW1/4			-106.798950	44.333267
P1575.0E	Stevenson Ditch {Enl. of}	03/09/1906			Clear Creek (drainage of)			Johnson County Irrigation Company	IRR_SW; RES	050N	083W	01	NW1/4SW1/4		-1		
P22673.0D	Stewart Pipe Line	03/01/1965	Fully Adjudicated	0.00	Sand Creek (3-50-82)		WALTER L.	STEWARD	IRR_SW	050N	082W	09	NW1/4NE1/4		0.043	-106.729214	44.323987
CR CC68/030	Stewart Pipeline	03/01/1965		0.00	Sand Creek (3-50-82)		LOREN	WELLS	IRR_SW	050N	082W	09	NW1/4NE1/4			-106.727860	44.322880
CR CC79/218	Story Fish Hatchery Cavern Intake	06/16/1992		10.00	South Piney Creek		WYOMING GAME	AND FISH COMMISSION	GWR	053N	084W	23	NE1/4NE1/4			-106.934990	44.556160
P30885.0D	Story Fish Hatchery Cavern Intake	06/16/1992	Fully Adjudicated	10.00	South Piney Creek				MIS_SW	053N	084W	23	NE1/4NE1/4		10.000	-106.934897	44.557033
P30688.0D	Story Pipeline No. 1	04/13/1981	Unadjudicated	0.00	Little Spring Creek				FIS; RES	053N	084W	13	NW1/4SW1/4		7.090	-106.928521	44.563355
P30689.0D	Story Pipeline No. 2	04/13/1981	Unadjudicated	0.05	Big Spring				MIS_SW	053N	084W	13	NW1/4SW1/4		0.050	-106.929998	44.563341
P30690.0D	Story Pipeline No. 3	04/13/1981	Unadjudicated	0.00	Big Spring				FIS; RES	053N	084W	13	NW1/4SW1/4		10.040	-106.929998	44.563341
P12432.0D	Stump Ditch	05/22/1914	Fully Adjudicated	0.09	Draw		Morris	Beal	IRR_SW	054N	079W	04	NE1/4NE1/4			-106.370442	44.686497
OR 06/488	Sturdevant Ditch	05/26/1884			Piney Creek		PAUL	BYRTUS	IRR_SW	053N	082W	12	NW1/4SE1/4				
OR 10/605	Sturdevant Ditch	05/26/1884		1.43	Piney Creek	Hiram Sturdevant			IRR_SW	053N	082W	14	SW1/4NW1/4				
OR 13/461	Sturdevant Ditch	05/26/1884			Piney Creek		JENNIE	WILLIAMS	IRR_SW	053N	082W	12	NW1/4SE1/4				
OR 13/467	Sturdevant Ditch	05/26/1884			Piney Creek		LAMAR ALTA	HARDEMAN	IRR_SW	053N	082W	11	NW1/4SE1/4				
OR 13/467	Sturdevant Ditch	05/26/1884			Piney Creek		LAMAR ALTA	HARDEMAN	IRR_SW	053N	082W	12	SE1/4SW1/4				
OR 02/194	Sturdevant Ditch 3" App.	12/31/1890		0.71	Piney Creek	Rudolph Mueller			IRR_SW	053N	082W	11	NW1/4SE1/4			-106.697940	44.577660

Clear Creek Watershed Direct Flow Water Rights

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OR 02/194	Sturgis Ditch	06/01/1881		2.86	Clear Creek (drainage of)	Wm. J. Sturgis			IRR_SW	053N	082W	31	SE1/4NW1/4			-106.783450	44.523600
OR 03/156	Sturgis Ditch	06/01/1881		0.86			O. C.	KILKENNY	IRR_SW	053N	082W	31	SE1/4NW1/4			-106.783450	44.523600
P1177.0E	Sturgis Ditch {Enl. of}	01/06/1904	Fully Adjudicated	1	Piney Creek		Ina B.	Senff	IRR_SW	053N	082W	32	NW1/4SW1/4		-1		
CR CC20/175	Sturgis Ditch,, Enl.	01/06/1904		1.00	Piney Creek		INA B.	SENFF	IRR_SW	053N	082W	31	SE1/4NW1/4			-106.783450	44.523600
P12406.0D	Supplementary Hector Ditch	05/08/1914			Cemetery Draw		W.H.	Pool	IRR_SW	056N	079W	25	SE1/4SE1/4			-106.308926	44.791337
OR 02/191	Syles Creek Ditch	05/01/1882		0.64	Sayles Creek	Henry Yarwood & Sons			IRR_SW	051N	083W	01	SW1/4NW1/4			-106.797700	44.421500
P17709.0D	Tat Ranch Pipe Line	06/04/1930	Unadjudicated	0.80	Brown Springs		F.W.	LEACH	DOM_SW; IRR_SW; STO	053N	083W	21	SW1/4SW1/4		0.800	-106.869443	44.545515
P17710.0D	Tat Ranch Pipe Line	06/04/1930	Unadjudicated	0.45	Little Piney Creek		F.W.	LEACH	DOM_SW; IRR_SW; STO	053N	083W	28	NW1/4NW1/4		0.450	-106.869156	44.542817
OR 02/189	Tay Ditch	06/15/1885		0.57	Rock Creek	Robert Foote			IRR_SW	051N	082W	15	NW1/4SW1/4			-106.717080	44.388520
OR 65/251	Tay Ditch	06/15/1885		0.57	Rock Creek	John Hill			IRR_SW	051N	082W	15	NW1/4SW1/4			-106.717080	44.388520
P34297.0D	T-CROSS-T RANCH PIT WATER HAUL	02/04/2010	Complete	1.00	Piney Creek	WY DEPARTMENT OF TRANSPORTATION	JOHN	CHILDERS	TEM	053N	083W	36	NE1/4NE1/4			-106.794361	44.525722
P7534.0E	THE HUNNELL NO. 1 PIPELINE ENLARGEMENT OF Hunnell No. 1 Pipeline, 1ST ENL. OF	08/30/2007	Fully Adjudicated	0.06	Hunnell No. 1 Spring				STKNDMS	053N	084W	13	NW1/4NW1/4		0.056	-106.930050	44.570519
P7533.0E	THE HUNNELL NO. 2 PIPELINE ENLARGEMENT OF Hunnell No. 2 Pipeline	08/30/2007	Complete	0.00	Hunnell No. 2 Spring				DOM_SW	053N	084W	13	NW1/4NW1/4		0.056	-106.930050	44.570519
CR CC63/021	The Prairie Dog Water Supply Co. Ditch	08/17/1950		100.00	South Piney Creek		ANDREW	STAGER	IRR_SW	053N	083W	18	NE1/4NE1/4			-106.894700	44.570470
P20615.0D	The Prairie Dog Water Supply Co. Ditch	08/17/1950	Fully Adjudicated	0.00	South Piney Creek		WM. I. & LOIS R.	MOORE	IRR_SW	053N	083W	18	NE1/4NE1/4		135.800	-106.895000	44.569722
P12838.0D	Thom Pipe Line	11/19/1914	Fully Adjudicated	0.07	Camp Comfort Draw		Wm. J.	Thorn	DOM_SW; IRR_SW	050N	083W	08	NW1/4SW1/4			-106.879040	44.314713
P19170.0D	Thom Pipe Line No. 1	05/17/1939		0.21	West Sand Creek		John C.	Thom, III	STO	050N	082W	09	NW1/4SW1/4		0.210	-106.738676	44.315776
P19172.0D	Thom Pipe Line No. 3	05/17/1939		0.13	Spring Draw		John C.	Thom, III	STO	050N	082W	05	NE1/4SW1/4		0.130	-106.753005	44.330050
CR CC38/025	Thom Reservoir	11/19/1914		1.44	Camp Comfort Draw		WILLIAM J.	THOM	DOM_SW; IRR_SW	050N	083W	08	NW1/4SW1/4			-106.878840	44.315510
P7082.0E	Thompson & Matthews Ditch,, Muddy Pipeline Enlargement of the	12/23/1993	Unadjudicated	8.43					IRR_SW	049N	082W	29	SW1/4SW1/4		81.7		
P6494.0E	Thompson and Matthews Ditch,, First Enlargement of the	11/05/1973	Fully Adjudicated	0					RES	049N	082W	30	SE1/4NE1/4		12		
CR CC76/014	Thuman Pipeline #1	02/04/1985		0.00	North Piney Creek		THURMAN E.	DECKER	IRR_SW	053N	084W	12	SW1/4NE1/4			-106.919880	44.582000
P29157.0D	Thuman Pipeline #1	02/04/1985	Fully Adjudicated	0.00	North Piney Creek				IRR_SW	053N	084W	12	SW1/4NE1/4		0.060	-106.919171	44.582267
CR CC76/011	Thurman Pump #1	02/04/1985		0.01	Thurman Spring Draw		THURMAN E.	DECKER	IRR_SW	053N	084W	12	NW1/4SE1/4			-106.919930	44.578120
P29156.0D	Thurman Pump #1	02/04/1985	Fully Adjudicated	0.00	Thurman Spring Draw				IRR_SW	053N	084W	12	NW1/4SE1/4		0.050	-106.919425	44.579765
CR CC67/063	Toad Water Supply Pipe Line	12/30/1963		0.01	Wright No. 2 Spring		ARTHUR E.	POWERS	DOM_SW; IRR_SW	053N	083W	18	NE1/4NW1/4			-106.904870	44.570500
P22537.0D	Toad Water Supply Pipe Line	12/30/1963	Fully Adjudicated	0.01	Wright No. 2 Spring		ARTHUR E. & LILLIE	POWERS	DOM_SW; IRR_SW	053N	083W	18	NE1/4NW1/4		0.014	-106.904874	44.570499
P33611.0D	Trinity Pump	06/29/2006	Unadjudicated		Peters Rivulet		James	Blanford	DOM_SW	053N	083W	07	NW1/4SE1/4		0.056	-106.899740	44.578100
P33819.0D	TURNER NO. 3 PIPELINE	08/30/2007	Complete	0.06	Turner No. 3 Spring				DOM_SW	053N	084W	13	NW1/4NW1/4		0.056	-106.930050	44.570519

Clear Creek Watershed Direct Flow Water Rights

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P7205.0D	Twin Ditch	05/01/1906	Fully Adjudicated		Bob's Draw		J. D.	POOL	DOM_SW; IRR_SW; STO	056N	078W	18	SE1/4SE1/4			-106.286694	44.823509
P18599.0D	U. M. Domestic Pipe Line	06/18/1935	Unadjudicated	0.13	Spring Draw			MEAD CREEK RANCH INC.	DOM_SW; STO	052N	083W	31	SE1/4SW1/4		0.130	-106.892600	44.429760
OR 11/321	Upper East Side Ditch	12/01/1881		0	Little Goose Creek		GOELET	GALLATIN	IRR_SW	053N	085W	01	NW1/4NE1/4				
OR 02/194	Upper Flying E Ditch	05/01/1886		1.71	Piney Creek	The Murphy Cattle Co.			IRR_SW	053N	082W	21	SE1/4SE1/4			-106.733330	44.544660
OR 02/194	Upper Harvey Ditch	06/01/1887		0.37	South Piney Creek	W.W. Harvey			IRR_SW	053N	084W	13	SE1/4SW1/4				
OR 07/392	Upper Harvey Ditch	06/01/1887			South Piney Creek		GEORGE P.	BUCKINGHAM	IRR_SW	053N	084W	13	SE1/4SW1/4				
P4783.0E	Upper Harvey Ditch,, {Enl. of}	11/12/1931	Fully Adjudicated	2.1	South Piney Creek		George P.	Buckingham	IRR_SW	053N	084W	13	SE1/4SW1/4		3		
CR CC47/322	Upper Harvey Ditch,, Enl.	11/12/1931		2.10	South Piney Creek		GEORGE P.	BUCKINGHAM	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
CR CC63/023	Upper Harvey Ditch,, Enl.	04/15/1952		50.00	South Piney Creek		THAD RICHARD	BARD	IRR_SW	053N	084W	13	SE1/4SW1/4			-106.924940	44.559770
P5617.0E	Upper Harvey Ditch,, Enlargement of the	04/15/1952	Fully Adjudicated	0	South Piney Creek		Andrew J.	Stager	IRR_SW	053N	084W	13	SE1/4SW1/4		5.07		
OR 02/194	Upper Phil Kearney Ditch	05/15/1881		4.93	Little Piney Creek	T.J. Foster			IRR_SW	053N	083W	28	NE1/4SE1/4				
OR 02/194	Upper Phil Kearney Ditch	05/15/1881		0.21	Little Piney Creek	Josef Leitner			IRR_SW	053N	083W	28	NE1/4SE1/4			-106.854320	44.534700
OR 13/367	Upper Phil Kearney Ditch	05/15/1881			Little Piney Creek		THOMAS F.	KEARNS	IRR_SW	053N	083W	28	NE1/4SE1/4				
OR 13/367	Upper Phil Kearney Ditch	05/15/1881			Little Piney Creek		THOMAS F.	KEARNS	IRR_SW	053N	083W	28	NW1/4SE1/4				
OR 13/367	Upper Phil Kearney Ditch	05/15/1881			Little Piney Creek		THOMAS F.	KEARNS	IRR_SW	053N	083W	27	SE1/4SW1/4				
OR 13/367	Upper Phil Kearney Ditch	05/15/1881			Little Piney Creek		THOMAS F.	KEARNS	IRR_SW	053N	083W	34	NE1/4NE1/4				
OR 13/367	Upper Phil Kearney Ditch	05/15/1881			Little Piney Creek		THOMAS F.	KEARNS	IRR_SW	053N	083W	26	SW1/4SW1/4				
CR CC22/089	Upper Sayles Ditch	01/24/1906		0.95	North Fork Sayles Creek		LENA	SAYLES	IRR_SW	051N	083W	07	NW1/4NE1/4			-106.888190	44.411180
P7035.0D	Upper Sayles Ditch	01/24/1906	Fully Adjudicated	0.96	North Fork Sayles Creek		LENA	SAYLES	IRR_SW	051N	083W	07	NW1/4NE1/4			-106.889031	44.411610
P2132.0E	Upper Sayles Ditch {Enl. of}				Sayles Creek		Martha A.	Bryant	IRR_SW	051N	085W	05	SW1/4SE1/4				
P22174.0D	Veteran Supply Ditch	12/11/1959	Unadjudicated	0.00	Clear Creek				RES	050N	082W	05	SE1/4NW1/4		1.680	-106.752743	44.333861
P34340.0D	VIGNAROLI WATER HAUL	05/07/2010	Complete	0.67	Clear Creek	WYOMING OIL & GAS COMMISSION	RON	WHITE	TEM	053N	080W	19	SW1/4SE1/4			-106.535639	44.544250
CR CC76/012	Visconti Spring #1 Pipeline	03/10/1975		0.00	Visconti Spring No. 1		JOHN E. HELEN L.	HANFT	IRR_SW	053N	083W	17	SW1/4NE1/4			-106.879520	44.567110
P24862.0D	Visconti Spring #1 Pipeline	03/10/1975	Fully Adjudicated	0.07	Visconti Spring No. 1				IRR_SW	053N	083W	17	SW1/4NE1/4		2.627	-106.879565	44.566816
OR 02/194	W. J. D. Ditch	04/30/1882		0.36	Piney Creek	Allen Williams			IRR_SW	053N	081W	07	SE1/4NE1/4			-106.652510	44.580600
OR 02/194	W. J. D. Ditch	04/30/1882		1.71	Piney Creek	Samuel Dickey			IRR_SW	053N	082W	12	NW1/4SE1/4			-106.677780	44.577260
OR 02/194	W. J. D. Ditch	04/30/1882		1.71	Piney Creek	David Jackins			IRR_SW	053N	082W	12	NW1/4SE1/4			-106.677780	44.577260
P182.0E	W. J. D. Ditch {Enl. of}	01/07/1896	Fully Adjudicated	1.43	Piney Creek		Samuel	Dickey	IRR_SW	053N	082W	12	NW1/4SE1/4		-1.000	-106.677222	44.575278
CR CA02/004	W. J. D. Ditch,, Enl.	01/07/1896		0.71	Piney Creek		SAMUEL	DICKEY	IRR_SW	053N	082W	12	NW1/4SE1/4			-106.677780	44.577260
CR CC72/356	W.J.D. Ditch,, Enl.	07/23/1970		1.69	Piney Creek			SCHOOL DISTRICT #1	IRR_SW	053N	082W	12	NW1/4SE1/4			-106.677780	44.577260
P6362.0E	W.J.D. Ditch,, Fowler Enlargement of	07/23/1970	Fully Adjudicated		Piney Creek				IRR_SW	053N	082W	12	NW1/4SE1/4		46.4		
P20047.0D	Wagon Box Pipe Line	04/17/1946	Fully Adjudicated	0.07	Wagon Box Spring				DOM_SW; STO	053N	083W	18	SE1/4NE1/4		0.066	-106.894706	44.566852
P34255.0D	WALLACE DOMESTIC PUMP	10/20/2009	Complete	0.06	North Piney Creek		SHARON	WALLACE	DOM_SW	053N	083W	08	NE1/4SW1/4	0.06	0.056	-106.885017	44.577844
CR CC69/249	Walters Pump	06/07/1968		0.03	North Piney Creek		KARL F.	WALTERS	IRR_SW	053N	084W	12	SW1/4NW1/4			-106.929960	44.581980

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P22945.0D	Walters Pump	06/07/1968	Fully Adjudicated	0.03	North Piney Creek		KARL F. & GRACE F.	WALTERS	IRR_SW	053N	084W	12	SW1/4NW1/4		0.056	-106.928237	44.580111
P16717.0D	Warfield Ditch	11/03/1923	Unadjudicated	0.88	Davis Draw		WALTER H.	WARFIELD	IRR_SW	055N	078W	14	SW1/4SE1/4		16.500	-106.211937	44.736848
OR 02/182	Watt Ditch	11/30/1884		2.86	Clear Creek (drainage of)	Peter C. Watt			IRR_SW	052N	081W	24	NW1/4NW1/4			-106.555680	44.468430
CR CC88/015	Watt Ditch,, Enl.	02/23/2005		2.86	Clear Creek	Watt Ranch			RES	052N	081W	24	NW1/4NW1/4			-106.555680	44.468430
P34234.0D	WEAKLY DOMESTIC PUMP	08/05/2009	Complete	0.06	Mill Creek		ALAN AND SUZANNE	WEAKLY	DOM_SW	053N	084W	12	NE1/4SE1/4		0.056	-106.912369	44.577553
P20359.0D	Wenburg Pump No. 1 Ditch	03/20/1950	Fully Adjudicated	0.37	Clear Creek		WAYNE Q.O.	WENBURG	IRR_SW	053N	080W	11	NW1/4SE1/4		0.390	-106.455493	44.575940
P20360.0D	Wenburg Pump No. 2 Ditch		Fully Adjudicated	0.70	Clear Creek		WAYNE Q.O.	WENBURG	IRR_SW	053N	080W	12	NW1/4SW1/4		0.720	-106.447117	44.576879
P19444.0D	West Ditch	09/05/1940	Fully Adjudicated	0.04	West Draw		H.W.	HUGHEY	DOM_SW; IRR_SW; STO	053N	083W	18	SE1/4NE1/4		0.307	-106.894706	44.566852
CR CC68/233	Westbrook Pipeline	09/08/1960		0.06	Westbrook Spring No. 1&2		MELVA	WESTBROOK	IRR_SW	053N	083W	18	SW1/4NW1/4			-106.909890	44.566930
P22476.0D	Westbrook Pipeline	09/08/1960	Fully Adjudicated	0.06	Westbrook Spring No. 1&2		MELVA	WESTBROOK	DOM_SW; IRR_SW	053N	083W	18	SW1/4NW1/4		0.080	-106.909888	44.566932
P10605.0D	WESTON NO. 1 DITCH	04/24/1911	Complete	0.21	Draw		ELFIE	WESTON	IRR_SW	056N	078W	08	NE1/4SE1/4			-106.268461	44.840210
P10606.0D	WESTON NO. 2 DITCH	04/24/1911	Complete		Draw		ELFIE	WESTON	IRR_SW	056N	078W	08	NW1/4NE1/4			-106.273561	44.847448
P9299.0D	WHEDON DITCH NO. 1	08/30/1909	Fully Adjudicated		Whedon Gulch		EARL AND BESSIE F	WHEDON	IRR_SW	056N	078W	07	SW1/4NE1/4			-106.292841	44.844822
P9300.0D	WHEDON DITCH NO. 2	08/30/1909	Fully Adjudicated		Dry Gulch		EARL	WHEDON	IRR_SW	056N	078W	17	NW1/4NE1/4			-106.271175	44.832117
CR CC34/200	Whedon Ditch No. 3	09/24/1910		0.14	North Whedon Gulch		BESSIE F.	WHEDON	IRR_SW	056N	078W	07	NE1/4NW1/4				
P10145.0D	WHEDON DITCH NO. 3	09/24/1910	Fully Adjudicated	0.14	North Whedon Gulch		BESSIE	WHEDON	IRR_SW	056N	078W	07	NE1/4NW1/4		-1.000	-106.298170	44.847813
P22460.0D	Whitmire Ditch	01/27/1964	Fully Adjudicated	0.03	North Piney Creek		WILLIAM H. & SYLVIA	LAWRENCE	DOM_SW; FIS; IRR_SW; RES; STO	053N	083W	07	SE1/4NW1/4		22.240	-106.907044	44.580509
P6373.0D	Wice Ditch	12/27/1904	Fully Adjudicated	0.23	McDonald Creek		Henry	Wice	IRR_SW	052N	083W	32	SE1/4SE1/4			-106.862500	44.429450
P2418.0E	WILCOX ENLARGEMENT OF SANDY CREEK DITCH	03/13/1911	Fully Adjudicated	0.99	Sandy Creek		HAMILTON	WILCOX	IRR_SW	051N	082W	08	SE1/4SE1/4		-1.000	-106.741728	44.397744
CR CC80/370	Wildlife Supply Ditch	10/21/1991		3.00	Cemetery Draw		CITY OF	BUFFALO	REC; RES	051N	082W	35	SE1/4NE1/4			-106.682430	44.348750
P30749.0D	Wildlife Supply Ditch	10/21/1991	Fully Adjudicated	49.52	Cemetery Draw			City of Buffalo	RES	051N	082W	35	SE1/4NE1/4		49.520	-106.683930	44.348202
P33007.0D	Wilson Stream Access Pump	06/09/2004	Unadjudicated		Piney Creek		Robert C.	Wilson	DOM_SW	053N	083W	26	SE1/4NW1/4		0.020	-106.824691	44.538109
CR CC35/486	Winter No. 1 Ditch	05/10/1910		0.34	Clear Creek		P. C.	WINTER	IRR_SW	053N	080W	11	NE1/4SW1/4			-106.461930	44.576720
P9800.0D	Winter No. 1 Ditch	05/10/1910	Fully Adjudicated	0.34	Clear Creek		P.C.	Winter	IRR_SW	053N	079W	07	NE1/4NW1/4			-106.412013	44.590847
CR CC35/487	Winter No. 2 Ditch	05/10/1910		0.41	Clear Creek		P. C.	WINTER	IRR_SW	053N	080W	11	NE1/4SW1/4			-106.461930	44.576720
P9801.0D	Winter No. 2 Ditch	05/10/1910	Fully Adjudicated	0.41	Clear Creek		P.C.	Winter	IRR_SW	053N	079W	06	SW1/4SE1/4			-106.410381	44.592323
CR CC35/488	Winter No. 3 Ditch	05/10/1910		0.33	Clear Creek		P. C.	WINTER	IRR_SW	053N	080W	11	NE1/4SW1/4			-106.461930	44.576720
P9802.0D	Winter No. 3 Ditch	05/10/1910	Fully Adjudicated	0.43	Clear Creek		P.C.	Winter	IRR_SW	053N	079W	06	SW1/4NE1/4			-106.410057	44.596919
P34256.0D	WINTERLING DOMESTIC PUMP	08/03/2009	Incomplete	0.06	Spring Creek		JOHN	WINTERLING	DOM_SW	053N	084W	12	SE1/4SE1/4		0.056	-106.914167	44.574986
P34230.0D	WINTERS DOMESTIC PUMP	07/30/2009	Complete	0.06	Spring Creek		ALLEN	WINTERS	DOM_SW	053N	084W	12	SE1/4SE1/4		0.056	-106.914689	44.574714
P18305.0D	Wolfe Ditch No. 1	07/31/1933	Fully Adjudicated	0.03	North Fork Spring Creek		Annabel	Wolfe	DOM_SW; IRR_SW; STO	053N	084W	13	NW1/4NW1/4		0.430	-106.930054	44.570516

Clear Creek Watershed Direct Flow Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	TOTAL FLOW	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	TOTAL CAPACITY (AF/Yr)	DIVERSION CAPACITY AT HEAD GATE	LONGITUDE	LATITUDE
P18306.0D	Wolfe Ditch No. 2	07/21/1933	Unadjudicated		North Fork Spring Creek		Annabel	Wolfe	DOM_SW; IRR_SW; STO	053N	084W	13	NW1/4NW1/4		0.430	-106.930054	44.570516
CR CC75/355	Woods Ditch	01/08/1965		0.00	Whitmire Creek		ROY M. BLANCH N.	WOOD	IRR_SW	054N	079W	10	SW1/4SW1/4			-106.365400	44.660780
P23029.0D	Woods Ditch	01/08/1965	Fully Adjudicated	0.00	Whitmire Creek		Roy	Wood	IRR_SW	054N	079W	10	SW1/4SW1/4		2.970	-106.364992	44.660114
CR CC74/174	Wright Pipe Line	05/04/1977		0.02	Clear Creek		WYO BOARD	LAND COMMISSIONERS	STO	051N	081W	03	SW1/4NW1/4			-106.595980	44.421030
P25900.0D	Wright Pipe Line	05/04/1977	Fully Adjudicated	0.02	Clear Creek				STO	051N	081W	03	SW1/4NW1/4		0.022	-106.595932	44.421575
CR CC66/289	Wright Water Pump Pipeline	06/01/1960		0.02	Wright No. 1 Spring		LEAH M.	WRIGHT	DOM_SW; IRR_SW	053N	083W	18	NE1/4NW1/4			-106.904870	44.570500
P22264.0D	Wright Water Pump Pipeline	06/01/1960	Fully Adjudicated	0.02	Wright No. 1 Spring		Bernard G. & Leah M.	Wright	DOM_SW; IRR_SW	053N	083W	18	NE1/4NW1/4		0.016	-106.904874	44.570499
OR 02/189	Yarwood Ditch	10/31/1883		2.86	Rock Creek	Henry Yarwood & Sons			IRR_SW	052N	083W	28	SE1/4SW1/4				
OR 04/584	Yarwood Ditch	10/31/1883			Rock Creek		YARWOOD SONS	HENRY	IRR_SW	052N	083W	28	SE1/4SW1/4				
OR 23/120	Yarwood Ditch	10/31/1883			Rock Creek		EDWARD M.	TWING ESTATE	IRR_SW	052N	083W	28	SE1/4SW1/4				
P34258.0D	ZIMMERMAN DOMESTIC PUMP	09/30/2009	Complete	0.06	North Piney Creek		MICHAEL AND VICKI	ZIMMERMAN	DOM_SW	053N	083W	08	NE1/4SW1/4	0.06	0.056	-106.883703	44.577619
P8839.0D	Zing Ditch	11/10/1908	Fully Adjudicated		North Fork Deadman's Draw		L.L. & Gertrude	Zing	IRR_SW	055N	079W	22	SW1/4NE1/4			-106.354175	44.728151
CR CC32/229	Zing Reservoir	11/10/1908		24.00	North Fork Deadman's Draw		L. L.	ZINGG	IRR_SW	055N	079W	22	SW1/4NE1/4			-106.354920	44.726470
P14205.0D	Zortman Pipe Line	01/22/1916	Fully Adjudicated		Thelma Spring		Albert	Zortman	DOM_SW; STO	052N	082W	29	SW1/4SW1/4			-106.759273	44.444307

Appendix 3G.2

Storage Water Rights Tabulation

Clear Creek Watershed Storage Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
P13341.0R	41-31-5079W Reservoir	08/11/2008	Unadjudicated						Reservoir	CBM_SW; IND_SW; STO; WIL; COMBBU						
P6932.0R	4X Reservoir	08/07/1961	Fully Adjudicated	21.6			Malcolm	Hutton	Reservoir	STO						
CR CR18/116	76 RANCH STOCK RESERVOIR	03/10/1997		3.35	Cummings Creek	Fran Walter				STO	050N	082W	15		-106.710230	44.303260
CR CR18/115	76 Ranch Stock Reservoir,, Enl.	06/13/2001		19.20	Cummings Creek	Fran Walter				FIS; IRR_SW; STO	050N	082W	15		-106.710230	44.303260
P13356.0R	A1-5-5477 Reservoir	06/23/2008	Unadjudicated						Reservoir	CBM_SW; IND_SW; IRR_SW; STO; WIL; COMBBU						
CR CR09/014	Ackerley No. 3 Stock Reservoir	01/29/1963		11.45	Shuler Draw		WILLIAM A.	ACKERLEY		STO	056N	079W	30	SE1/4NW1/4	-106.421330	44.798320
P13376.0R	Angus Reservoir	10/20/2008	Unadjudicated						Reservoir	IRR_SW; STO; COMBBU						
P9852.0R	Apel Fish Pond Reservoir	04/08/1992	Fully Adjudicated	0.30	Peters Rivulet		HOWARD L. & ROMA J.	APEL	Reservoir	FIS	053N	083W	7	SE1/4SW1/4	-106.906478	44.573113
CR CR13/253	Apel Fish Pond Reservoir	04/08/1992		0.30	Peters Rivulet		EDWIN AND CLARA	JOUBERT		FIS	053N	083W	07	SE1/4SW1/4	-106.904870	44.574240
P7367.0R	Arno Reservoir	12/11/1970	Fully Adjudicated	3	Arno Draw		Jim	Arno	Reservoir	STO	051N	082W	29	NW1/4SW1/4		
CR CR08/171	Arno Reservoir	12/11/1970		3.00	Arno Draw		JIM	ARNO		STO	051N	082W	29	NW1/4SW1/4	-106.757510	44.358980
P3564.0R	ARROYO RESERVOIR	08/02/1919	Fully Adjudicated	12.90	Arroyo Draw		PETER K. AND DORIS M.	JONES	Reservoir	IRR_SW	051N	082W	15	NE1/4NW1/4	-106.712136	44.395142
P6108.0R	Auzqui No. 1 Reservoir	12/30/1953	Unadjudicated	66.50	Number Two Draw		ARNOUD	AUZQUI	Reservoir	STO	054N	078W	30		-106.291346	44.625558
P6109.0R	Auzqui No. 2 Reservoir	12/30/1953	Unadjudicated	42.70	Number Two Draw		Arnaud	Auzqui	Reservoir	STO	054N	078W	31	NE1/4NW1/4	-106.286252	44.614725
P6287.0R	Auzqui No. 3 Reservoir	01/03/1956	Unadjudicated	14.15	East Fork Number Two Draw		Arnaud	Auzqui	Reservoir	STO	054N	078W	32	NE1/4NW1/4	-106.276273	44.613981
P13355.0R	B1-9-5477 Reservoir	06/23/2008							Reservoir	CBM_SW; IND_SW; IRR_SW; STO; WIL; COMBBU						
CR CR06/446	Baldwin No. 2 Reservoir	08/25/1969		9.88	Armstrong Draw		JOHN A.	ESPONDA		STO	051N	080W	All			
P13108.0R	BALKENBUSH RESERVOIR	07/27/2007	Complete		South Piney Creek				Reservoir	FIS; STO; WL	053N	083W	18	NE1/4SW1/4	-106.904789	44.563331
CR CR02/378	Bandy Stock Reservoir	09/26/1960		0.88	Lawrence Draw		CHARLES K.	LAWRENCE		STO	052N	081W	21	SW1/4NW1/4	-106.615970	44.464640
P300.0S	BART STOCK RESERVOIR	07/06/1953	Complete	11.71	Fawn Draw		JOHN	DALZELL	Reservoir	STO	055N	077W	04	SW1/4NW1/4	-106.142553	44.772994
CR CR09/111	Basin Stock Reservoir	10/26/1960		4.96	Basin Draw		GRACE F.	WALTERS		STO	052N	080W	18	SE1/4SE1/4		
CR CR18/113	Bauman No. 1 Reservoir	03/01/2000		242.30	Bauman Draw	Ucross Land Company				WET	053N	080W	17	NW1/4NE1/4	-106.517350	44.569290
P12980.0R	Bauman No.1 Reservoir	03/01/2000	Fully Adjudicated		Bauman Draw				Reservoir	WET	053N	080W	17	NW1/4NE1/4	-106.517350	44.569290
P4584.0R	Belus No. 1 Reservoir	03/07/1935	Fully Adjudicated	11.91	Harper Draw		Steve	Belus	Reservoir	IRR_SW; STO; COMBBU	053N	081W	30	SE1/4SW1/4	-106.662547	44.529898
CR CR01/135	Belus No. 1 Reservoir	03/07/1935		11.91	Harper Draw		STEVE	BELUS		IRR_SW; STO	053N	081W	30	SE1/4SW1/4	-106.662800	44.529740
P6510.0R	Belus No. 2 Reservoir	06/24/1959	Fully Adjudicated	10.50	South Fork Harper Draw			Belus Ranch Corp.	Reservoir	IRR_SW; STO; COMBBU	053N	081W	30	SW1/4SW1/4	-106.668830	44.529185
CR CR02/341	Belus No. 2 Reservoir	06/24/1959		10.50	South Fork Harper Draw			BELUS RANCH CORPORATION		IRR_SW; STO	053N	081W	30	SW1/4SW1/4	-106.667910	44.529750
CR CR10/289	Belus Ranch Corporation #1 and State of Wyoming Stock Reservoir	06/21/1983		2.50	South Fork Harper Draw		WYO BOARD	LAND COMMISSIONERS		STO	053N	082W	36	NE1/4NE1/4	-106.672960	44.526140
P9875.0R	Belus Reservoir	06/18/1992	Fully Adjudicated	48.25	Box Elder Creek			Belus Ranch Corp.	Reservoir	IRR_SW; STO; COMBBU	052N	082W	23	SE1/4SW1/4	-106.691407	44.456076
CR CR14/146	Belus Reservoir	06/18/1992		48.25	Box Elder Creek		BELUS	RANCH CORP.		IRR_SW; STO	052N	082W	23	SE1/4SW1/4	-106.691340	44.457170
P6523.0R	Belus Reservoir No. 1,,Enlargement of the	11/17/1958	Unadjudicated	44.36	Harper Draw		John	Belus	Reservoir	IRR_SW; STO; COMBBU	053N	081W	30	SE1/4SW1/4	-106.662548	44.529824
CR CR10/164	Ben #1 Stock Reservoir	08/20/1981		1.73	Ben Draw		BEN	MOORE		STO	051N	083W	23	SW1/4NW1/4	-106.817930	44.377740
P19313.0S	BENTON 2010 N. CABIN CREEK	03/29/2010	Complete		West Cabin Creek		COLE AND OR ELAINE	BENTON	Reservoir	STO	058N	078W	35	NW1/4SE1/4	-106.223314	44.959897
CR CR08/045	Bergner #19 Stock Reservoir	12/04/1973		1.11	Middle Fork Mill Creek			BERGNER CORPORATION		STO	050N	083W	23	NE1/4SE1/4	-106.803300	44.286730
CR CR08/040	Bergner No. 10 Stock Reservoir	01/10/1972		0.35	Mill Creek			BERGNER CORPORATION		STO	050N	082W	27	SE1/4NW1/4	-106.712310	44.276190
CR CR08/041	Bergner No. 11 Stock Reservoir	01/10/1972		0.54	Mill Creek			BERGNER CORPORATION		STO	050N	082W	29	SE1/4NW1/4	-106.752620	44.276030
CR CR08/042	Bergner No. 12 Stock Reservoir	01/10/1972		0.44	Mill Creek			BERGNER CORPORATION		STO	050N	082W	29	SW1/4NE1/4	-106.747590	44.276060
CR CR08/043	Bergner No. 15 Stock Reservoir	01/10/1972		0.35	South Prong Mill Creek			BERGNER CORPORATION		STO	050N	083W	26	SE1/4SE1/4	-106.803340	44.268550
CR CR08/044	Bergner No. 17 Stock Reservoir	01/10/1972		0.21	Spring Branch			BERGNER CORPORATION		STO	050N	083W	24	SW1/4SW1/4	-106.798240	44.282970
CR CR08/039	Bergner No. 18 Stock Reservoir	01/10/1972		0.19	Field Draw			BERGNER CORPORATION		STO	050N	081W	18	NW1/4NE1/4	-106.647110	44.308720

Clear Creek Watershed Storage Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
CR CR08/170	Bergner No. 9 Stock Reservoir	01/10/1972		0.35	Bull Creek			BERGNER CORPORATION		STO	050N	082W	26	SE1/4NE1/4	-106.682060	44.275970
CR CR02/183	Betz #1 Stock Reservoir	12/30/1953		10.38	North Fork Clear Creek Draw		ALVIN	BETZ		STO	052N	079W	05	NE1/4SE1/4	-106.382150	44.509160
P7188.0R	Big Boy Reservoir	05/20/1969	Fully Adjudicated	29.58			Phil	Schuman	Reservoir	FIS; STO; COMBBU						
P7564.0R	Big Donaldson Reservoir	07/10/1973	Fully Adjudicated	56.60	Double Crossing Draw		EDNA E.	LANDECK	Reservoir	STO	053N	080W	24	NW1/4NE1/4	-106.436395	44.554113
CR CR07/333	Big Donaldson Reservoir	07/10/1973		56.60	Double Crossing Draw		EDNA E.	LANDECK		STO	053N	080W	24	NW1/4NE1/4	-106.436800	44.555350
P6524.0R	Big Draw Reservoir,,Enlargement of	11/17/1958	Unadjudicated	23.86	Big Draw		John	Belus	Reservoir	IRR_SW; STO; COMBBU	053N	081W	30	SE1/4NE1/4	-106.650385	44.537293
CR CR02/340	Big Draw Stock Reservoir	11/10/1958		8.50	Big Draw		JOHN	BELUS		STO	053N	081W	30	SE1/4NE1/4	-106.652600	44.537010
P10132.0R	Big John No. 1 Reservoir	08/05/1994	Fully Adjudicated	0.04	Sand Creek (3-50-82)				Reservoir	FIS; REC; WIL; COMBBU	050N	082W	09	NW1/4NE1/4	-106.727859	44.322879
CR CR14/249	Big John No. 1 Reservoir	08/05/1994		0.04	Sand Creek (3-50-82)		EDGAR C.	SMITH		FIS; REC	050N	082W	09	NW1/4NE1/4	-106.727860	44.322880
CR CR02/380	Big Spring	09/26/1960		5.10	Hodge Draw		CHARLES K.	LAWRENCE		STO	052N	081W	20	NW1/4SE1/4	-106.625980	44.460990
P13000.0R	BISON MEADOWS DETENTION RESERVOIR	08/29/2007	Incomplete		Cemetery Draw				Reservoir	FLO	051N	082W	35	SW1/4SE1/4	-106.687531	44.341511
P427.0S	BLUE GULCH NO. 1 STOCK RESERVOIR	10/08/1953	Complete	9.25	Blue Gulch		FRANK	JACOBS	Reservoir	STO	056N	079W	36		-106.322269	44.779983
P839.0R	BOB RESERVOIR	05/01/1906	Fully Adjudicated	28.00	Bob's Draw		R.E.L.	POOL	Reservoir	DOM_SW; IRR_SW; STO	056N	078W	18	SE1/4NW1/4	-106.298324	44.829353
P5852.0R	BOGGS RESERVOIR	03/26/1951	Fully Adjudicated	5.05	Cemetery Draw	JOHNSON COUNTY CEMETERY DISTRICT			Reservoir	DOM_SW; IRR_SW; STO	050N	082W	03	SW1/4NE1/4	-106.707983	44.333728
CR CR01/446	Boggs Reservoir	03/26/1951		5.05	Cemetery Draw	JOHNSON COUNTY CEMETERY DISTRICT				DOM_SW; IRR_SW; STO	050N	082W	03	SW1/4NE1/4	-106.707980	44.333740
CR CR02/384	Bond Stock Reservoir	09/26/1960		3.37	Bond Draw		CHARLES K.	LAWRENCE		STO	052N	081W	32	SW1/4NE1/4	-106.626170	44.435830
P12093.0R	Boulder Lane Reservoir	06/18/2004	Unadjudicated		Looney Draw				Reservoir	IRR_SW; STO; COMBBU	052N	079W	All			
P6667.0R	Brock Reservoir	02/17/1961	Fully Adjudicated	50.9			LARRY J. & CHERYL GERARD &	JULIE BAKER	Reservoir	IRR_SW						
CR CR02/385	Bruce Stock Reservoir	09/26/1960		1.29	Haley Draw		CHARLES K.	LAWRENCE		STO	051N	081W	05	SW1/4NW1/4	-106.636790	44.421320
CR CR09/054	Brug & Lusher #20 Stock Reservoir	06/09/1969		1.10	Brug Draw			BRUG		STO	054N	080W	20	NE1/4NW1/4	-106.522490	44.641460
CR CR09/056	Brug & Lusher #32 Stock Reservoir	05/14/1969		5.82	Brug-Lusher Draw		JOHN	BRUG		STO	054N	080W	09	SW1/4SW1/4	-106.507750	44.659510
CR CR09/055	Brug and Lusher #18 Stock Reservoir	06/09/1969		1.92	Kinney Draw		JOHN	BRUG		STO	054N	080W	09	SW1/4NW1/4	-106.507790	44.666720
CR CR10/476	Buffalo Diversion Reservoir	12/07/1984		2.56	Clear Creek		CITY OF	BUFFALO		MUN_SW	050N	083W	10	SE1/4NW1/4	-106.833660	44.319240
CR CR15/156	Buffalo Park Wetlands Reservoir	06/13/1996		1.92	Clear Creek (Drainage of)	City of Buffalo				WET	051N	082W	34	NW1/4SE1/4	-106.707840	44.344640
P10658.0R	Buffalo Park Wetlands Reservoir #1	06/13/1996	Fully Adjudicated	1.92	Clear Creek (Drainage of)			City of Buffalo	Reservoir	WET	051N	082W	34	NW1/4SE1/4	-106.717338	44.348106
P10659.0R	Buffalo Park Wetlands Reservoir #2	06/13/1996	Fully Adjudicated	0.73	Clear Creek (Drainage of)			City of Buffalo	Reservoir	WET	051N	082W	34	SE1/4SW1/4	-106.709856	44.346666
P10660.0R	Buffalo Park Wetlands Reservoir #3	06/13/1996	Fully Adjudicated	2.19	KG Draw			City of Buffalo	Reservoir	WET	051N	082W	34	SE1/4SW1/4	-106.709856	44.346666
P10661.0R	Buffalo Park Wetlands Reservoir #4	06/13/1996	Fully Adjudicated	6.76	KG Draw				Reservoir	WET	051N	082W	34	SW1/4SW1/4	-106.709856	44.346666
P10662.0R	Buffalo Park Wetlands Reservoir #5	06/13/1996	Fully Adjudicated	0.69	Clear Creek (Drainage of)			City of Buffalo	Reservoir	WET	051N	082W	34	SE1/4SW1/4	-106.709856	44.346666
CR CR15/157	Buffalo Park Wetlands Reservoir No. 2	06/13/1996		0.73	Clear Creek (Drainage of)	City of Buffalo				WET	051N	082W	34	SE1/4SW1/4	-106.714810	44.342580
CR CR15/158	Buffalo Park Wetlands Reservoir No. 3	06/13/1996		2.19	KG Draw	City of Buffalo				WET	051N	082W	34	SE1/4SW1/4	-106.714810	44.342580
CR CR15/159	Buffalo Park Wetlands Reservoir No. 4	06/13/1996		6.75	KG Draw	City of Buffalo				WET	051N	082W	34	SW1/4SW1/4	-106.717320	44.342530
CR CR15/160	Buffalo Park Wetlands Reservoir No. 5	06/13/1996		0.69	Clear Creek (Drainage of)	City of Buffalo				WET	051N	082W	34	SE1/4SW1/4	-106.714810	44.342580
P9659.0R	Buffalo Sewage Treatment Lagoon Reservoir	05/16/1991	Fully Adjudicated	273.98	Clear Creek (drainage of)				Reservoir	IND_SW	051N	082W	36	NW1/4NE1/4	-106.667177	44.352221
CR CR13/176	Buffalo Sewage Treatment Lagoon Reservoir	05/16/1991		0.00	Clear Creek (drainage of)		CITY OF	BUFFALO		IND_SW	051N	082W	36	NW1/4NE1/4	-106.667180	44.352220
P10716.0R	Buffaloberry Reservoir	05/11/1998	Fully Adjudicated				Rick & Cynthia	Pallister	Reservoir	STO; WIL; COMBBU						
CR CR16/002	Buffaloberry Reservoir	05/11/1998		4.80	Coal Gulch	Rick Pallister, et al.				STO	051N	082W	23	NW1/4NE1/4	-106.686830	44.381260
P8948.0R	Buffulo Diversion Reservoir	12/07/1984	Fully Adjudicated	2.56	Clear Creek				Reservoir	MUN_SW	050N	083W	10	SE1/4NW1/4	-106.833665	44.319241

Clear Creek Watershed Storage Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
CR CR07/406	Bull Stock Reservoir	12/26/1972		8.94	Scott Draw		RICHARD W.	REECE		STO	055N	077W	19	NW1/4SE1/4	-106.172760	44.725920
P1732.0S	BUMBACA NO. 1 STOCK RESERVOIR	12/03/1956	Complete	4.60	Little Dry Draw		JAMES	BUMBACA	Reservoir	STO	055N	079W	26	NW1/4NW1/4	-106.345031	44.715594
P2066.0S	BUMBACA NO. 1 STOCK RESERVOIR	08/26/1957	Complete	2.72	Road Draw		JAMES	BUMBACA	Reservoir	STO	055N	079W	22	NW1/4NW1/4	-106.366889	44.729761
P1733.0S	BUMBACA NO. 2 STOCK RESERVOIR	12/03/1956	Complete	14.40	Bumbaca Draw		JAMES	BUMBACA	Reservoir	STO	055N	079W	23	NW1/4SW1/4	-106.345578	44.723794
P2067.0S	BUMBACA NO. 2 STOCK RESERVOIR	08/26/1957	Complete	1.05	South Twin Draw		JAMES	BUMBACA	Reservoir	STO	055N	079W	23	SE1/4NW1/4	-106.339572	44.726683
P1734.0S	BUMBACA NO. 3 STOCK RESERVOIR	12/03/1956	Complete	2.23	Jim Draw		JAMES	BUMBACA	Reservoir	STO	055N	079W	24	SW1/4NW1/4	-106.324325	44.726969
P2068.0S	BUMBACA NO. 3 STOCK RESERVOIR	08/26/1957	Fully Adjudicated	2.83	North Twin Draw		JAMES	BUMBACA	Reservoir	STO	055N	079W	23	NE1/4NW1/4	-106.340969	44.731397
CR CR05/426	Businga No. 1 Reservoir	12/10/1962		5.75	Businga Spring Creek		TIMOTHY N	SCHELL		FIS; REC	053N	083W	18	NW1/4NE1/4	-106.899790	44.570490
CR CR05/427	Businga No. 2 Reservoir	12/10/1962		1.26	Businga Spring Creek		BENJAMIN A. ELIZABETH J.	ROMAN		FIS; REC	053N	083W	18	NW1/4NE1/4	-106.899790	44.570490
CR CR05/428	Businga No. 3 Reservoir	12/10/1962		0.95	Businga Spring Creek		CLAUDE	BUSINGA		FIS; REC	053N	083W	18	NW1/4NE1/4	-106.899790	44.570490
P6850.0R	Busted Clutch Reservoir	10/15/1963	Unadjudicated	55.40	Number Three Draw		Arnaud	Auzqui	Reservoir	STO	054N	078W	18	NE1/4NW1/4	-106.286373	44.658581
P13336.0R	Butte Reservoir	08/13/2008	Unadjudicated						Reservoir	IRR_SW; STO; COMBBU						
CR CR02/381	C C Stock Reservoir	09/26/1960		2.32	Hodge Draw		CHARLES K.	LAWRENCE		STO	052N	081W	28	SE1/4SW1/4	-106.611090	44.443150
CR CR08/165	C. C. No. 2 Stock Reservoir	12/13/1972		4.17	Hodge Draw		CHARLES K.	LAWRENCE		STO	052N	081W	28	NW1/4SW1/4	-106.616090	44.446710
CR CR08/166	C. C. No. 3 Stock Reservoir	12/13/1972		4.97	Hodge Draw		CHARLES K.	LAWRENCE		STO	052N	081W	33	NE1/4SE1/4	-106.601020	44.432330
P6723.0R	Cadiz Stock Reservoir	04/14/1959	Unadjudicated	54.85	West Fork Leiter Draw			L SLASH H CATTLE CO.	Reservoir	STO	055N	078W	33	NW1/4NW1/4		
P7533.0R	CAMP COMFORT RESERVOIR (CHG TO LAKE DESMET RES)	08/16/1939	Fully Adjudicated	11640.00	Clear Creek	M&M RANCH ACQUISITION CO LLC			Reservoir	DOM_SW; IND_SW; IRR_SW; STO	050N	083W	08	SW1/4SE1/4	-106.869364	44.310564
CR CR11/361	Camp Comfort Reservoir (CHG TO LAKE DeSMET RES)	08/16/1939		11640.00	Clear Creek			TEXACO INC.		DOM_SW; IND_SW; IRR_SW; STO	053N	082W	31	SE1/4SW1/4	-106.783400	44.516420
CR CR04/125	Caplan Fish Reservoir	11/26/1956		0.04	Caplan Spring		H. L.	CAPLAN		FIS	053N	083W	18	NE1/4NW1/4	-106.904870	44.570500
P9923.0R	Carpenter No. 1 Reservoir	06/07/1993	Fully Adjudicated	0.23	Lanier Draw		Thomas K.	Carpenter	Reservoir	FIS	050N	082W	03	NW1/4SW1/4	-106.717504	44.329946
CR CR14/118	Carpenter No. 1 Reservoir	06/07/1993		0.23	Lanier Draw		DEBBIE A.	AXTELL		FIS	050N	082W	03	NW1/4SW1/4	-106.719300	44.331650
CR CR08/167	Center No. 2 Stock Reservoir	06/26/1969		14.95	Center Draw		MARTON	BROTHERS INC.		STO	051N	081W	28	SW1/4NW1/4	-106.616780	44.363160
P4837.0R	Childress Reservoir	01/24/1938	Unadjudicated	5.44	Childress Draw		M. F.	CHILDRESS	Reservoir	STO	054N	080W	19	SW1/4NW1/4	-106.545904	44.639164
P9089.0R	Clearmont Facultative Lagoon Reservoir	04/30/1985	Fully Adjudicated	23.05	Clear Creek (drainage of)				Reservoir	IND_SW	054N	079W	21	NW1/4SE1/4	-106.375447	44.635378
CR CR10/475	Clearmont Facultative Lagoon Reservoir	04/30/1985		0.00	Clear Creek (drainage of)			TOWN OF CLEARMONT		IND_SW	054N	079W	21	NW1/4SE1/4	-106.375450	44.635380
P65.0R	Cloud Peak Reservoir	07/13/1896	Fully Adjudicated	2720.00	South Fork South Piney Creek		William	Bryant	Reservoir	IRR_SW	051N	085W	9	SE1/4SE1/4	-107.087315	44.403105
CR CR01/071	Cloud Peak Reservoir	07/13/1896			South Fork South Piney Creek			ROCK CREEK PINEY RES DITCH CO.			051N	085W	09	SE1/4SE1/4	-107.085900	44.403180
CR CR05/073	Cloud Peak Reservoir,, Enl.	09/28/1933		677.68	South Fork South Piney Creek			ROCK CREEK PINEY RESERVOIR DITCH CO.		IRR_SW	051N	085W	09	SE1/4SE1/4	-107.085900	44.403180
CR CR05/262	Cloud Peak Reservoir,, Enl.	09/22/1961		172.72	South Fork South Piney Creek			ROCK CREEK PINEY RES DITCH CO.		IRR_SW	051N	085W	09	SE1/4SE1/4	-107.085900	44.403180
P6223.0R	Cloud Peak Reservoir,, Enlargement	09/28/1933	Fully Adjudicated	3397.68	South Fork South Piney Creek				Reservoir	IRR_SW	051N	085W	9	SE1/4SE1/4	-107.085719	44.403360
P6906.0R	Cloud Peak Reservoir,, Enlargement of	09/22/1961	Fully Adjudicated	3570.40	South Fork South Piney Creek				Reservoir	IRR_SW	051N	085W	9	SE1/4SE1/4	-107.085792	44.403358
CR CR08/168	Coal Mine Stock Reservoir	06/10/1969		4.30	Coal Mine Draw		HAT BAR	CATTLE COMPANY		STO	051N	081W	20	SW1/4SW1/4	-106.636810	44.370350
CR CR03/401	Collins #2 Stock Reservoir,, Enl.	10/09/1961		4.11	Fairbanks Draw		BYRON T.	COLLINS		STO	053N	082W	09	NE1/4NW1/4	-106.743130	44.584990
CR CR03/403	Collins No. 2 Stock Reservoir	05/15/1959		0.36	Fairbanks Draw		BYRON T.	COLLINS		STO	053N	082W	09	NE1/4NW1/4	-106.743130	44.584990
CR CR03/402	Collins No. 3 Stock Reservoir	05/15/1959		6.58	Fairbanks Draw		BYRON T.	COLLINS		STO	053N	082W	09	NE1/4NW1/4	-106.743130	44.584990
P6099.0R	Corrals Reservoir	12/21/1953	Fully Adjudicated	63.20	Big Corrals Draw		MORRIS	Weinberg	Reservoir	DOM_SW; IRR_SW; STO; COMBBU	054N	078W	05	NE1/4SW1/4	-106.276370	44.680760
CR CR02/159	Corrals Reservoir	12/21/1953		63.20	Big Corrals Draw		MORRIS	WEINBERG		DOM_SW; IRR_SW; STO	054N	078W	05	NE1/4SW1/4	-106.276370	44.680760
P3136.0S	COYNE TIBBETS #1 STOCK RESERVOIR	01/25/1960	Complete	1.94	Quarter Draw		COYNE	TIBBETS	Reservoir	STO	057N	077W	08	NW1/4SE1/4	-106.162792	44.931792

Clear Creek Watershed Storage Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
P3416.0S	COYOTE STOCK RESERVOIR	10/06/1960	Complete	4.97	Coyote Draw	T CROSS T RANCH, LLC			Reservoir	STO	053N	082W	30	NE1/4NW1/4	-106.783467	44.542225
P338.0S	CRACKENBERGER #1 STOCK RESERVOIR	08/25/1953	Complete	8.14	Coal Creek		JOE	CRACKENBERGER	Reservoir	STO	054N	081W	34	NW1/4NE1/4	-106.597497	44.613036
P12311.0R	Cross H #1 Reservoir	12/28/2000	Unadjudicated		Sand Creek (36-51-82)		Wayne	Nelson	Reservoir	WIL	050N	082W	14	NE1/4NE1/4	-106.682210	44.308730
P12312.0R	Cross H #2 Enl of Reeves Reservoir	12/28/2000	Unadjudicated		Sand Creek (36-51-82)		Wayne	Nelson	Reservoir	WIL	050N	082W	14	SE1/4NE1/4	-106.682190	44.305090
P11620.0R	CROSS H #3 RESERVOIR	08/10/2000	Unadjudicated		Sand Creek (36-51-82)		Wayne	Nelson	Reservoir	WIL	050N	082W	14	SW1/4SE1/4	-106.687155	44.297824
P11408.0R	Cross H #4 Reservoir	02/28/2003	Unadjudicated		Sand Creek (36-51-82)		Wayne	Nelson	Reservoir	WIL/WET	050N	082W	14	NW1/4NE1/4	-106.685573	44.308151
P2369.0R	Cultra Reservoir	07/22/1912	Fully Adjudicated	23.94	Lake Draw		THOMAS W.	CULTRA	Reservoir	IRR_SW	055N	077W	07	SW1/4NW1/4	-106.182348	44.760269
P1665.0R	D.M. POOL RESERVOIR	11/26/1909	Fully Adjudicated	2.50	Dan's Gulch		D. M.	POOL	Reservoir	IRR_SW	056N	078W	21	NW1/4NW1/4	-106.263372	44.819050
P13354.0R	D3-5-5477 Reservoir	06/23/2008	Unadjudicated						Reservoir	CBM_SW; IND_SW; IRR_SW; STO; WIL; COMBBU						
CR CR03/101	Dar Kelley #1 Stock Reservoir	02/19/1960		3.47	Cameron Gulch		DAR D.	KELLEY		STO	053N	082W	11	NE1/4SW1/4	-106.702990	44.577710
CR CR03/103	Dar Kelley #2 Stock Reservoir	02/19/1960		16.05	Fairbanks Draw		DAR D.	KELLEY		STO	053N	082W	10	SE1/4SE1/4	-106.713090	44.574090
P3619.0S	DEE WORDEN STOCK RESERVOIR	02/13/1961	Complete	3.53	Red Draw		E. D.	WORDEN	Reservoir	STO	055N	079W	21	SW1/4NE1/4	-106.375347	44.726222
P6642.0R	Deep Reservoir	12/08/1960	Unadjudicated	6.03	Deep Draw		Konrad	Leis	Reservoir	STO	053N	081W	35	SE1/4SW1/4	-106.582273	44.514483
CR CR16/006	Degel Fish Pond No.1	03/13/1995		2.67	Spring Creek	Michael A. Degel				FIS; REC	053N	083W	07	SE1/4NW1/4	-106.904770	44.581990
CR CR16/007	Degel Fish Pond No.2	03/13/1995		1.17	Spring Creek	Michael A. Degel				FIS; REC	053N	083W	07	SE1/4NW1/4	-106.904770	44.581990
CR CR16/008	Degel Fish Pond No.3	03/13/1995		0.39	Spring Creek	Michael A. Degel				FIS; REC	053N	083W	07	SE1/4NW1/4	-106.904770	44.581990
P1747.0R	Democrat Reservoir	04/02/1910		80.80	Thompson Fork		Donald	Thompson	Reservoir	IRR_SW	053N	079W	03	SE1/4NE1/4	-106.342009	44.599180
P6581.0R	Dick No. 1 Stock Reservoir	09/28/1959	Unadjudicated	21.25	West Fork Cottonwood Draw		James A.	Bumbaca	Reservoir	STO	055N	079W	14	NE1/4NW1/4	-106.337803	44.744300
P7158.0R	Diversion Reservoir	06/03/1964	Fully Adjudicated	0.70	Little North Fork Shell Creek		Harold T. & Helen B.	Buell	Reservoir	FIS; IRR_SW; COMBBU	052N	083W	15	NE1/4NW1/4	-106.832930	44.483110
CR CR06/064	Diversion Reservoir	06/03/1964		0.70	Little North Fork Shell Creek		HELEN B.	BUELL		FIS; IRR_SW	052N	083W	15	NE1/4NW1/4	-106.832930	44.483110
P2506.0R	Divide Reservoir	06/20/1913		2.50	North Fork Lone Tree Creek		LUELLA	COLEMAN	Reservoir	IRR_SW	054N	081W	25	NW1/4SE1/4	-106.556007	44.620711
P10717.0R	Dixon Reservoir	03/20/1998	Fully Adjudicated				MORRIS	DIXON	Reservoir	FIS						
P3201.0S	DONALD ROBERTS #10 STOCK RESERVOIR	01/29/1960	Complete	3.00	DR No. 10 Draw		DONALD	ROBERTS	Reservoir	STO	055N	080W	23	SW1/4SW1/4	-106.464211	44.717453
P3200.0S	DONALD ROBERTS #8 STOCK RESERVOIR	01/29/1960	Complete	3.40	DR No. 8 Draw		DONALD	ROBERTS	Reservoir	STO	056N	080W	34	SW1/4SW1/4	-106.487006	44.775583
CR CR07/332	Donaldson #2 Stock Reservoir	07/03/1973		5.22	Double Crossing Draw		EDNA ELIZABETH	LANDECK		STO	053N	080W	24	SE1/4NW1/4	-106.441860	44.551710
CR CR07/338	Donaldson #3 Stock Reservoir	07/03/1973		3.87	Douglas Draw		WILLIAM	LANDECK		STO	053N	080W	22	NW1/4NW1/4	-106.487180	44.555030
CR CR07/339	Donaldson #4 Stock Reservoir	07/03/1973		5.70	Phillips Draw		WILLIAM	LANDECK		STO	053N	080W	27	NW1/4NW1/4	-106.487450	44.540600
CR CR07/334	Donaldson #5 Stock Reservoir	07/03/1973		1.50	Donaldson No. 5 Draw		WILLIAM	LANDECK		STO	053N	080W	35	NW1/4NW1/4	-106.467170	44.526050
P7257.0R	Donaldson Reservoir	12/11/1969	Fully Adjudicated	31.05			Phil	Schuman	Reservoir	FIS; STO; COMBBU						
P4798.0R	Donaldson Reservoir	01/20/1938	Unadjudicated	3.10	Donaldson Dry Draw		GEORGE W.	DONALDSON	Reservoir	STO	053N	080W	26	SE1/4SE1/4	-106.452023	44.529714
CR CR08/033	Donaldson Stock Reservoir	11/01/1962		9.93	Town Gulch/Thompson Draw		WALLACE L.	VANNOY		STO	053N	079W	26	SE1/4NW1/4	-106.331130	44.542360
P3692.0S	DOOLEY #1 STOCK RESERVOIR	03/13/1961	Complete	5.75	Swamp Draw		ELBERT	DOOLEY	Reservoir	STO	055N	078W	17		-106.268047	44.741097
P589.0S	DOOLEY NO. 1 STOCK RESERVOIR	12/17/1953	Expired	4.28	School House Draw		ELBERT	DOOLEY	Reservoir	STO	055N	078W	17	SW1/4SE1/4	-106.274144	44.736622
P4087.0R	Double Crossing Reservoir	03/29/1917		243.35	Clear Creek			L.Z. Leiter Estate	Reservoir	IRR_SW	053N	080W	12	NE1/4NE1/4	-106.431521	44.584271
CR CR12/054	Duck Pond #1 Stock Reservoir	08/23/1988		0.15	Sand Creek (3-50-82)		RAY W AND BARBARA A	MOORE		STO	050N	082W	09	NW1/4NE1/4	-106.727860	44.322880
CR CR05/154	Dump Stock Reservoir	11/18/1959		1.46	Dump Draw		A.J.	BARKER		STO	051N	082W	33	NE1/4NE1/4	-106.722330	44.351770
CR CR02/287	East Stock Reservoir	05/15/1959		0.09	First East Cemetery Draw		H. A.	BRAMMER		STO	053N	083W	27	SW1/4NE1/4	-106.839160	44.538270
CR CR07/337	Edna Elizabeth Landeck #1 Stock Reservoir	07/03/1973		5.90	Landeck Draw		EDNA ELIZABETH	LANDECK		STO	053N	080W	23	NW1/4NW1/4	-106.467190	44.555150
P7294.0R	Elk Reservoir	04/14/1970	Fully Adjudicated	13.37	Elk Draw			ELK RESERVOIR COMPANY	Reservoir	DOM_SW; FIS; REC; STO; COMBBU	050N	084W	12	SW1/4NW1/4	-106.916758	44.323504
P14491.0S	ELLENWOOD LLC 6 STOCK RESERVOIR	04/24/2001	Complete		Pasture Draw	ELLENWOOD RANCH LLC			Reservoir	STO	054N	081W	31	SW1/4NE1/4	-106.655647	44.611089
P14492.0S	ELLENWOOD LLC 7 STOCK RESERVOIR	04/24/2001	Complete		Williams Draw	ELLENWOOD RANCH LLC			Reservoir	STO	053N	081W	07	NE1/4NW1/4	-106.662572	44.582844
P14493.0S	ELLENWOOD LLC 8 STOCK RESERVOIR	04/24/2001	Complete		Zowie Draw	ELLENWOOD RANCH LLC			Reservoir	STO	053N	082W	01	NE1/4SE1/4	-106.673528	44.592547

Clear Creek Watershed Storage Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
CR CR08/696	Elusive Stock Reservoir	12/26/1972		6.85	Chaffee Gulch			CLEAR CREEK GRAZING ASSOCIATION		STO	056N	077W	33	NE1/4SW1/4	-106.137520	44.783850
P12852.0R	Emerald Park No. 1 Reservoir	12/07/2006	Unadjudicated		Sandy Creek				Reservoir	FIS; IRR_SW; COMBBU	051N	082W	08	NE1/4SE1/4	-106.7423	44.40304
P12920.0R	ENL LITTLE # 1-19 (P12794R) RESERVOIR	03/22/2007	Incomplete		Cottonwood Draw				Reservoir	CBM_SW; IND_SW; IRR_SW; STO; WIL	055N	078W	19		-106.293125	44.730978
P13293.0R	Enl of Gibbs No. 10 Reservoir	09/15/2008	Unadjudicated						Reservoir	IRR_SW; STO; COMBBU						
P3220.0S	ENL OF RALPH FOSTER NO. 1 STOCK RESERVOIR	02/04/1960	Complete	7.98	Rough Draw		RALPH	FOSTER	Reservoir	STO	055N	079W	20	NE1/4NE1/4	-106.392361	44.728233
P13401.0R	Enl of T55NR75W17SWNW Reservoir	12/18/2008							Reservoir	IRR_SW; STO; COMBBU						
P2124.0R	ENL OF WHEDON DITCH NO. 1	04/24/1911	Complete	4.00	Draw		ELFIE	WESTON	Reservoir	IRR_SW	056N	078W	17	NW1/4NE1/4	-106.272881	44.831825
P12313.0R	Enl. Keffer No. 1 Reservoir	10/05/2004	Unadjudicated		Cummings Creek				Reservoir	IRR_SW; STO; COMBBU	050N	082W	15	NE1/4NW1/4	-106.713200	44.308710
P13263.0R	Enl. of Rocky Road Reservoir	10/25/2007	Unadjudicated		Looney Draw				Reservoir	IRR_SW; STO; COMBBU	052N	079W	All			
P13378.0R	Enlarged Crump 42-4-5375 Reservoir	11/12/2008	Unadjudicated						Reservoir	CBM_SW; IRR_SW; STO; COMBBU						
CR CR08/553	Feeger Stock Reservoir	05/14/1975		6.20	Feeger Draw		JOHN A.	FEEGER		STO	051N	082W	22	SW1/4SE1/4	-106.707170	44.370430
P13282.0R	Feldspar Reservoir	08/30/2007	Unadjudicated						Reservoir	IRR_SW; STO; COMBBU						
P1906.0R	Fields Reservoir	08/01/1910		35.00	Middle Fork Arkansas Creek		EDWIN N.	FIELDS	Reservoir	IRR_SW; STO; COMBBU	055N	080W	25	NE1/4SE1/4	-106.430845	44.708142
P3115.0S	FILLMORE NO. 1 STOCK RESERVOIR	03/04/1960	Complete	3.29	Squaw Creek		JENNIE	FILLMORE	Reservoir	STO	057N	078W	23	NE1/4SE1/4	-106.220842	44.901069
P7290.0R	FIRST ENL OF HEALY RESERVOIR	10/14/1957	Fully Adjudicated	13725.00	Clear Creek	M&M RANCH ACQUISITION CO LLC			Reservoir	DOM_SW; IND_SW; IRR_SW; REC; STO	051N	081W	03	NW1/4SW1/4	-106.595517	44.416225
P11483.0R	FIRST ENL. 76 RANCH STOCK RES	06/13/2001	Unadjudicated		Cummings Creek		Francis D.	Walter	Reservoir	FIS; IRR_SW; STO; COMBBU	050N	082W	15		-106.704236	44.308826
P10415.0R	Fish and Wildlife Reservoir	08/27/1996	Fully Adjudicated	0.07	Sand Creek (3-50-82)		Michael F.	Schaefer	Reservoir	FIS; WIL; COMBBU	050N	082W	09	NE1/4NW1/4	-106.733007	44.319340
CR CR14/468	Fish and Wildlife Reservoir	08/27/1996		0.07	Sand Creek (3-50-82)		2-B	LAND LIVESTOCK CO		FIS	050N	082W	09	NE1/4NW1/4	-106.732910	44.322890
P6050.0R	Fish Reservoir	07/27/1953	Fully Adjudicated	2.65	Leach Draw		Lucy G.	Leach	Reservoir	DOM_SW; FIS; IRR_SW; STO; COMBBU	053N	083W	29	SE1/4NE1/4	-106.874263	44.537590
CR CR02/061	Fish Reservoir	07/27/1953		2.65	Leach Draw		LUCY G.	LEACH		DOM_SW; FIS; IRR_SW; STO	053N	083W	29	SE1/4NE1/4	-106.874470	44.538330
P373.0S	FOSTER #1 STOCK RESERVOIR	09/14/1953	Expired	2.67	Sand Draw		RALPH	FOSTER	Reservoir	STO	055N	079W	29	NE1/4SW1/4	-106.403275	44.706647
P1839.0S	FOSTER NO. 1 STOCK RESERVOIR	01/23/1957	Complete	5.21	Rough Draw		RALPH	FOSTER	Reservoir	STO	055N	079W	20	NE1/4NE1/4	-106.392303	44.728186
P2235.0S	FOSTER NO. 1 STOCK RESERVOIR	03/10/1958	Complete	15.25	Deadman's Draw		RALPH	FOSTER	Reservoir	STO	055N	079W	17	NW1/4NW1/4	-106.406942	44.744097
P2689.0S	FOSTER NO. 1 STOCK RESERVOIR	03/11/1959	Complete	8.70	White Stump Draw		RALPH	FOSTER	Reservoir	STO	055N	079W	32	NW1/4NE1/4	-106.395114	44.701856
P3528.0S	FOSTER NO. 1 STOCK RESERVOIR	12/27/1960	Complete	4.50	Betz Draw		RALPH	FOSTER	Reservoir	STO	055N	079W	18	NE1/4NW1/4	-106.422389	44.742586
P1840.0S	FOSTER NO. 2 STOCK RESERVOIR	01/23/1957	Complete	3.25	Little Foster Draw		RALPH	FOSTER	Reservoir	STO	055N	079W	29	NE1/4NW1/4	-106.401269	44.714994
P983.0S	FOSTER NO. 2 STOCK RESERVOIR	11/30/1954	Expired	2.26	Black Stump Draw		RALPH	FOSTER	Reservoir	STO	055N	079W	30	NW1/4NW1/4	-106.426489	44.715161
P984.0S	FOSTER NO. 3 STOCK RESERVOIR	11/30/1954	Expired	0.91	Road Draw		RALPH	FOSTER	Reservoir	STO	055N	080W	25	SE1/4NE1/4	-106.431958	44.711125
P1300.0S	FOSTER NO. 7 STOCK RESERVOIR	11/23/1955	Expired	0.76	Side Draw		RALPH	FOSTER	Reservoir	STO	055N	079W	30	NE1/4NW1/4	-106.422217	44.715386
P4834.0R	Foster Reservoir	01/24/1938	Unadjudicated	18.10	Foster Draw		JOHN T.	FOSTER	Reservoir	STO	056N	079W	34	SE1/4SE1/4	-106.350473	44.776246
CR CR06/440	Four H Reservoir	02/28/1966		28.16	Walters Draw		JOHN A.	ESPONDA		STO	052N	081W	13	SW1/4SE1/4	-106.545480	44.471810
CR CR05/462	Fowler No. 1 Stock Reservoir	12/05/1958		6.51	Twin Fork Draw		DAVID C.	FOWLER		STO	053N	081W	04		-106.619830	44.593330
P3257.0S	FOWLER NO. 2 STOCK RESERVOIR	04/26/1960	Complete	13.39	Pasture Draw	CAROLYN R. FOWLER, TRUSTEE	CLINE	FOWLER	Reservoir	STK	053N	081W	05	SE1/4NE1/4	-106.631608	44.594375
CR CR05/463	Fowler No. 2 Stock Reservoir	12/05/1958		11.23	Z. Burris Draw		DAVID C.	FOWLER		STO	054N	081W	32	SE1/4NE1/4	-106.632560	44.609530
CR CR07/251	Fowler No. 5 Stock Reservoir	06/26/1973		1.08	Lost Draw		DAVID C.	FOWLER		STO	054N	081W	32	SW1/4NE1/4	-106.637580	44.609550
CR CR07/249	Fowler No. 6 Stock Reservoir	06/26/1973		8.94	Kent Draw		DAVID C.	FOWLER		STO	054N	081W	33	NE1/4NW1/4	-106.622530	44.613100
CR CR07/250	Fowler No. 7 Stock Reservoir	06/26/1973		1.36	Bone Draw		DAVID C.	FOWLER		STO	054N	081W	28	SW1/4SE1/4	-106.617530	44.616680
CR CR08/038	Fowler No. 8 Stock Reservoir	09/28/1973		2.46	Lost Draw		DAVID C.	FOWLER		STO	054N	081W	32	NW1/4NE1/4	-106.637540	44.613160
P6332.0R	Fowler Reservoir	06/25/1956	Fully Adjudicated	72			John H.	Fowler	Reservoir	IRR_SW; STO; COMBBU						
CR CR02/285	Fowler Reservoir	06/25/1956		72.00	Double Crossing Creek		JOHN H.	FOWLER		IRR_SW; STO	053N	079W	19		-106.414330	44.554950
P5417.0R	Foxhall Reservoir	03/17/1941	Unadjudicated	11.25	Foxhall Draw		V.S.	GRIFFITH	Reservoir	STO	055N	080W	03	NE1/4NW1/4	-106.481328	44.771039
P5677.0R	Francie No. 1 Reservoir	06/29/1949	Fully Adjudicated	12.00	Williams Draw		Francis Anna L.	Wood	Reservoir	IRR_SW; STO; COMBBU	053N	082W	01	SW1/4NE1/4	-106.678818	44.596691

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WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
CR CR01/413	Francie No. 1 Reservoir	06/29/1949		12.00	Williams Draw		FRANCIS ANNA L.	WOOD		IRR_SW; STO	053N	082W	01	SW1/4NE1/4	-106.677690	44.595320
P5678.0R	Francie No. 2 Reservoir	06/29/1949	Fully Adjudicated	11.45	Williams Draw		Francis Anna L.	Wood	Reservoir	IRR_SW; STO; COMBBU	053N	082W	01	SW1/4NE1/4	-106.677007	44.595168
CR CR01/414	Francie No. 2 Reservoir	06/29/1949		11.45	Williams Draw		FRANCIS ANNA L.	WOOD		IRR_SW; STO	053N	082W	01	SW1/4NE1/4	-106.677690	44.595320
P5679.0R	Francie No. 3 Reservoir	06/29/1949	Fully Adjudicated	4.95	Williams Draw		Francis Anna L.	Wood	Reservoir	IRR_SW; STO; COMBBU	053N	082W	01	NE1/4SE1/4	-106.673581	44.592164
CR CR01/415	Francie No. 3 Reservoir	06/29/1949		4.95	Williams Draw		FRANCIS ANNA L.	WOOD		IRR_SW; STO	053N	082W	01	NE1/4SE1/4	-106.672680	44.591580
P3134.0S	FRANK JACOBS #1 STOCK RESERVOIR	01/25/1960	Complete	2.64	Twin Forks Draw		FRANK	JACOBS	Reservoir	STO	055N	079W	11	NW1/4SW1/4	-106.345172	44.752525
P3135.0S	FRANK JACOBS #2 STOCK RESERVOIR	01/25/1960	Complete	3.05	Two Drakes Draw		FRANK	JACOBS	Reservoir	STO	055N	079W	01	NW1/4NW1/4	-106.327228	44.771903
P8897.0R	Frankovic Reservoir	07/27/1981	Fully Adjudicated	4.96	Cedar Draw		RUDIE	FRANKOVIC	Reservoir	FIS	050N	084W	12	SW1/4NW1/4	-106.917735	44.322817
CR CR10/165	Frankovic Reservoir	07/27/1981		4.96	Cedar Draw		RUDIE	FRANKOVIC		FIS	050N	084W	12	SW1/4NW1/4	-106.917730	44.322810
P18659.0S	GAT STOCK RESERVOIR	08/30/2007	Fully Adjudicated		Gat Draw				Reservoir	STO	053N	084W	13	NW1/4NW1/4	-106.930050	44.570519
CR CR18/114	GAT Stock Reservoir	08/30/2007		0.33	Gat Draw	Jerry J. Gatlin				STO	053N	084W	13	NW1/4NW1/4	-106.930050	44.570520
P9451.0R	Gates Reservoir	03/10/1988	Fully Adjudicated	0.28	Gates Drain				Reservoir	FIS; IRR_SW; STO; WIL; COMBBU	053N	084W	12	SE1/4SE1/4	-106.914952	44.574251
CR CR12/371	Gates Reservoir	03/10/1988		0.14	Gates Drain		L. D.	KENNINGTON		FIS; STO	053N	084W	12	SE1/4SE1/4	-106.914950	44.574250
P2651.0R	Gaugh Reservoir	05/08/1914		36.00	GOUGH CREEK		W. M.	GAUGH	Reservoir	DOM_SW; IRR_SW; STO; COMBBU	052N	083W	13	SE1/4SW1/4	-106.792483	44.472170
P1268.0S	GREEN #2 STOCK RESERVOIR	11/03/1955	Expired	4.91	Corner Draw		GLENN	GREEN	Reservoir	STO	057N	077W	17	NE1/4SW1/4	-106.170361	44.916703
P7085.0R	Green Cabin No. 3 Reservoir	12/11/1968	Unadjudicated	35.33				VANNOY BROTHERS	Reservoir	FLO; STO; COMBBU						
P7058.0R	Green Cabin Reservoir	01/11/1960	Unadjudicated	51.93	Green Cabin Draw		Henry	Van Noy	Reservoir	FLO; STO; COMBBU	053N	079W	17		-106.389398	44.571189
P464.0S	GREEN NO. 1 STOCK RESERVOIR	10/30/1953	Complete	4.14	Green Draw		GLENN	GREEN	Reservoir	STO	057N	078W	12	SE1/4SE1/4	-106.198203	44.927522
P19213.0S	GREGORY NO. 1 STOCK RESERVOIR	03/25/2004	Complete		Nielsen Draw	FIDELITY SERVICES			Reservoir	STO	051N	083W	10	NE1/4NE1/4	-106.822656	44.411283
P931.0S	GRIFFITH NO. 1 STOCK RESERVOIR	10/18/1954	Complete	0.88	East Fork Griffith Draw		VERNON	GRIFFITH	Reservoir	STO	055N	080W	02	NE1/4NW1/4	-106.463089	44.772836
P5305.0R	Griffith Reservoir	07/03/1940	Unadjudicated	25.00	Hay Creek		VERNON S.	GRIFFITH	Reservoir	STO	056N	079W	17	NE1/4SW1/4	-106.403004	44.823463
P5985.0R	Griffith Reservoir	12/17/1952	Unadjudicated	43.08	Griffith Creek(29-56-78)		VERNON S.	GRIFFITH	Reservoir	STO	056N	078W	29	SE1/4NE1/4	-106.267559	44.800318
P6724.0R	Griffith Stock Reservoir	04/21/1959	Unadjudicated	26.75	Griffith Draw(32-56-79)		VERNON S.	GRIFFITH	Reservoir	STO	056N	079W	31	NE1/4SE1/4	-106.410041	44.779398
CR CR06/437	Hall Draw Stock Reservoir	06/22/1966		10.92	Hall Draw		ANNA L.	FIELDGROVE		STO	052N	079W	06	SW1/4SE1/4	-106.407440	44.505570
P946.0S	HANDO NO. 1 STOCK RESERVOIR	10/28/1954	Complete	3.87	Hando Draw		PAUL	WHITAKER	Reservoir	STO	055N	078W	15	NW1/4NW1/4	-106.242422	44.746506
P9266.0R	Hansen Fish Pond No. 1 Reservoir	12/13/1982	Unadjudicated	0.08	Peters Rivulet				Reservoir	REC	053N	083W	7	SW1/4SE1/4	-106.900889	44.575229
CR CR11/370	Hansen Fish Pond No. 1 Reservoir	12/13/1982		0.08	Peters Rivulet		GUNDER H. CAROLE L.	HANSEN		REC	053N	083W	07	SW1/4SE1/4	-106.899780	44.574230
P9267.0R	Hansen Fish Pond No. 2 Reservoir	12/13/1982	Fully Adjudicated	0.16	Peters Rivulet				Reservoir	REC	053N	083W	7	SW1/4SE1/4	-106.901025	44.575151
CR CR11/371	Hansen Fish Pond No. 2 Reservoir	12/13/1982		0.16	Peters Rivulet		GUNDER H. CAROLE L.	HANSEN		REC	053N	083W	07	SW1/4SE1/4	-106.899780	44.574230
P4621.0R	Happersett Reservoir	11/22/1935	Unadjudicated	8.5	Johnson Creek		C.F.	Happersett	Reservoir	DOM_SW; IRR_SW; STO; COMBBU	051N	083W	14	SW1/4NE1/4		
P1850.0R	Hay Creek Reservoir	06/21/1910		156.00	Hay Creek		OLIVE M.	MAXWELL	Reservoir	IRR_SW	056N	079W	21	NE1/4SW1/4	-106.380639	44.809119
P12896.0R	HAY MEADOW RESERVOIR	09/27/2004	Incomplete		Bale Draw				Reservoir	IRR_SW; STO	054N	081W	29	SW1/4SW1/4	-106.647519	44.616811
P7289.0R	HEALY RESERVOIR (CHG IN PART TO LAKE DESMET RES)	04/15/1957	Fully Adjudicated	41974.00	Clear Creek	M&M RANCH ACQUISITION CO LLC			Reservoir	IND_SW; IRR_SW; OTH	051N	081W	03	NW1/4SW1/4	-106.595517	44.416225
CR CR11/359	Healy Reservoir (CHG IN PART TO LAKE DeSMET RES)	04/15/1957		41974.00	Clear Creek			TEXACO INC.		DOM_SW; IND_SW; IRR_SW; POW; STE	053N	082W	31	SE1/4SW1/4	-106.783400	44.516420
CR CR11/360	Healy Reservoir,, Enl.	10/14/1957		13725.00	Clear Creek			TEXACO INC.		DOM_SW; IND_SW; IRR_SW; POW; REC; STE; STO	053N	082W	31	SE1/4SW1/4	-106.783400	44.516420
P845.0R	Hector Reservoir	05/01/1906	Fully Adjudicated	36.00	Buffalo Creek		W. A.	POOL	Reservoir	DOM_SW; IRR_SW; STO; COMBBU	056N	079W	25	SE1/4SE1/4	-106.308926	44.791337
P9268.0R	Held Fish Pond	12/13/1982	Fully Adjudicated	0.90	Peters Rivulet				Reservoir	REC	053N	083W	7	SW1/4SE1/4	-106.901121	44.575133
CR CR11/372	Held Fish Pond	12/13/1982		0.90	Peters Rivulet		JOHN	SCHOAL		REC	053N	083W	07	SW1/4SE1/4	-106.899780	44.574230
P6455.0R	Henry Reservoir	01/17/1958	Unadjudicated	21.74	Fowler Draw (7-53-79)		Henry	Van Noy	Reservoir	STO	053N	079W	29	NW1/4SE1/4	-106.386190	44.538689
P6011.0R	Hepp No. 2 Reservoir	02/24/1953	Unadjudicated	65.55			Fred	Hepp	Reservoir	IRR_SW; STO; COMBBU						
P5995.0R	Hepp Reservoir	12/31/1952	Unadjudicated	102.25			Fred	Hepp	Reservoir	IRR_SW; STO; COMBBU						
CR CR02/286	Hepp Stock Reservoir	08/02/1956		0.83	Unlucky Draw		KARL	HEPP		STO	053N	083W	35	NE1/4SW1/4	-106.823940	44.520340
P4827.0R	Hesse Reservoir No. 2	02/16/1938	Fully Adjudicated	12.75					Reservoir	STO						

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P5663.0R	HILL RESERVOIR	04/13/1948	Fully Adjudicated	8.25	Arroyo Draw		PETER K. AND DORIS M.	JONES	Reservoir	DOM_SW; IRR_SW; STO	051N	082W	15	SE1/4NW1/4	-106.710900	44.393119
CR CR02/132	Hill Reservoir	04/13/1948		8.25	Arroyo Draw		RALPH B CHARLOTTE K	ALLEY		DOM_SW; IRR_SW; STO	051N	082W	15	SE1/4NW1/4	-106.711890	44.392160
CR CR06/441	Hillard No. 1 Stock Reservoir	06/01/1971		12.25	Sandy Creek		EARL	HILLARD		STO	051N	083W	13	NW1/4SE1/4	-106.787630	44.388600
P3580.0R	Huggins Reservoir	11/24/1919		30.94	Huggins Creek		JOSHUA B.	HUGGINS	Reservoir	DOM_SW; IRR_SW; COMBBU	052N	082W	36	SW1/4SW1/4	-106.75996	44.428531
P5251.0S	HUMID STOCK RESERVOIR	07/14/1965	Complete	8.10	Humid Draw				Reservoir	STO	055N	079W	32	SE1/4SE1/4	-106.390922	44.690503
P6852.0R	Huson Reservoir	08/07/1964	Fully Adjudicated	36.65	Rock Creek		C.E.	Huson	Reservoir	IRR_SW; STO; COMBBU	051N	082W	22	NE1/4NE1/4	-106.701200	44.381250
CR CR05/151	Huson Reservoir	08/07/1964		36.65	Rock Creek		C. E.	HUSON		IRR_SW; STO	051N	082W	22	NE1/4NE1/4	-106.701770	44.381220
P6112.0R	Ike Reservoir	01/14/1954	Unadjudicated	10.38	Ike Draw		RALPH	THOMAS	Reservoir	STO	053N	080W	21	SW1/4SE1/4	-106.498181	44.543695
P12333.0R	ISLAND RESERVOIR	02/23/2005	Fully Adjudicated		Clear Creek				Reservoir		052N	081W	12	SE1/4NW1/4	-106.550530	44.493680
CR CR18/185	Island Reservoir	02/23/2005		4.28	Clear Creek	Watt Ranch				IRR_SW	052N	081W	12	SE1/4NW1/4	-106.550530	44.493680
P7978.0R	J. M. No. 1 Reservoir	03/17/1977	Fully Adjudicated	0.64	J. M. Creek No. 1		JOHN M.	HUSMAN	Reservoir	IRR_SW	053N	083W	18	SW1/4NW1/4	-106.899792	44.570484
CR CR09/015	J. M. No. 1 Reservoir	03/17/1977		0.64	J. M. Creek No. 1		JOHN M.	HUSMAN		IRR_SW	053N	083W	18	SW1/4NW1/4	-106.909890	44.566930
P7979.0R	J. M. No. 2 Reservoir	03/17/1977	Fully Adjudicated	0.14	J. M. Creek No. 2		JOHN M.	HUSMAN	Reservoir	IRR_SW	053N	083W	18	SW1/4NW1/4	-106.899792	44.570484
CR CR09/016	J. M. No. 2 Reservoir	03/17/1977		0.14	J. M. Creek No. 2		JOHN M.	HUSMAN		IRR_SW	053N	083W	18	SW1/4NW1/4	-106.909890	44.566930
P10824.0R	JA Creek Reservoir	10/12/1998	Fully Adjudicated		J. A. Creek		LOLLIE	PLANK	Reservoir	STO; WIL; COMBBU	053N	083W	33	SE1/4NW1/4	-106.866460	44.524482
P5097.0S	JACOBS #3 STOCK RESERVOIR	10/01/1963	Fully Adjudicated	2.30	Skull Gulch		FRANK	JACOBS	Reservoir	STO	056N	079W	35		-106.331764	44.784078
P4805.0S	JACOBS NO. 4 STOCK RESERVOIR	09/18/1964	Complete	20.00	East Side Draw		FRANK	JACOBS	Reservoir	STO	056N	079W	25		-106.307808	44.790744
P6128.0R	Jacobs Reservoir	12/10/1953	Fully Adjudicated	33.77			FRANK A.	JACOBS	Reservoir	IRR_SW; STO; COMBBU						
CR CR09/059	Jason Stock Reservoir	11/09/1971		5.80	Jason Draw			UCROSS LAND COMPANY		STO	053N	081W	22	SE1/4NE1/4	-106.592700	44.551320
P5799.0R	Jeffers No. Four Reservoir	02/26/1951		2.00	Jeffers Draws No. 1-4		Hale C.	Jeffers	Reservoir	IRR_SW; STO; COMBBU	053N	082W	29	SW1/4SW1/4	-106.768471	44.530516
P5796.0R	Jeffers No. One Reservoir	02/26/1951		2.75	Jeffers Draws No. 1-4		Hale C.	Jeffers	Reservoir	IRR_SW; STO; COMBBU	053N	082W	20	SE1/4SE1/4	-106.753474	44.544704
P5798.0R	Jeffers No. Three Reservoir	02/26/1951		1.90	Jeffers Draws No. 1-4		Jack E.	Jeffers	Reservoir	IRR_SW; STO; COMBBU	053N	082W	29	NW1/4SE1/4	-106.758372	44.533952
P5797.0R	Jeffers No. Two Reservoir	02/26/1951		2.00	Jeffers Draws No. 1-4		Hale C.	Jeffers	Reservoir	IRR_SW; STO; COMBBU	053N	082W	29	SW1/4NE1/4	-106.758386	44.537556
P1812.0R	Jennie E. Butterfield Reservoir	05/18/1910	Fully Adjudicated	2.50	Butterfield Draw		Jennie E.	Butterfield	Reservoir	IRR_SW	054N	081W	29	SE1/4SW1/4	-106.642518	44.616788
P9943.0R	JM No. 11 Reservoir	08/26/1993	Fully Adjudicated	1.96	Johnson Creek				Reservoir	FIS; REC; STO; WIL; COMBBU	051N	083W	22	SW1/4SE1/4	-106.826416	44.372447
P1576.0R	Jones Reservoir	06/24/1909		16.00	Jones Draw		K. C.	JONES	Reservoir	IRR_SW; STO; COMBBU	054N	080W	18	NW1/4NW1/4	-106.548451	44.656750
CR CR09/112	Jonesy Stock Reservoir	06/12/1973		0.16	Jonesy Draw		MARY ANN	SMITH		STO	051N	083W	34	NW1/4SE1/4	-106.828500	44.344600
P2117.0R	Jouvenat Reservoir	03/11/1911	Unadjudicated	110.00	Town Draw		J. B.	JOUVENAT	Reservoir	DOM_SW; IRR_SW; COMBBU	054N	080W	12	NW1/4NW1/4	-106.446487	44.671398
P4136.0R	Julio Reservoir	09/27/1929		11.95	Supply Draw		LUCIA	JULIO	Reservoir	DOM_SW; IRR_SW; COMBBU	053N	079W	19		-106.414329	44.554920
P11133.0R	Julson Reservoir	11/02/2000	Unadjudicated		Julson Draw		SIDNEY A. & RUTH M.	JULSON	Reservoir	FIR; FIS; STO; WIL; COMBBU	051N	083W	23	SW1/4NW1/4	-106.820511	44.378909
CR CR16/300	Julson Reservoir	11/02/2000		0.33	Julson Draw	Sidney and Ruth Julson				FIR; FIS; STO	051N	083W	23	SW1/4NW1/4	-106.817930	44.377740
P6407.0R	Karl Reservoir	03/04/1957	Fully Adjudicated	34.04	North Waegle Draw		KARL F.	WALTERS	Reservoir	STO	052N	081W	24	NE1/4SW1/4	-106.550896	44.460736
P6728.0R	Karl Reservoir	06/23/1959	Fully Adjudicated	54.35	Walters Draw		JOHN A. & GLADYS	ESPONDA	Reservoir	STO	052N	081W	13	SW1/4SE1/4	-106.546362	44.471373
P6115.0R	Karl Reservoir	01/28/1954	Fully Adjudicated	47.15			KARL F.	WALTERS	Reservoir	STO						
CR CR03/105	Karl Reservoir	03/04/1957		34.04	North Waegle Draw		KARL F.	WALTERS		STO	052N	081W	24	NE1/4SW1/4	-106.550570	44.461070
CR CR11/362	Karl Reservoir	06/23/1959		54.35	Walters Draw		WYO BOARD	LAND COMMISSIONERS		STO	052N	081W	13	SW1/4SE1/4	-106.545480	44.471810
P328.0S	KAUFMANN #1 STOCK RESERVOIR	08/12/1953	Complete	7.08	Middle Fork Coal Creek		FRED	KAUFMANN	Reservoir	STO	054N	081W	27	SE1/4SE1/4	-106.592975	44.616897
P5916.0R	Kaufmann Reservoir	03/10/1952	Unadjudicated	129.22	Sturgis Draw		Alex	Kaufmann	Reservoir	DOM_SW; IRR_SW; STO; COMBBU	053N	082W	28	SW1/4NW1/4	-106.748045	44.538434
P6555.0R	Kearney Lake Reservoir	04/14/1950	Fully Adjudicated	6130.55	Kearney Creek				Reservoir	IRR_SW	052N	085W	29	SW1/4NW1/4	-107.121145	44.451657
P962.0R	Kearney Lake Reservoir	11/22/1906	Fully Adjudicated	3847.50	Kearney Creek				Reservoir	DOM_SW; IRR_SW; STO; COMBBU	052N	085W	30	NE1/4SW1/4	-107.135462	44.447865
CR CR01/008	Kearney Lake Reservoir	11/22/1906		1854.05	Kearney Creek			KEARNEY LAKE LAND RESERVOIR CO.		DOM_SW; IRR_SW; STO	052N	085W	30	NE1/4SW1/4	-107.135720	44.449330
CR CR03/441	Kearney Lake Reservoir	04/14/1950		4276.50	Kearney Creek			KEARNEY LAKE LAND RESERVOIR CO.		IRR_SW	052N	085W	29	SW1/4NW1/4	-107.120560	44.452950
CR CR04/042	Kearney Lake Reservoir,, Enl.	12/31/1964		193.79	Kearney Creek			KEARNEY LAKE LAND RESERVOIR CO.		IRR_SW	052N	085W	29	SW1/4NW1/4	-107.120560	44.452950

Clear Creek Watershed Storage Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
P6826.0R	Kearney Lake Reservoir,,Enlargement of	12/31/1964	Fully Adjudicated	6324.34	Kearney Creek				Reservoir	IRR_SW	052N	085W	29	SW1/4NW1/4	-107.121145	44.451657
P11666.0R	Keffer No. 1 Reservoir	11/13/2003	Unadjudicated		Cummings Creek				Reservoir	IRR_SW; STO; COMBBU	050N	082W	15	NE1/4NW1/4	-106.710750	44.308139
P10462.0R	Keffer Reservoir	12/19/1996	Fully Adjudicated	2.00	Cummings Creek		Charles W. & Sherry S.	Keffer, Jr.	Reservoir	FIS	050N	082W	15	NE1/4NW1/4	-106.713202	44.308704
CR CR14/467	Keffer Reservoir	12/19/1996		2.00	Cummings Creek		L GARY AND DONNA J	MILLS		FIS	050N	082W	15	NE1/4NW1/4	-106.713200	44.308710
CR CR03/102	Kelley No. 3 Stock Reservoir	10/24/1960		4.96	Cameron Gulch		DAR D.	KELLEY		STO	053N	082W	10	SW1/4NE1/4	-106.718130	44.581350
CR CR10/059	Kessler No. 1 Pond Reservoir	12/08/1983		0.25	Kessler Springs Draw		GLEN	KESSLER		REC	053N	083W	17	NE1/4NW1/4	-106.884570	44.570640
CR CR10/060	Kessler No. 2 Pond Reservoir	12/08/1983		0.32	Kessler Springs Draw		GLEN	KESSLER		REC	053N	083W	17	NE1/4NW1/4	-106.884570	44.570640
P3850.0R	Kilbourne No. 1 Fish Pond Reservoir	06/19/1922	Unadjudicated	0.52	South Piney Creek		EDNA	KILBOURNE	Reservoir	FIS	053N	083W	7	SW1/4SE1/4	-106.900927	44.575169
P3851.0R	Kilbourne No. 2 Fish Pond Reservoir	06/19/1922		0.16	South Piney Creek		EDNA	KILBOURNE	Reservoir	FIS	053N	083W	7	NW1/4SE1/4	-106.899736	44.578100
P4894.0R	Kimble Reservoir	07/11/1938	Unadjudicated	1.61	Kimble Draw		GLENN E.	KIMBLE	Reservoir	STO	054N	079W	19	NW1/4NW1/4	-106.425343	44.642622
P9920.0R	Knott No. 1 Reservoir	06/07/1993	Fully Adjudicated	0.12	Lanier Draw		Dwight	Knott	Reservoir	FIS	050N	082W	03	NW1/4SW1/4	-106.717504	44.329946
CR CR14/115	Knott No. 1 Reservoir	06/07/1993		0.12	Lanier Draw		DWIGHT	KNOTT		FIS	050N	082W	03	NW1/4SW1/4	-106.719300	44.331650
P9921.0R	Knott No. 2 Reservoir	06/07/1993	Fully Adjudicated	0.26	Lanier Draw		Dwight	Knott	Reservoir	FIS	050N	082W	03	NW1/4SW1/4	-106.476034	44.505627
CR CR14/116	Knott No. 2 Reservoir	06/07/1993		0.26	Lanier Draw		DWIGHT	KNOTT		FIS	050N	082W	03	NW1/4SW1/4	-106.719300	44.331650
P9922.0R	Knott No. 3 Reservoir	06/07/1993	Fully Adjudicated	0.08	Lanier Draw		Dwight	Knott	Reservoir	FIS	050N	082W	03	NW1/4SW1/4	-106.717504	44.329946
CR CR14/117	Knott No. 3 Reservoir	06/07/1993		0.08	Lanier Draw		DWIGHT	KNOTT		FIS	050N	082W	03	NW1/4SW1/4	-106.719300	44.331650
P19340.0S	KOR #2 STOCK	02/01/2010	Incomplete		Piney Creek	KOR	NATHAN	MULLINAX	Reservoir	STK	053N	083W	22	SW1/4SE1/4	-106.836944	44.545186
P4793.0R	Kumor Reservoir	01/20/1938	Fully Adjudicated	3.80	Kumor Draw		PETER	KUMOR	Reservoir	STO	051N	081W	06	SE1/4SE1/4	-106.641975	44.414194
CR CR01/137	Kumor Reservoir	01/20/1938		3.80	Kumor Draw		PETER	KUMOR		STO	051N	081W	06	SE1/4SE1/4	-106.641980	44.414200
P973.0R	Lake DeSmet Reservoir	01/12/1907	Fully Adjudicated	59250.00	Piney Creek			Texaco, Inc.	Reservoir	DOM_SW; IRR_SW; POW; STO; COMBBU	053N	082W	31	SE1/4SW1/4	-106.784108	44.515778
CR CR01/024	LAKE DESMET RESERVOIR	01/12/1907	Fully Adjudicated	25000.00	Piney Creek	LAKE DESMET COUNTIES COALITION JOINT POWERS BOARD				DOM_SW; IRR_SW; POW; STO	053N	082W	31	SE1/4SW1/4	-106.783400	44.516419
CR CR03/016	LAKE DESMET RESERVOIR,, ENL.	04/03/1950	Fully Adjudicated	30129.00	Piney Creek	LAKE DESMET COUNTIES COALITION JOINT POWERS BOARD				DOM_SW; IND_SW; IRR_SW; POW; STO	053N	082W	31	SE1/4SW1/4	-106.783400	44.516419
CR CR11/365	Lake DeSmet Reservoir,, Enl.	02/02/1955		38960.00	Rock Creek			TEXACO INC.		IND_SW	053N	082W	31	SE1/4SW1/4	-106.783400	44.516420
CR CR11/367	Lake DeSmet Reservoir,, Enl.	02/25/1955		17738.00	French Creek			TEXACO INC.		IND_SW; IRR_SW	053N	082W	31	SE1/4SW1/4	-106.783400	44.516420
P5829.0R	LAKE DESMET RESERVOIR,,1ST ENLARGEMENT OF THE	04/03/1950	Fully Adjudicated	55129.00	Piney Creek	TEXACO, INC.			Reservoir	DOM_SW; IND_SW; IRR_SW; POW; STO	053N	082W	31	NW1/4SE1/4	-106.777400	44.518136
P7009.0R	Lake DeSmet Reservoir,,3rd Enlargement	02/25/1955	Fully Adjudicated	111827	French Creek			Texaco, Inc.	Reservoir	IND_SW; IRR_SW; COMBBU	053N	082W	31	SE1/4SW1/4		
P6225.0R	Lake DeSmet Reservoir,,Second Enlargement of the	02/02/1955	Fully Adjudicated	94089	Rock Creek			Texaco, Inc.	Reservoir	IND_SW	053N	082W	31	SE1/4SW1/4		
P6385.0R	Landeck Irrigation Reservoir	11/26/1956	Fully Adjudicated	81.08	Double Crossing Draw				Reservoir	IRR_SW; STO; COMBBU	053N	080W	12	SE1/4SE1/4	-106.430845	44.574209
CR CR06/436	Landeck Irrigation Reservoir	11/26/1956		77.92	Double Crossing Draw		EDNA ELIZABETH	LANDECK		STO	053N	080W	12	SE1/4SE1/4	-106.431660	44.573410
P3199.0S	LARRY WOODS STOCK RESERVOIR	01/29/1960	Complete	2.37	Smallwoods Draw		LARRY	WOODS	Reservoir	STO	056N	077W	06	SE1/4NE1/4	-106.167972	44.859883
P14416.0S	LAWRENCE A2-28 STOCK RESERVOIR	08/14/2001	Complete		Lawrence Draw (Drainage of)				Reservoir	STO	052N	081W	28	NW1/4NE1/4	-106.603486	44.453567
P6526.0R	Lawrence No. 1 Stock Reservoir	09/26/1960	Fully Adjudicated	7.74	Lawrence Draw			Clear Creek Ranch	Reservoir	STO	052N	081W	27	SE1/4SW1/4	-106.591317	44.443228
CR CR02/376	Lawrence No. 1 Stock Reservoir	09/26/1960		7.74	Lawrence Draw		CHARLES K.	LAWRENCE		STO	052N	081W	27	SE1/4SW1/4	-106.590920	44.443200
CR CR02/377	Lawrence No. 2 Stock Reservoir	09/26/1960		4.65	Lawrence Draw		CHARLES K.	LAWRENCE		STO	052N	081W	28	NW1/4NE1/4	-106.605960	44.453840
P5956.0R	Leiter Reservoir	09/15/1952	Fully Adjudicated	52.70	Cadiz Draw		MORRIS	Weinberg	Reservoir	IRR_SW	055N	078W	33	NE1/4NW1/4	-106.256319	44.704290
CR CR02/181	Leiter Reservoir	09/15/1952		52.70	Cadiz Draw		MORRIS	WEINBERG		IRR_SW	055N	078W	33	NE1/4NW1/4	-106.256690	44.704050
P12794.0R	LITTLE #1-19 RESERVOIR	05/09/2006	Incomplete		Cottonwood Draw				Reservoir	CNG_SW; STO	055N	078W	19	NE1/4NE1/4	-106.285067	44.732947
P1279.0S	LITTLE NO. 1 STOCK RESERVOIR	11/10/1955	Fully Adjudicated	4.04	Little Draw		PHIL	LITTLE	Reservoir	STO	055N	078W	07	NW1/4NE1/4	-106.293197	44.760428
P6865.0R	Little Red #2 Reservoir	12/22/1965	Unadjudicated	228.44	Clear Creek		JOHN L.	LUSHER	Reservoir	IRR_SW; STO; COMBBU	053N	080W	16	NE1/4SW1/4		
P6360.0R	Little Red Reservoir	05/01/1956	Fully Adjudicated	89.42	Ike Draw		JOHN L.	LUSHER	Reservoir	IRR_SW	053N	080W	16	SE1/4NW1/4	-106.502356	44.565427
CR CR02/131	Little Red Reservoir	05/01/1956		89.42	Ike Draw		JOHN L.	LUSHER		IRR_SW	053N	080W	16	SE1/4NW1/4	-106.502200	44.565780

Clear Creek Watershed Storage Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
P5442.0R	Little Sour Dough Reservoir	07/03/1941	Fully Adjudicated	1.63	Little Sour Dough Creek			USDA - National Forest Service	Reservoir	DOM_SW; FIS; STO; COMBBU	049N	084W	01	NW1/4NE1/4	-106.910324	44.250138
CR CR01/217	Little Sour Dough Reservoir	07/03/1941		1.63	Little Sour Dough Creek		USDA	FOREST SERVICE		DOM_SW; FIS; STO	049N	084W	01	NW1/4NE1/4	-106.908780	44.251440
CR CR15/154	Little Sour Dough Reservoir (act the Tie Hack Reservoir)	10/18/1933		1646.67	South Fork Clear Creek	City of Buffalo				FIS; MUN_SW; REC	050N	084W	23	SE1/4SE1/4	-106.923560	44.285150
P9489.0R	Little Sour Dough Reservoir (CHANGED TO TIE HACK RESERVOIR)	10/18/1933	Fully Adjudicated	1646.67	South Fork Clear Creek				Reservoir	FIS; MUN_SW; POW; REC; COMBBU	050N	084W	23	SE1/4SE1/4		
P4470.0R	Long Lake Reservoir	12/07/1931		24.80	South Fork Middle Fork Clear Creek		C.M.	MCNEESE	Reservoir	DOM_SW; IRR_SW; STO; COMBBU	050N	085W	25	SW1/4SE1/4	-107.029180	44.272495
P7565.0R	Love No. 1 Reservoir	10/03/1973	Fully Adjudicated	10.60	Mowry Draw			LOVE LAND & CATTLE CO.	Reservoir	FLO; IRR_SW; STO; COMBBU	052N	083W	32	NE1/4NW1/4	-106.874485	44.440492
CR CR08/552	Love No. 1 Reservoir	10/03/1973		8.62	Mowry Draw			LOVE LAND CATTLE COMPANY		IRR_SW; STO	052N	083W	32	NE1/4NW1/4	-106.873100	44.440320
P7566.0R	Love No. 2 Reservoir	10/03/1973	Fully Adjudicated	19.21	Mowry Creek			LOVE LAND & CATTLE CO.	Reservoir	FLO; IRR_SW; STO; COMBBU	052N	083W	33	SW1/4NW1/4	-106.856357	44.438298
CR CR08/551	Love No. 2 Reservoir	10/03/1973		17.06	Mowry Creek			LOVE LAND CATTLE COMPANY		IRR_SW; STO	052N	083W	33	SW1/4NW1/4	-106.858060	44.436550
P7292.0R	LOWER CLEAR CREEK RESERVOIR COMPANY - BOXELDER RESERVOIR	02/21/1968	Fully Adjudicated	20000.00	Piney Creek	CITY OF GILLETTE			Reservoir	IND_SW; IRR_SW; STO	052N	082W	27	SW1/4NW1/4	-106.718364	44.449772
CR CR11/364	Lower Clear Creek Reservoir Company - Boxelder Reservoir	02/21/1968		11800.00	Piney Creek			LOWER CLEAR CREEK IRRIGATION DISTRICT		IND_SW; IRR_SW; POW; STO	053N	082W	31	SE1/4SW1/4	-106.783400	44.516420
P18474.0S	LOWER WHIT N 5 STOCK RESERVOIR	04/24/2007	Incomplete		Whit N 5 Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	08	NE1/4NW1/4	-106.400819	44.671711
P18473.0S	LOWER WHIT N 6 STOCK RESERVOIR	04/24/2007	Incomplete		T Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	08	SE1/4NW1/4	-106.400839	44.668061
P18472.0S	LOWER WHIT N 7 STOCK RESERVOIR	04/24/2007	Incomplete		Colt Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	08	SW1/4NW1/4	-106.405889	44.668069
P17987.0S	LOWER WHIT S. 1 STOCK RESERVOIR	07/07/2006	Complete		Tietjen Draw	SHERI D.TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	17	SW1/4NE1/4	-106.395819	44.653461
P17988.0S	LOWER WHIT S. 2 STOCK RESERVOIR	07/07/2006	Complete		Lucky Draw	SHERI D.TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	17	SW1/4SE1/4	-106.395769	44.646169
P1852.0R	Luman Reservoir	06/27/1910	Unadjudicated	8.00	Clearmont Road Gulch		BERT R.	LUMAN	Reservoir	IRR_SW	056N	079W	32	SE1/4SE1/4	-106.390820	44.776328
P9794.0R	Marshall Duck Reservoir	04/22/1992	Fully Adjudicated	10.07	Johnson Creek				Reservoir	FIS; WIL; COMBBU	051N	083W	12	NE1/4SE1/4	-106.781412	44.401083
CR CR13/254	Marshall Duck Reservoir	04/22/1992		10.07	Johnson Creek		GARY R.	MARSHALL		FIS	051N	083W	12	NE1/4SE1/4	-106.782530	44.403140
P4830.0R	Marshall Reservoir	01/24/1938		2.79	Marshall Draw		W. H.	MARSHALL	Reservoir	STO	054N	081W	22	SW1/4NW1/4	-106.607609	44.638207
P680.0S	MASTERS & SHREVE #4 STOCK RESERVOIR	01/04/1954	Expired	9.69	North Whedon Gulch		RAYMOND	SHREVE	Reservoir	STO	056N	078W	07		-106.288097	44.842494
P636.0S	MASTERS AND SHREVE #1 STOCK RESERVOIR	12/28/1953	Expired	4.24	North Whedon Gulch		RAYMOND	SHREVE	Reservoir	STO	056N	078W	07	NW1/4NW1/4	-106.303517	44.847467
P679.0S	MASTERS AND SHREVE #3 STOCK RESERVOIR	01/04/1954	Expired	8.94	Shreve Draw		RAYMOND	SHREVE	Reservoir	STO	056N	077W	31	NW1/4NE1/4	-106.173153	44.791081
CR CR09/057	Maxted Stock Reservoir	05/14/1969		12.34	Maxted Draw		JOHN	BRUG		STO	054N	080W	21	NE1/4SW1/4	-106.502130	44.634330
P1887R	MAXWELL AND HUNTSMAN RESERVOIR	06/21/1910	Abandoned	66.00	Cemetery Draw		SLATER A.	MAXWELL	Reservoir	IRR_SW; STO	056N	079W	35	SW1/4NW1/4	-106.343688	44.783623
CR CR03/399	McAlister Stock Reservoir	12/02/1963		2.09	McAlister Draw		DAVID J.	WATT		STO	052N	080W	22	NE1/4SW1/4	-106.471450	44.463990
P18424.0S	MCCANN STOCK RESERVOIR	03/05/2007	Incomplete		Sandy Creek		BOB AND RUTHANNE	MCCANN	Reservoir	STO	051N	082W	17	SE1/4NW1/4	-106.752539	44.392161
P5664.0R	McHenry Reservoir	05/04/1948	Unadjudicated	0.73	McHenry Draw		S.F.	MCHENRY	Reservoir	DOM_SW; STO; COMBBU	050N	082W	11	SW1/4NE1/4	-106.687298	44.319690

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CR CR13/412	McIntyre Fishing Reservoir	06/16/1993		0.23	Sand Creek (3-50-82)		GREY AND TRUDY	POLEY		FIS	050N	082W	04	NE1/4SE1/4	-106.722400	44.329910
P13606.0R	MCKENZIE NO. 1 RESERVOIR	02/26/2010	Complete		Spring Draw				Reservoir	IRR_SW; STO	050N	082W	14	NE1/4SW1/4	-106.694361	44.299917
P13607.0R	MCKENZIE NO. 2 RESERVOIR	02/26/2010	Complete		Spring Draw		RAYNARD	MCKENZIE	Reservoir	IRR_SW; STO	050N	082W	15	SE1/4SE1/4	-106.699947	44.298578
P13608.0R	MCKENZIE NO. 3 RESERVOIR	02/26/2010	Complete		Spring Draw		RAYNARD	MCKENZIE	Reservoir	IRR_SW; STO	050N	082W	22	NE1/4NE1/4	-106.701000	44.295833
CR CR13/410	McKinley #1 Stock Reservoir	05/07/1990		9.00	Spring Creek		KENNETH BARBARA	POLEY		STO	051N	083W	15	NE1/4SE1/4	-106.822930	44.388840
CR CR13/411	McKinley #2 Stock Reservoir	05/07/1990		8.50	Spring Creek		KENNETH BARBARA	POLEY		STO	051N	083W	15	NE1/4SE1/4	-106.822930	44.388840
P9999.0R	McKinley Fish Habitat Reservoir	02/07/1994	Fully Adjudicated	1.31	Johnson Creek				Reservoir	FIS	051N	083W	14	SW1/4NW1/4	-106.819828	44.391564
CR CR13/409	McKinley Fish Habitat Reservoir	02/07/1994		1.30	Johnson Creek		KENNETH BARBARA	POLEY		FIS	051N	083W	14	NW1/4NW1/4	-106.817860	44.396070
P13264.0R	Metzer Reservoir	07/09/2007	Unadjudicated		Sandy Creek		Gerald J.	Metzer	Reservoir	FIS; WIL; COMBBU	051N	082W	17	NW1/4SW1/4	-106.75758	44.38854
P7159.0R	Miles Reservoir	06/03/1964	Fully Adjudicated	3.10	Little North Fork Shell Creek		Harold T. & Helen B.	Buell	Reservoir	FIS; IRR_SW; REC; STO; COMBBU	052N	083W	15	NE1/4NE1/4	-106.822812	44.483162
CR CR06/063	Miles Reservoir	06/03/1964		3.10	Little North Fork Shell Creek		HELEN B.	BUELL		FIS; IRR_SW; REC; STO	052N	083W	15	NE1/4NE1/4	-106.822810	44.483160
P7622.0R	Mill Creek Reservoir	11/16/1973		15653.00	Mill Creek			City of Buffalo	Reservoir	DOM_SW; IND_SW; IRR_SW; POW; STO; COMBBU	050N	082W	30	SE1/4NE1/4	-106.762674	44.275909
CR CR06/442	Miller No. 2 Stock Reservoir	05/17/1971		3.50	Basin Draw		OWEN	MILLER		STO	051N	083W	11	SW1/4SE1/4	-106.807750	44.399650
CR CR06/062	Miller Stock Reservoir	07/27/1970		11.14	Miller Draw		OWEN	MILLER		STO	051N	083W	11	NE1/4SW1/4	-106.812800	44.403340
P10710.0R	Mischke #1 Wetland Reservoir	06/29/1998	Unadjudicated				Ron	Mischke	Reservoir	WET; WIL; COMBBU						
P3577.0S	MOORE NO. 1 STOCK RESERVOIR	01/26/1961	Complete	5.95	West Dearie Gulch				Reservoir	STO	055N	078W	35	SW1/4NW1/4	-106.221983	44.698844
P5529.0S	MOORE NO. 1 STOCK RESERVOIR	01/24/1966	Complete	3.35	West Bridge Draw		WILLIAM	MOORE	Reservoir	STO	055N	078W	34	SW1/4SW1/4	-106.241478	44.692864
CR CR08/699	Moore No. 5 Stock Reservoir	12/16/1966		3.43	Big Corrals Draw		INC.	SEVEN UP RANCHES		STO	054N	078W	22	SE1/4NE1/4	-106.225590	44.641760
CR CR08/700	Moore No. 5 Stock Reservoir,, Enl.	08/27/1968		3.37	Big Corrals Draw			SEVEN UP RANCHES CO.		STO	054N	078W	22	SE1/4NE1/4	-106.225590	44.641760
P1300.0R	Moore Reservoir (CHANGED TO LAKE DeSMETRES)	08/31/1906	Fully Adjudicated	875	Rock Creek		MYRA M.	MOORE	Reservoir	DOM_SW; IRR_SW; POW; STO; COMBBU	053N	082W	31	SE1/4SW1/4	-106.784417	44.515785
CR CR16/109	Moore Wetland Reservoir	11/03/1997		35.90	Sahara Draw	Bob Moore an Ucross Land Company				WET	053N	080W	11	NE1/4SW1/4	-106.461930	44.576720
P7132.0R	Morarity No. 2 Reservoir	09/11/1964	Fully Adjudicated	13.25	North Prong Cottonwood Draw		PHIL S.	LITTLE	Reservoir	STO	055N	079W	13	SE1/4NE1/4	-106.309715	44.742998
CR CR08/694	Morarity No. 2 Reservoir	09/11/1964		13.25	North Prong Cottonwood Draw		INC.	LITTLE RANCH CO.		STO	055N	079W	13	SE1/4NE1/4	-106.309070	44.741330
P18349.0S	MOREY #1 STOCK RESERVOIR	12/04/2003	Complete		Bug Draw				Reservoir	STO	053N	081W	21	NW1/4NE1/4	-106.617661	44.555031
P7045.0R	Moriarty No. 1 Reservoir	01/15/1963	Fully Adjudicated	33.64	West Prong Big Cottonwood Draw		PHIL S.	LITTLE	Reservoir	STO	055N	079W	13	NE1/4NW1/4	-106.319471	44.745406
CR CR08/692	Moriarty No. 1 Reservoir	01/15/1963		13.64	West Prong Big Cottonwood Draw		INC.	LITTLE RANCH CO.		STO	055N	079W	13	NE1/4NW1/4	-106.319360	44.744820
P6652.0R	Mowry Reservoir	04/05/1960	Fully Adjudicated	25.34	Mowry Creek		CHAS. H.	EVITT	Reservoir	FIS; IRR_SW; STO; COMBBU	052N	083W	33	NW1/4NE1/4	-106.849148	44.439692
CR CR03/040	Mowry Reservoir	04/05/1960		25.34	Mowry Creek		CHAS H.	EVITT		FIS; IRR_SW; STO	052N	083W	33	NW1/4NE1/4	-106.848050	44.440000
CR CR02/345	Murray No. 1 Stock Reservoir	08/11/1959		6.75	Murray Draw		DAVID J.	WATT		STO	052N	081W	17	SE1/4NE1/4	-106.620900	44.479030
CR CR02/346	Murray No. 2 Stock Reservoir	08/11/1959		1.74	Murray Draw		DAVID J.	WATT		STO	052N	081W	22	NW1/4SE1/4	-106.585950	44.461200
CR CR02/347	Murray No. 3 Stock Reservoir	08/11/1959		1.71	West Fork Murray Draw		DAVID J.	WATT		STO	052N	081W	17	NE1/4SE1/4	-106.620920	44.475430
CR CR02/373	Murray Stock Reservoir	09/26/1960		6.24	Murray Draw		CHARLES K.	LAWRENCE		STO	052N	081W	22	SW1/4NW1/4	-106.595930	44.464730
P7621.0R	Negro Creek Reservoir, First Enlargement of the	09/19/1956		13910.92	Clear Creek (drainage of)			City of Buffalo	Reservoir	DOM_SW; IND_SW; IRR_SW; POW; STO; COMBBU	050N	082W	30	SE1/4NE1/4	-106.762674	44.275909
P9882.0R	Neltje Reservoir	10/05/1992	Fully Adjudicated	2.27	Cameron Gulch				Reservoir	DSP; STO; COMBBU	053N	082W	11	SE1/4SW1/4	-106.700838	44.575866
CR CR13/408	Neltje Reservoir	10/05/1992		0.05	Cameron Gulch			NELTJE		DOM_SW; STO	053N	082W	11	SE1/4SW1/4	-106.702980	44.574100
CR CR08/163	Niedringhaus #19 (ULM) Stock Reservoir	08/12/1975		1.44	Ulm Draw		LAMBERT	NIEDRINGHAUS		STO	054N	081W	11	SW1/4SE1/4	-106.577890	44.659600
CR CR08/162	Niedringhaus #23 (ULM) Stock Reservoir	08/12/1975		4.36	Lone Tree Creek		LAMBERT	NIEDRINGHAUS		STO	054N	081W	14	SW1/4NE1/4	-106.577840	44.652420
P2725.0S	NIELSEN NO. 1 STOCK RESERVOIR	04/14/1959	Fully Adjudicated	4	Nielsen Draw		NIELS	NEILSON	Reservoir	STO	051N	083W	10	SW1/4NE1/4	-106.828206	44.408497
CR CR05/152	Nielsen No. 1 Stock Reservoir	04/14/1959		4.00	Nielsen Draw		NIELS P.	NIELSEN		STO	051N	083W	10	SW1/4NE1/4	-106.827920	44.407090
P2726.0S	NIELSEN NO. 2 STOCK RESERVOIR	04/14/1959	Fully Adjudicated	1.4	Nielsen Draw		NIELS	NIELSEN	Reservoir	STO	051N	083W	10	SW1/4NE1/4	-106.826317	44.408592
CR CR05/153	Nielsen No. 2 Stock Reservoir	04/14/1959		1.40	Nielsen Draw		NIELS P.	NIELSEN		STO	051N	083W	10	SW1/4NE1/4	-106.827920	44.407090

Clear Creek Watershed Storage Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
CR CR06/443	Nielsen No. 5 Stock Reservoir	09/28/1970		2.33	North Prong Sayles Creek		NIELS P.	NIELSEN		STO	051N	083W	03	SE1/4NE1/4	-106.822880	44.421730
P1397.0R	No. 2 Reservoir	10/24/1908	Fully Adjudicated	25.50	Number Two Draw		DONALD	THOMSON	Reservoir	STO	054N	078W	30	NW1/4SW1/4	-106.296428	44.625434
P13472.0R	NORTHERN	07/09/2009	Incomplete		Piney Creek	MCMURRY READY MIX COMPANY	GENE	BRUMMOND	Reservoir	IND_SW; STO; WL	053N	083W	36	SE1/4NE1/4	-106.792556	44.523917
P7349.0R	Norwood Reservoir	12/03/1970	Fully Adjudicated	31.97	Coal Creek		RAYMOND N.	PLANK	Reservoir	FIS; IND_SW; IRR_SW; REC; STO; COMBBU	053N	081W	02	NE1/4SE1/4	-106.573616	44.590509
CR CR09/058	Norwood Reservoir	12/03/1970		23.65	Coal Creek		RAYMOND N.	PLANK		FIS; FLO; IND_SW; IRR_SW; REC; STO	053N	081W	02	NE1/4SE1/4	-106.572070	44.591440
P13383.0R	Oedekoven 12-27-57-74 Reservoir	09/26/2008	Unadjudicated						Reservoir	IRR_SW; STO; COMBBU						
P7225.0R	Oil Well Stock Reservoir	07/28/1967	Fully Adjudicated	81.83	Davis Draw			SEVEN UP RANCHES INC.	Reservoir	ERO; MIS_SW; STO; COMBBU	055N	078W	26	SW1/4SE1/4	-106.210404	44.706640
CR CR08/698	Oil Well Stock Reservoir	07/28/1967		81.83	Davis Draw		INC.	SEVEN UP RANCHES		STO	055N	078W	26	SW1/4SE1/4	-106.211050	44.707650
P10511.0R	Old Stockyards No. 1 Reservoir	10/09/1996	Fully Adjudicated	9.08	Sand Creek (36-51-82)		Wayne	Nelson	Reservoir	FIS; WIL; COMBBU	051N	082W	36	SE1/4SW1/4	-106.672314	44.341371
CR CR15/225	Old Stockyards No. 1 Reservoir	10/09/1996		9.08	Sand Creek (36-51-82)	Wayne Nelson				FIS	051N	082W	36	SE1/4SW1/4	-106.672310	44.341370
P10512.0R	Old Stockyards No. 2 Reservoir	10/09/1996	Fully Adjudicated	12.24	Sand Creek (36-51-82)		Wayne	Nelson	Reservoir	FIS; WIL; COMBBU	051N	082W	36	NE1/4SW1/4	-106.672283	44.345011
CR CR15/226	Old Stockyards No. 2 Reservoir	10/09/1996		12.24	Sand Creek (36-51-82)	Wayne Nelson				FIS	051N	082W	36	NE1/4SW1/4	-106.672280	44.345010
P10513.0R	Old Stockyards No. 3 Reservoir	10/09/1996	Fully Adjudicated	9.90	Sand Creek (36-51-82)		Wayne	Nelson	Reservoir	FIS; WIL; COMBBU	051N	082W	36	NE1/4SW1/4	-106.672283	44.345011
CR CR15/227	Old Stockyards No. 3 Reservoir	10/09/1996		9.90	Sand Creek (36-51-82)	Wayne Nelson				FIS	051N	082W	36	NE1/4SW1/4	-106.672280	44.345010
P346.0S	OLIVER NO. 1 STOCK RESERVOIR	09/01/1953	Complete	0.33	Murphy Gulch		BERNICE	OLIVER	Reservoir	STO	053N	082W	18	SE1/4NW1/4	-106.783133	44.568539
P4791.0R	Oliver Reservoir	01/19/1938	Unadjudicated	6.35			HARRY D.	OLVER	Reservoir	STO						
P6726.0R	Ollie Stock Reservoir	05/22/1959	Unadjudicated	54.66	Number Three Draw		Arnaud	Auzqui	Reservoir	STO	054N	079W	12	SE1/4NE1/4	-106.306695	44.667833
P13374.0R	Open Reservoir	05/12/2008							Reservoir	IRR_SW; STO; COMBBU						
CR CR16/302	Oxbow Reservoir	12/16/2002		2.86	Piney Creek	Scott Probasco, dba Wilwalka, LLC					053N	082W	15	SE1/4SW1/4	-106.723340	44.559280
CR CR17/008	Partners Pond	04/17/2000		14.16	Clear Creek	Rocking Horse Ranch				FIS	056N	077W	02		-106.094210	44.859530
P6349.0R	Pat Reservoir	09/04/1956		65.45			MRS. ANNA L.	FIELDGROVE	Reservoir	STO						
P5980.0R	Pence Reservoir	12/01/1952	Fully Adjudicated	153.85	Lone Tree Creek		ERNEST M. & AUDRA I.	PENCE	Reservoir	DOM_SW; IRR_SW; STO; COMBBU	054N	080W	23	SW1/4SW1/4	-106.467639	44.631637
CR CR12/053	Pence Reservoir	12/01/1952		153.85	Lone Tree Creek		RICHARD M. AND LOIS P.	WILLIAMS		DOM_SW; IRR_SW; STO	054N	080W	23	NW1/4SW1/4	-106.466680	44.634650
CR CR14/403	Pepper Reservoir	01/13/1992		2.07	Rock Spring Branch		RICHARD D.	SMITH		FIS	050N	082W	05	SE1/4NW1/4	-106.752890	44.333640
P12919.0R	Perry 6-24 Reservoir	03/22/2007	Unadjudicated		Clear Creek				Reservoir	CBM_SW; IND_SW; IRR_SW; STO; WIL; COMBBU	055N	079W	24	SW1/4NE1/4	-106.313960	44.726940
P6829.0R	Phil No. 2 Reservoir	09/06/1960	Fully Adjudicated	48.15	Archie Draw		Phil	Schuman	Reservoir	STO	052N	080W	All		-106.478746	44.469831
CR CR05/260	Phil No. 2 Reservoir	09/06/1960		48.15	Archie Draw		PHIL	SCHUMAN		STO	052N	080W	All		-106.519250	44.482420
P3765.0R	Piney Meadows Reservoir	07/27/1921		386.05	North Piney Creek				Reservoir	IRR_SW	053N	084W	20	NE1/4SE1/4	-106.997093	44.548344
P4463.0R	Pinhead Reservoir	04/09/1931	Fully Adjudicated	56.72	Pin Head Creek		A. W.	LONABAUGH	Reservoir	IRR_SW	054N	080W	05	SE1/4SE1/4	-106.514318	44.675424
CR CR01/136	Pinhead Reservoir	04/09/1931		56.72	Pin Head Creek		A.W.	LONABAUGH		IRR_SW; STO	054N	080W	05	SE1/4SE1/4	-106.512820	44.673930
P3825.0S	PIPE STOCK RESERVOIR	11/20/1961	Fully Adjudicated	7.04	Taylor Draw		GEORGE	LIMMER	Reservoir	STO	051N	082W	17	NW1/4NW1/4	-106.75565	44.395047
CR CR08/169	Pipe Stock Reservoir	11/20/1961		7.04	Taylor Draw		GEORGE	LIMMER		STO	051N	082W	17	NW1/4NW1/4	-106.757490	44.395820
CR CR03/400	Pitsch No. 1 Stock Reservoir	04/06/1964		10.50	Fowler Draw (9-53-80)		ALEX	PITSCH		STO	053N	080W	05	SE1/4SE1/4	-106.512060	44.587590
CR CR08/448	Pitsch No. 3 Stock Reservoir	10/07/1974		18.36	Donkey Creek		ALEX	PITSCH		STO	053N	080W	08	NW1/4SE1/4	-106.517220	44.576480
CR CR08/450	Pitsch No. 4 Stock Reservoir	10/07/1974		6.23	Coal Creek		ALEX	PITSCH		STO	053N	080W	07	SW1/4SE1/4	-106.537060	44.573100
CR CR08/451	Pitsch No. 5 Stock Reservoir	10/07/1974		9.06	Coal Creek		ALEX	PITSCH		STO	053N	080W	07	SW1/4SW1/4	-106.546930	44.573300
P7071.0R	Pollard No. 1 Reservoir	09/11/1964	Fully Adjudicated	36.75			PHIL S.	LITTLE	Reservoir	STO						
CR CR01/182	Post Island Reservoir	05/06/1938		1.07	Island Spring Branch			JOHNSON COUNTY		FIS	050N	082W	05	NE1/4SE1/4	-106.742840	44.330030
CR CR16/119	Poweshiek Reservoir	12/15/1998		7.30	South Fork Shell Creek	Larry Brannian				STO	052N	083W	23	NW1/4SE1/4	-106.807670	44.461430
P13392.0R	R14-32 Reservoir	05/07/2009	Unadjudicated						Reservoir	CBM_SW; IND_SW; IRR_SW; STO; WIL; COMBBU						
P13345.0R	R6-29 Reservoir	06/27/2008	Unadjudicated						Reservoir	IRR_SW; STO; COMBBU						

Clear Creek Watershed Storage Water Rights

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P3219.0S	RALPH FOSTER #2 STOCK RESERVOIR	02/04/1960	Complete	3.58	Foster Draw		RALPH	FOSTER	Reservoir	STO	055N	079W	19	SE1/4NE1/4	-106.410947	44.726011
P1616.0R	Rate & Huson Reservoir	07/27/1909	Fully Adjudicated	72.00	Pin Head Creek		RATE AND	HUSON	Reservoir	IRR_SW	054N	080W	14	NW1/4SW1/4	-106.462694	44.648667
CR CR06/438	Rattlesnake No. 1 Reservoir	12/04/1967		56.20	Rattlesnake Spring Draw		ANNA L.	FIELDGROVE		FIS; STO	052N	080W	12		-106.429760	44.494370
CR CR01/183	Rearing Pond No. 6	06/17/1938		3.45	Spring Branch			JOHNSON COUNTY		FIS	050N	084W	16	SE1/4SE1/4	-106.963720	44.301220
P5033.0R	Rearing Pond No. 7 Reservoir	09/29/1938		4.30	Little Sour Dough Creek			JOHNSON COUNTY BOARD OF COMMISSIONERS	Reservoir	FIS	049N	084W	01	SE1/4NW1/4	-106.913308	44.246925
P6861.0R	Reeves Reservoir	06/13/1962	Fully Adjudicated	5.35	Sand Creek (36-51-82)				Reservoir	DOM_SW; FIS; IND_SW; IRR_SW; MAN; STO; COMBBU	050N	082W	14	SW1/4NE1/4	-106.685237	44.305463
CR CR05/074	Reeves Reservoir	06/13/1962		5.35	Sand Creek (36-51-82)		NORTHERN WYOMING	LAND COMPANY		DOM_SW; FIS; IND_SW; IRR_SW; MAN; STO	050N	082W	14	SW1/4NE1/4	-106.687210	44.305130
P694.0R	Republican Reservoir	06/17/1905	Fully Adjudicated	50.40	Town Gulch/Thompson Draw		DONALD	THOMSON	Reservoir	IRR_SW	053N	079W	10	NW1/4NE1/4	-106.346820	44.588810
P6226.0R	Reynolds Box Elder Reservoir (CHG. TO ENL LAKE DESMET RES)	02/04/1955	Fully Adjudicated	8902	Piney Creek			Texaco, Inc.	Reservoir	IND_SW; IRR_SW; STO; COMBBU	053N	082W	31	SE1/4SW1/4		
CR CR11/366	Reynolds Box Elder Reservoir (CHG. TO ENL LAKE DESMET RES)	02/04/1955		8902.00	Piney Creek			TEXACO INC.		IND_SW; IRR_SW; STO	053N	082W	31	SE1/4SW1/4	-106.783400	44.516420
P8729.0R	REYNOLDS CLEAR CREEK DIVERSION DAM	09/28/1977	Fully Adjudicated	285.40	Clear Creek	M&M RANCH ACQUISITION CO LLC			Reservoir	IND_SW; IRR_SW; STO	051N	081W	09	NW1/4SW1/4	-106.616506	44.402972
CR CR10/058	Reynolds Clear Creek Diversion Dam	09/28/1977		12.10	Clear Creek			TEXACO INC.		STO	051N	081W	09	NW1/4SW1/4	-106.616510	44.402980
P7291.0R	Reynolds High Dam Reservoir	11/13/1963	Fully Adjudicated	44442	Piney Creek			Texaco, Inc.	Reservoir	IND_SW; IRR_SW; POW; STO; COMBBU	053N	082W	32	SE1/4NE1/4		
CR CR11/363	Reynolds High Dam Reservoir	11/13/1963		37340.00	Piney Creek			TEXACO INC.		IND_SW; IRR_SW; POW; STO	053N	082W	31	SE1/4SW1/4	-106.783400	44.516420
P7010.0R	Reynolds Piney Creek Diversion Dam Reservoir	02/03/1969	Fully Adjudicated	50.80	Piney Creek			Texaco, Inc.	Reservoir	IND_SW; IRR_SW; POW; REC; STO; COMBBU	053N	083W	25	SW1/4SW1/4	-106.808748	44.531000
CR CR06/171	Reynolds Piney Creek Diversion Dam Reservoir	02/03/1969		50.80	Piney Creek			REYNOLDS MINING CORPORATION		IND_SW; IRR_SW; POW; REC; STO	053N	083W	25	SW1/4SW1/4	-106.808750	44.531000
P6227.0R	Reynolds Shell Creek Reservoir (CHG TO LAKE DeSMET RES)	03/08/1955	Fully Adjudicated	1304	Shell Creek			Texaco, Inc.	Reservoir	IND_SW; IRR_SW; COMBBU	053N	083W	31	SE1/4SW1/4		
CR CR11/368	Reynolds Shell Creek Reservoir (CHG TO LAKE DeSMET RES)	03/08/1955		1304.00	Shell Creek			TEXACO INC.		IND_SW; IRR_SW	053N	082W	31	SE1/4SW1/4	-106.783400	44.516420
CR CR11/369	Reynolds Shell Creek Reservoir,, Enl.	04/16/1957		740.00	Shell Creek			TEXACO INC.		IND_SW; IRR_SW; STO	053N	082W	31	SE1/4SW1/4	-106.783400	44.516420
P7532.0R	Reynolds Shell Creek Reservoir,,Enlargement of the (CHG TO LAKE DESMET RES)	04/16/1957	Fully Adjudicated	2109	Shell Creek			Texaco, Inc.	Reservoir	IND_SW; IRR_SW; STO; COMBBU	053N	082W	31	SE1/4SW1/4		
CR CR08/701	Rice No. 2 Stock Reservoir	10/28/1960		3.65			C. H.	RICE		STO	054N	081W	21	NE1/4NE1/4	-106.612590	44.641820
P4832.0R	Rietveld Reservoir	01/24/1938	Unadjudicated	3.84	Rietveld Draw		PETE	RIETVELD	Reservoir	STO	054N	079W	34	NW1/4SE1/4	-106.356283	44.607151
P5684.0S	RILEY STOCK RESERVOIR	02/28/1966	Fully Adjudicated	11.80	Smith Draw	SOLDIER CREEK ACQUISTION III, LLC			Reservoir	STO	051N	081W	12	SE1/4NW1/4	-106.548792	44.407928
CR CR09/469	Riley Stock Reservoir	02/28/1966		11.80	Smith Draw		GRACE F.	WALTERS		STO	051N	081W	12	SE1/4NW1/4	-106.550640	44.406480
P7052.0R	Roberts "Luman Draw" Stock Reservoir	11/04/1963	Fully Adjudicated	28.20	Luman Draw		DONALD H.	ROBERTS	Reservoir	FLO; STO; COMBBU	056N	079W	29	SW1/4SE1/4	-106.393886	44.792042
CR CR08/158	Roberts "Luman Draw" Stock Reservoir	11/04/1963		28.20	Luman Draw		DONALD H.	ROBERTS		STO	056N	079W	29	SW1/4SE1/4	-106.395920	44.791040
P6540.0R	Roberts Black Stump Reservoir	10/14/1959	Unadjudicated	21.60	Black Stump Draw		DONALD H.	ROBERTS	Reservoir	STO	055N	080W	14	SW1/4SW1/4	-106.465198	44.733029
P3650.0S	ROBERTS NO. 1 STOCK RESERVOIR	02/21/1961	Complete	4.25	Lost Draw		DONALD	ROBERTS	Reservoir	STO	056N	079W	18	SW1/4NE1/4	-106.417367	44.825903

Clear Creek Watershed Storage Water Rights

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P3651.0S	ROBERTS NO. 2 STOCK RESERVOIR	02/21/1961	Complete	1.70	Oil Well Draw		DONALD	ROBERTS	Reservoir	STO	056N	079W	09	NW1/4SE1/4	-106.375583	44.838078
P3653.0S	ROBERTS NO. 3 STOCK RESERVOIR	02/24/1961	Complete	7.35	Roberts Draw		DONALD	ROBERTS	Reservoir	STO	055N	079W	04	NW1/4NW1/4	-106.387844	44.771119
P3654.0S	ROBERTS NO. 4 STOCK RESERVOIR	02/24/1961	Complete	5.95	Roberts No. 4 Draw		DONALD	ROBERTS	Reservoir	STO	056N	078W	32	SE1/4NW1/4	-106.277803	44.787706
P3652.0S	ROBERTS NO. 6 STOCK RESERVOIR	02/21/1961	Complete	4.10	Roberts No. 6 Draw		DONALD	ROBERTS	Reservoir	STO	055N	079W	06	NW1/4NW1/4	-106.426353	44.773661
CR CR02/348	Rock Reservoir	11/03/1958		0.40	Rock Spring Branch		FRANK B.	SHREVE		FIS; REC; STO	050N	082W	05	SW1/4NW1/4	-106.757970	44.333650
P12161.0R	Rocky Road Reservoir	06/18/2004	Unadjudicated		Looney Draw				Reservoir	IRR_SW; STO; COMBBU	052N	079W	All			
P2844.0R	Roll Reservoir	02/26/1915	Fully Adjudicated	10.59	Davis Draw		E.F.	Roll	Reservoir	IRR_SW	055N	078W	26	SE1/4NW1/4	-106.216756	44.716297
P12094.0R	Rough Ride Reservoir	06/18/2004	Unadjudicated		Looney Draw				Reservoir	IRR_SW; STO; COMBBU	052N	079W	All			
P5418.0R	Rowena Reservoir	03/17/1941	Unadjudicated	16.25	Hay Creek		V.S.	GRIFFITH	Reservoir	STO	056N	080W	12	NE1/4SE1/4	-106.432686	44.838776
P2729.0S	ROWLEY NO. 1 STOCK RESERVOIR	04/17/1959	Complete	6.03	M. C. Draw		M. C.	ROWLEY	Reservoir	STO	057N	077W	35	SW1/4NE1/4	-106.104236	44.876881
P779.0S	ROWLEY STOCK RESERVOIR	02/23/1954	Complete	2.03	Rowley Draw		MERIL	ROWLEY	Reservoir	STO	057N	077W	36	NW1/4SE1/4	-106.082492	44.873931
P13659.0R	RULE PIT RESERVOIR	08/19/2010	Fully Adjudicated		Field Draw	CROELL REDI-MIX	BRIAN	MARCHANT	Reservoir	IND_SW; WET	051N	081W	31	SW1/4SE1/4	-106.646333	44.342167
P12493.0R	Rule Weltand North Reservoir	12/28/2000	Unadjudicated		Field Draw		Tom	Rule	Reservoir	WIL	051N	081W	31	NE1/4SE1/4	-106.641810	44.344980
CR CR09/052	Sahara Draw Stock Reservoir	09/22/1969		3.31	Sahara Draw		JOHN	BRUG		STO	054N	080W	32	SE1/4NE1/4	-106.512140	44.609120
P8206.0R	Sandy No. 1 Reservoir	09/05/1980	Fully Adjudicated	6.02	Sayles Creek		Helen	Kenney	Reservoir	IRR_SW; STO; COMBBU	051N	083W	03	SW1/4NW1/4	-106.837987	44.42178
CR CR09/060	Sandy No. 1 Reservoir	09/05/1980		0.09	Sayles Creek		HELEN K.	KENNEY		STO	051N	083W	03	SW1/4NW1/4	-106.837990	44.421780
P9670.0R	Sare #1 Recreation Reservoir	09/14/1990	Fully Adjudicated	0.22	Redman Draw		KEITH	SARE	Reservoir	FIS; REC; COMBBU	053N	083W	8	SE1/4SW1/4	-106.883980	44.573632
CR CR13/177	Sare #1 Recreation Reservoir	09/14/1990		0.22	Redman Draw		HUNTER RANCH	INC.		FIS; REC	053N	083W	08	SE1/4SW1/4	-106.884550	44.574360
P9671.0R	Sare #2 Recreation Reservoir	09/14/1990	Fully Adjudicated	0.19	Redman Draw		KEITH	SARE	Reservoir	FIS; REC; COMBBU	053N	083W	8	SE1/4SW1/4	-106.883588	44.574252
CR CR13/178	Sare #2 Recreation Reservoir	09/14/1990		0.19	Redman Draw		HUNTER RANCH	INC.		FIS; REC	053N	083W	08	SE1/4SW1/4	-106.884550	44.574360
P9672.0R	Sare #3 Recreation Reservoir	09/14/1990	Fully Adjudicated	1.54	Redman Draw		KEITH	SARE	Reservoir	FIS; REC; COMBBU	053N	083W	8	SW1/4SE1/4	-106.879919	44.573646
CR CR13/179	Sare #3 Recreation Reservoir	09/14/1990		1.54	Redman Draw		HUNTER RANCH	INC.		FIS; REC	053N	083W	08	SW1/4SE1/4	-106.879490	44.574470
P6623.0R	SAYLES CREEK NO. 2 RESERVOIR	09/29/1960	Complete	2.82	North Fork Sayles Creek	LOVE LAND & CATTLE CO.	CHRISTY	LOVE	Reservoir		051N	083W	08	NW1/4NW1/4	-106.877311	44.411894
P6210.0R	SAYLES CREEK RESERVOIR	01/05/1955	Incomplete	8.74	North Fork Sayles Creek	LOVE LAND & CATTLE CO.	CHRISTY	LOVE	Reservoir	IRR_SW	051N	083W	08	NE1/4NW1/4	-106.87515	44.412217
P10416.0R	Schaefer Reservoir	08/27/1996	Fully Adjudicated	0.28	Sand Creek (3-50-82)		Michael F.	Schaefer	Reservoir	FIS; WIL; COMBBU	050N	082W	09	SE1/4NW1/4	-106.733007	44.319340
CR CR14/470	Schaefer Reservoir	08/27/1996		0.28	Sand Creek (3-50-82)		2-B	LAND LIVESTOCK CO		FIS	050N	082W	09	SE1/4NW1/4	-106.733010	44.319340
CR CR02/374	School Section Stock Reservoir	09/26/1960		3.25	School Section Draw		WYO BOARD	LAND COMMISSIONERS		STO	052N	081W	16	SW1/4NE1/4	-106.605930	44.479110
CR CR05/461	Schuman #4 Stock Reservoir	12/09/1968		5.50	Scotty Draw		GEORGE	SCHUMAN		STO	053N	080W	15	NW1/4SE1/4	-106.477100	44.562330
P3801.0R	Scott No. 1 Reservoir	01/31/1922		1.62	Scott Draw		MRS. J.J.	SCOTT	Reservoir	STO	055N	077W	18	SW1/4SW1/4	-106.182189	44.736735
P3802.0R	Scott No. 2 Reservoir	01/31/1922		1.08	Scott Draw		MRS. J. J.	SCOTT	Reservoir	STO	055N	077W	19	NW1/4NW1/4	-106.182029	44.732969
P3803.0R	Scott No. 3 Reservoir	01/31/1922		0.84	Eighty Draw		MRS. J. J.	SCOTT	Reservoir	STO	055N	077W	30	NE1/4NW1/4	-106.178972	44.719278
P1396.0R	Seven Brothers Reservoir	10/20/1908		7773.70			Wilbur P.	Keays	Reservoir	IRR_SW	050N	085W	10	NE1/4NE1/4	-107.068474	44.326201
P9086.0R	Shell Creek Recreation and Stock Reservoir	12/20/1979	Fully Adjudicated	55.95	Shell Creek			Texaco, Inc.	Reservoir	FIS; REC; STO; COMBBU	052N	083W	01	SE1/4SW1/4	-106.792375	44.501356
CR CR10/372	Shell Creek Recreation and Stock Reservoir	12/20/1979		55.95	Shell Creek			TEXACO INC.		FIS; REC; STO	052N	083W	01	SE1/4SW1/4	-106.792380	44.501360
CR CR06/061	Shider Reservoir,, Enl.	12/22/1953		26.30	Whitmire Creek		WILLIAM L.	PEASE		IRR_SW; STO	055N	080W	27	SW1/4SE1/4	-106.476500	44.704050
P7238.0R	Shider Reservoir,,First Enlargement	12/22/1953	Fully Adjudicated	40.00	Whitmire Creek		Mark S. & Shelly	Kirby	Reservoir	IRR_SW; STO; COMBBU	055N	080W	27	SW1/4SE1/4	-106.475734	44.703480
P6086.0R	Snider #1 Reservoir	01/05/1953	Fully Adjudicated	10.95	Whitmire Creek		Mark S. & Shelly	Kirby	Reservoir	IRR_SW; STO; COMBBU	055N	080W	35	NW1/4SE1/4	-106.456192	44.694062
P6857.0R	Snider #1 Town Draw	09/29/1961	Unadjudicated	55.50	Town Draw		WILLIAM L.	PEASE	Reservoir	STO	054N	080W	03	SE1/4NE1/4	-106.471644	44.682245
P6087.0R	Snider #2 Reservoir	01/05/1953	Fully Adjudicated	28.90	Whitmire Creek		Mark S. & Shelly	Kirby	Reservoir	IRR_SW; STO; COMBBU	055N	080W	35	NW1/4SE1/4	-106.456192	44.694187
P6088.0R	Snider #3 Reservoir	01/05/1953	Fully Adjudicated	16.87	Whitmire Creek		Mark S. & Shelly	Kirby	Reservoir	IRR_SW; STO; COMBBU	055N	080W	35	SE1/4NW1/4	-106.462551	44.697723
P6089.0R	Snider #4 Reservoir	01/05/1953	Fully Adjudicated	15.85	Whitmire Creek		Mark S. & Shelly	Kirby	Reservoir	IRR_SW; STO; COMBBU	055N	080W	34	NE1/4NE1/4		
P6090.0R	Snider #5 Reservoir	01/05/1953	Fully Adjudicated	13.70	Whitmire Creek		Mark S. & Shelly	Kirby	Reservoir	IRR_SW; STO; COMBBU	055N	080W	27	SW1/4SE1/4	-106.475546	44.703549
P6091.0R	Snider #6 Reservoir	01/05/1953	Fully Adjudicated	30.85	Snider Draw		Mark S. & Shelly	Kirby	Reservoir	IRR_SW; STO; COMBBU	055N	080W	27	SE1/4SE1/4	-106.469504	44.704545
CR CR02/367	Snider No. 1 Reservoir	01/05/1953		10.95	Whitmire Creek		WILLIAM L.	PEASE		IRR_SW; STO	055N	080W	35	NW1/4SE1/4	-106.456120	44.693930

Clear Creek Watershed Storage Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
P987.0S	SNIDER NO. 1 STOCK RESERVOIR	12/01/1954	Complete	6.85	Snider Draw		WILLIAM	PEASE	Reservoir	STO	055N	079W	31	SE1/4NE1/4	-106.410942	44.697378
CR CR02/368	Snider No. 2 Reservoir	01/05/1953		28.90	Whitmire Creek		WILLIAM L.	PEASE		IRR_SW; STO	055N	080W	35	NW1/4SE1/4	-106.456120	44.693930
CR CR02/369	Snider No. 3 Reservoir	01/05/1953		16.87	Whitmire Creek		WILLIAM L.	PEASE		IRR_SW; STO	055N	080W	35	SE1/4NW1/4	-106.461230	44.697330
CR CR02/370	Snider No. 4 Reservoir	01/05/1953		15.85	Whitmire Creek		WILLIAM L.	PEASE		IRR_SW; STO	055N	080W	34	NE1/4NE1/4	-106.471390	44.700650
CR CR02/371	Snider No. 5 Reservoir	01/05/1953		13.70	Whitmire Creek		WILLIAM L.	PEASE		IRR_SW; STO	055N	080W	27	SW1/4SE1/4	-106.476500	44.704050
CR CR02/372	Snider No. 6 Reservoir	01/05/1953		30.85	Snider Draw		WILLIAM L.	PEASE		IRR_SW; STO	055N	080W	27	SE1/4SE1/4	-106.471400	44.704190
P10763.0R	Sonny Reservoir	06/08/1998	Fully Adjudicated						Reservoir	FIS						
CR CR16/009	Sonny Reservoir	06/08/1998		1.47	North Fork Clear Creek		DAN AND JULIA	MOORE		FIS	050N	084W	12	NW1/4SW1/4	-106.917700	44.319220
P4119.0R	South Fork Pond Reservoir	04/28/1927	Unadjudicated	53.15	South Fork Clear Creek			CLEAR CREEK TIMBER CO.	Reservoir	IRR_SW	050N	084W	32	SW1/4NW1/4	-106.999987	44.265376
P6624.0R	SOUTH SAYLES NO. 2 RESERVOIR	09/29/1960	Complete	12.7	South Fork Sayles Creek	LOVE LAND & CATTLE CO.	CHRISTY	LOVE	Reservoir		051N	083W	08	NE1/4SW1/4	-106.872389	44.404072
P6363.0R	SOUTH SAYLES RESERVOIR	12/29/1955	Expired	23.1	South Fork Sayles Creek	LOVE LAND & CATTLE CO.	CHRISTY	LOVE	Reservoir		051N	083W	08	SW1/4NE1/4	-106.870167	44.407825
P13471.0R	SOUTHERN	07/09/2009	Incomplete		Little Piney Creek	MCMURRY READY MIX COMPANY	GENE	BRUMMOND	Reservoir	STO; WL; IND_SW	053N	083W	36	SE1/4NE1/4	-106.794639	44.523250
P2493.0R	Sparks Reservoir	05/20/1913	Fully Adjudicated	42.30	North Fork Shell Creek		DOUGLAS B.	SPARKS	Reservoir	IRR_SW; STO; COMBBU	052N	083W	09	NE1/4SE1/4	-106.843466	44.491200
P9408.0R	Spielman Fishing Preserve Reservoir	07/08/1988	Unadjudicated	0.18	South Piney Creek		Ann	Spielman	Reservoir	FIS; REC; COMBBU	053N	084W	13	NE1/4SE1/4	-106.914904	44.563367
CR CR12/055	Spielman Fishing Preserve Reservoir	07/08/1988		0.18	South Piney Creek		ANN S.	SPIELMAN		FIS; REC	053N	084W	13	NE1/4SE1/4	-106.914900	44.563370
CR CR01/456	Springer No. 2 Reservoir	12/31/1951		11.84	Springer Draw		ELZA	SPRINGER		IRR_SW; STO	050N	082W	02	SW1/4SE1/4	-106.687360	44.326950
CR CR01/270	Springer Reservoir	11/10/1939		4.50	Springer Draw		ELZA	SPRINGER		FIS; IRR_SW	050N	082W	02	SW1/4SE1/4	-106.687360	44.326950
P13287.0R	Stamato Wetland Reservoir	10/11/2007	Unadjudicated				John P. & Ang	Stamato	Reservoir	WET						
CR CR08/449	State No. 1 Stock Reservoir	10/07/1974		9.59	Bur Draw		WYO BOARD	LAND COMMISSIONERS		STO	053N	080W	06	NE1/4SE1/4	-106.531950	44.591290
CR CR02/375	State Stock Reservoir	09/26/1960		15.20	Waegle Draw		WYO BOARD	LAND COMMISSIONERS		STO	052N	081W	35	NE1/4NE1/4	-106.560860	44.439550
P7403.0R	Stevens No. 2 Reservoir	04/27/1971	Fully Adjudicated	415.12	Clear Creek		Fred I. & Linda S	Dowd	Reservoir	IRR_SW; STO; COMBBU	052N	081W	23	SE1/4NW1/4	-106.570912	44.464889
CR CR09/053	Stevens No. 2 Reservoir	04/27/1971		20.00	Clear Creek			UCROSS LAND COMPANY		STO	052N	081W	23	SE1/4NW1/4	-106.570910	44.464890
P6824.0R	Stevens Reservoir	09/28/1964	Fully Adjudicated	28.39	Four Draw		Fred I. & Linda S	Dowd	Reservoir	FIS; IRR_SW; REC; STO; COMBBU	052N	081W	23	NW1/4SE1/4	-106.565969	44.461972
CR CR04/124	Stevens Reservoir	09/28/1964		28.39	Four Draw		CHARLES C. B.	STEVENS		FIS; IRR_SW; REC; STO	052N	081W	23	NW1/4SE1/4	-106.565820	44.461260
P4442.0R	Stevenson Reservoir	09/11/1930	Unadjudicated	7.77			DR. C.E.	STEVENSON	Reservoir	IRR_SW						
P1592.0S	STOKEY NO. 1 STOCK RESERVOIR	10/07/1955	Complete	1.28	South Prong Mill Creek		RUSSELL	STOKEY	Reservoir	STO	050N	082W	31	NW1/4NW1/4	-106.778861	44.265853
P9269.0R	Stover Fish Pond	12/13/1982	Fully Adjudicated	0.13	Peters Rivulet				Reservoir	REC	053N	083W	7	SW1/4SE1/4	-106.901244	44.575111
CR CR11/373	Stover Fish Pond	12/13/1982		0.13	Peters Rivulet		TOM D.	NEWMAN		REC	053N	083W	07	SW1/4SE1/4	-106.899780	44.574230
P2652.0R	Supplementary Hector Reservoir	05/08/1914		25.00	Cemetery Draw		W. H.	POOL	Reservoir	IRR_SW; STO; COMBBU	056N	079W	25	SE1/4SE1/4	-106.308926	44.791337
P13415.0R	T55NR76W12SESW Reservoir	11/03/2008	Unadjudicated						Reservoir	IRR_SW; STO; COMBBU						
P10057.0R	Talley No. 1 Reservoir	06/23/1994	Fully Adjudicated	1.01	Redman Draw		Douglas G.	Madison	Reservoir	FIS	053N	083W	17	NE1/4NE1/4	-106.874450	44.570868
CR CR14/147	Talley No. 1 Reservoir	06/23/1994		1.01	Redman Draw		LLOYD AND WILMA	GIBSON		FIS	053N	083W	17	NE1/4NE1/4	-106.874450	44.570870
P10058.0R	Talley No. 2 Reservoir	06/23/1994	Fully Adjudicated	0.70	Redman Draw		Douglas G.	Madison	Reservoir	FIS	053N	083W	17	NE1/4NE1/4	-106.874450	44.570868
CR CR15/310	Talley No. 2 Reservoir	06/23/1994		0.07	Redman Draw	Douglas G. Madison				FIS	053N	083W	17	NE1/4NE1/4	-106.874450	44.570870
CR CR06/172	Tam Stock Reservoir	11/03/1969		4.94	Tam Draw		HARRY E.	SENFF		STO	053N	082W	22	SW1/4SW1/4	-106.728290	44.544650
P10480.0R	Tanner Reservoir	02/24/1997	Fully Adjudicated	0.22	Sand Creek (3-50-82)		Joe	Tanner	Reservoir	FIS; REC; STO; WIL; COMBBU	050N	082W	04	SE1/4SE1/4	-106.722624	44.326400
CR CR14/469	Tanner Reservoir	02/24/1997		0.22	Sand Creek (3-50-82)		DAVE	GRABBERT		FIS; REC; STO	050N	082W	04	SE1/4SE1/4	-106.722620	44.326400
P11038.0R	TAYLOR CABIN POND RESERVOIR	03/23/1999	Fully Adjudicated		North Fork Sayles Creek			Wyo. State Game & Fish Dept.	Reservoir		051N	083W	07	NW1/4NE1/4	-106.886689	44.411828
CR CR18/186	Taylor Cabin Pond Reservoir	03/23/1999		7.15	North Fork Sayles Creek	Wyoming Department of Transportation, et al.				FIS; WET	051N	083W	07	NW1/4NE1/4	-106.888190	44.411180
P9984.0R	Taylor No. 2 Reservoir	07/12/1993	Fully Adjudicated	36.24	Sandy Creek				Reservoir	FIS; IRR_SW; COMBBU	051N	082W	08	SW1/4SE1/4	-106.745999	44.401133

Clear Creek Watershed Storage Water Rights

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CR CR15/281	Taylor No. 2 Reservoir	07/12/1993		36.24	Sandy Creek	George Taylor				FIS; STO; WET	051N	082W	08	SW1/4SE1/4	-106.747380	44.399420
P6515.0R	TAYLOR RESERVOIR	07/27/1959	Fully Adjudicated	21.41	Taylor Draw		GEORGE	TAYLOR	Reservoir	IRR_SW	051N	082W	08	SE1/4SW1/4	-106.751469	44.398269
CR CR02/386	Taylor Reservoir	07/27/1959		21.41	Taylor Draw		GEORGE A.	TAYLOR		IRR_SW	051N	082W	08	SE1/4SW1/4	-106.752420	44.399440
P619.0S	TEBBETS NO. 2 STOCK RESERVOIR	12/21/1953	Complete	1.30	West Cabin Creek		COYNE	TIBBETS	Reservoir	STO	057N	077W	07	NW1/4SE1/4	-106.181869	44.933661
P2771.0R	Thom Reservoir	11/19/1914	Fully Adjudicated	1.44	Camp Comfort Draw		WILLIAM J.	THOM	Reservoir	DOM_SW; IRR_SW; COMBBU	050N	083W	08	NW1/4SW1/4	-106.878837	44.315508
P5098.0R	Thom Reservoir	05/17/1939	Fully Adjudicated	14.20	Reservoir Draw		John C.	Thom, III	Reservoir	IRR_SW; STO; COMBBU	050N	082W	08	NW1/4NE1/4	-106.748277	44.321626
CR CR01/203	Thom Reservoir	05/17/1939		14.20	Reservoir Draw		JOHN C.	THOM		IRR_SW; STO	050N	082W	08	NW1/4NE1/4	-106.748120	44.322890
P6758.0R	Three Fork Stock Reservoir	02/18/1964	Unadjudicated	7.95	Miller Draw		James A.	Bumbaca	Reservoir	STO	055N	079W	24	SE1/4NW1/4	-106.321354	44.727067
P2118.0S	TIBBETS #2 STOCK RESERVOIR	11/22/1957	Complete	7.79	East Cabin Creek		COYNE	TIBBETS	Reservoir	STO	057N	077W	06	SW1/4NE1/4	-106.185358	44.951558
P370.0S	TIBBETS NO. 1 STOCK RESERVOIR	09/08/1953	Complete	19.22	West Cabin Creek		COYNE	TIBBETS	Reservoir	STO	057N	077W	07		-106.187847	44.932064
P647.0S	TIBBETS NO. 3 STOCK RESERVOIR	12/29/1953	Complete	5.50	West Cabin Creek		COYNE	TIBBETS	Reservoir	STO	057N	077W	07		-106.183036	44.930336
P9700.0R	Tie Hack Reservoir, Enlargement of the	09/12/1989	Fully Adjudicated	2435.11	South Fork Clear Creek				Reservoir	REC	050N	084W	23	SE1/4SE1/4	-106.923564	44.285148
CR CR15/155	Tie Hack Reservoir,, Enl.	09/12/1989		788.44	South Fork Clear Creek	City of Buffalo				REC	050N	084W	23	SE1/4SE1/4	-106.923560	44.285150
P12155.0R	T-J Fishing Reservoir	05/23/2005	Fully Adjudicated		Sand Creek (3-50-82)		Francis D.	Walter	Reservoir	FIS	050N	082W	04	SE1/4SE1/4	-106.722620	44.326400
CR CR18/096	T-J Fishing Reservoir	05/23/2005		0.50	Sand Creek (3-50-82)	Maxine Schroeder				FIS	050N	082W	04	SE1/4SE1/4	-106.722620	44.326400
P307.0S	TODD NO. 1 STOCK RESERVOIR	08/03/1953	Complete	5.35	Coal Creek		FRED	TODD	Reservoir	STO	053N	081W	02	NE1/4SW1/4	-106.581494	44.592314
P6129.0R	TODD RESERVOIR	12/22/1953	Complete	10.44	Box Elder Creek		FRED	TODD	Reservoir	IRR_SW; STO	053N	081W	15	NE1/4SW1/4	-106.601278	44.561936
P4118.0R	Triangle Park Reservoir	01/05/1920		1042	South Fork		PAUL A.	RATHWELL	Reservoir	IRR_SW	051N	084W	32	NE1/4NW1/4		
P3816.0R	Triangle Reservoir	10/11/1921		2823.05	South Fork		Paul A.	Rothwell	Reservoir	IRR_SW	051N	084W	31	SE1/4NW1/4	-107.0155	44.35306
P11031.0R	Trinity Reservoir	05/24/2000	Unadjudicated		Peters Rivulet		Lawrence	Zillmer	Reservoir	FIS	053N	083W	07	NW1/4SE1/4		
CR CR15/362	Twin Lakes No. 1 Reservoir	02/02/1995		2.05	Springer Draw	Twin Lakes, L.C.				FIS	050N	082W	02	SE1/4SW1/4	-106.692380	44.327020
CR CR15/363	Twin Lakes No. 2 Reservoir	02/02/1995		10.40	Springer Draw	Twin Lakes, L.C.				FIS	050N	082W	02	SE1/4SW1/4	-106.692380	44.327020
P6397.0R	Twin No. 1 Reservoir	01/14/1957	Fully Adjudicated	39.33	Betz Draw				Reservoir	STO	052N	079W	05	SE1/4NE1/4	-106.381630	44.512943
P847.0R	Twin No. 1 Reservoir	05/01/1906	Fully Adjudicated	20.00	Bob's Draw		J. D.	POOL	Reservoir	DOM_SW; IRR_SW; STO; COMBBU	056N	078W	18	SE1/4SE1/4	-106.288830	44.820764
CR CR02/182	Twin No. 1 Reservoir	01/14/1957		39.33	Betz Draw		J. L.	BEYDLER		STO	052N	079W	05	SE1/4NE1/4	-106.382150	44.512780
P850.0R	TWIN NO. 2 RESERVOIR	05/09/1906	Fully Adjudicated	20.00	Bob's Draw		J. D.	POOL	Reservoir	DOM_SW; IRR_SW; STO	056N	078W	18	SE1/4SE1/4	-106.288831	44.820764
CR CR02/383	Twin Stock Reservoir	09/26/1960		1.42	Wright Draw		CHARLES K.	LAWRENCE		STO	051N	081W	04	NW1/4NW1/4	-106.616190	44.424860
P18471.0S	U.U. TOWN DRAW 1 STOCK RESERVOIR	04/24/2007	Incomplete		Down Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	080W	12	SE1/4NW1/4	-106.441289	44.668281
P10312.0R	Ucross Oxbow #174 Reservoir	02/08/1995	Fully Adjudicated	9.08	Piney Creek				Reservoir	STO; WET; COMBBU	053N	080W	18	NW1/4SW1/4	-106.548223	44.559254
CR CR15/224	Ucross Oxbow No. 174 Reservoir	02/08/1995		9.07	Piney Creek	Ucross Land Company				STO; WET	053N	080W	18	NW1/4SW1/4	-106.547220	44.562390
P18470.0S	UPPER WHIT N 1 STOCK RESERVOIR	04/24/2007	Incomplete		Bond Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	05	NW1/4SW1/4	-106.405881	44.679081
P18463.0S	UPPER WHIT N 2 STOCK RESERVOIR	04/24/2007	Incomplete		Brosnan Draw	SHERI D TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	05	NW1/4SW1/4	-106.405881	44.679081
P18469.0S	UPPER WHIT N 3 STOCK RESERVOIR	04/24/2007	Incomplete		Brosnan Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	05	NE1/4SW1/4	-106.400839	44.679039
P18467.0S	UPPER WHIT N 4 STOCK RESERVOIR	04/24/2007	Incomplete		Remmington Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	06	NE1/4SE1/4	-106.410911	44.679111
P18468.0S	UPPER WHIT N 5 STOCK RESERVOIR	04/24/2007	Incomplete		Steele Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	05	SW1/4NW1/4	-106.405881	44.682769

Clear Creek Watershed Storage Water Rights

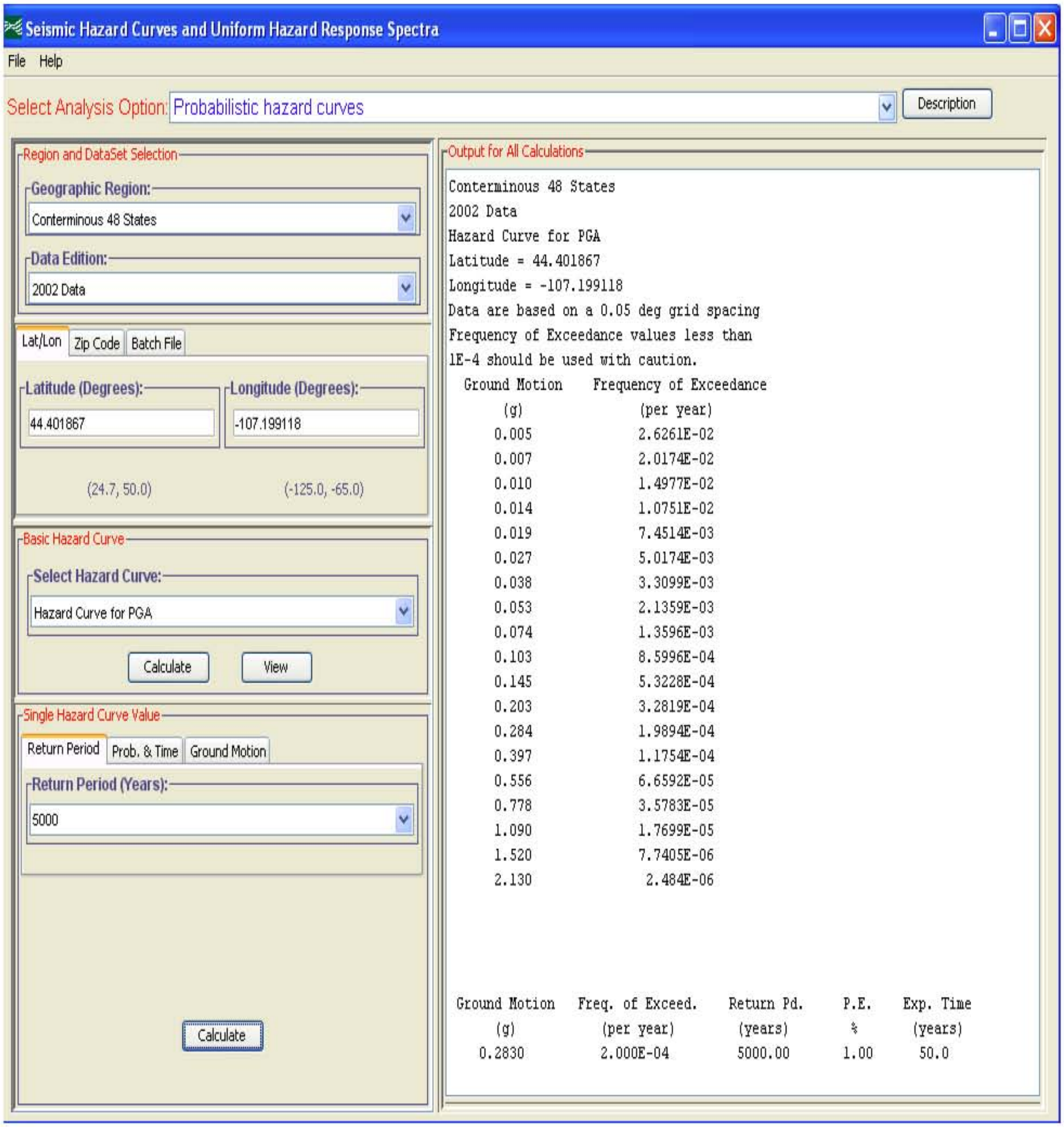
WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
P18466.0S	UPPER WHIT N 6 STOCK RESERVOIR	04/24/2007	Incomplete		Remmington Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	06	SE1/4NE1/4	-106.410900	44.682811
P18461.0S	UPPER WHIT N7 STOCK RESERVOIR	04/24/2007	Incomplete		Pump Draw	SHERI D TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	05	SW1/4NW1/4	-106.405881	44.682769
P18475.0S	UPPER WHIT S 10 STOCK RESERVOIR	04/24/2007	Incomplete		Upper Whit S 10 Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	080W	01	SE1/4SW1/4	-106.441131	44.675731
P18465.0S	UPPER WHIT S1 STOCK RESERVOIR	04/24/2007	Incomplete		Panorama Draw	SHERI D. TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	07	NE1/4SW1/4	-106.421031	44.664311
P18464.0S	UPPER WHIT S2 STOCK RESERVOIR	04/24/2007	Incomplete		Panorama Draw	SHERI D TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	07	NE1/4SW1/4	-106.421031	44.664311
P18462.0S	UPPER WHIT S3 STOCK RESERVOIR	04/24/2007	Incomplete		Panorama Draw	SHERI D TIETJEN REVOCABLE TRUST			Reservoir	STO	054N	079W	07	SE1/4SW1/4	-106.421039	44.660689
P5889.0R	Van Noy Reservoir	11/05/1951	Unadjudicated	30.05	Fowler Draw (7-53-79)		Henry	Van Noy	Reservoir	STO	053N	079W	20		-106.397316	44.560426
P5105.0R	VanAuken Reservoir	07/31/1939		6.07	Sand Draw		W. G.	VANAUKEN	Reservoir	STO	049N	082W	03	SW1/4NE1/4	-106.705769	44.246866
CR CR08/035	Vannoy-DeVoe Stock Reservoir	08/02/1954		4.56	Devoe Draw		WALLACE L.	VANNOY		STO	053N	079W	24	SE1/4NW1/4	-106.310870	44.556810
P6544.0R	Veteran Reservoir	12/21/1959			Clear Creek				Reservoir	FIS	050N	082W	05	NE1/4SE1/4	-106.742839	44.330031
P3161.0S	WALT WARFIELD #1 STOCK RESERVOIR	01/25/1960	Complete	5.26	Warfield No. 1 Draw		WALTER	WARFIELD	Reservoir	STO	055N	078W	24	NE1/4NE1/4	-106.186494	44.733781
P3162.0S	WALT WARFIELD #2 STOCK RESERVOIR	01/25/1960	Complete	3.11	Warfield No. 2 Draw		WALTER	WARFIELD	Reservoir	STO	055N	078W	14	SW1/4NE1/4	-106.209456	44.742981
P5992.0R	Walters Reservoir	12/31/1952	Fully Adjudicated	49.95	Waegle Draw			ESPONDA RANCH COMPANY	Reservoir	STO	051N	080W	06	SE1/4SW1/4	-106.530395	44.416946
CR CR03/106	Walters Reservoir	12/31/1952		49.95	Waegle Draw			ESPONDA RANCH COMPANY		STO	051N	080W	06	SE1/4SW1/4		
CR CR02/344	Walters Stock Reservoir	08/11/1959		6.50	Four Draw		DAVID J.	WATT		STO	052N	081W	23	NW1/4NW1/4	-106.576000	44.468540
P5732.0R	Warfield Reservoir	07/13/1950	Fully Adjudicated	19.20	Davis Draw		W. H.	WARFIELD	Reservoir	IRR_SW; STO; COMBBU	055N	078W	14	NE1/4NW1/4	-106.216705	44.746134
CR CR01/427	Warfield Reservoir	07/13/1950		19.20	Davis Draw		W. H.	WARFIELD		IRR_SW; STO	055N	078W	14	NE1/4NW1/4	-106.216160	44.747900
P7586.0R	Waterhole No. 3 Reservoir	07/09/1973	Fully Adjudicated	2.1			John W.	Zak	Reservoir	FIS						
P7653.0R	Waterhole No. 4 Reservoir	10/28/1974	Fully Adjudicated	3.17			John W.	Zak	Reservoir	FIS						
CR CR03/114	Watt #2 Stock Reservoir	10/10/1957		4.97	Homestead Draw		EVAN J.	WATT		STO	057N	077W	16	NE1/4SE1/4		
CR CR03/404	Watt Stock Reservoir	12/02/1963		6.37	North Branch Watt Draw		DAVID J.	WATT		STO	052N	081W	03	NW1/4SE1/4	-106.585900	44.504350
P13375.0R	Well 22 Reservoir	05/12/2008	Unadjudicated						Reservoir	IRR_SW; STO; COMBBU						
CR CR07/408	West Fork Dam Stock Reservoir	12/30/1953		17.35	Donaldson Draw		WILLIAM	LANDECK		STO	053N	080W	34	NW1/4NE1/4	-106.477230	44.526090
P1617.0R	WHEDEN NO. 1 RESERVOIR	08/30/1909	Fully Adjudicated	24.64	Whedon Gulch		EARL AND BESSIE F.	WHEDON	Reservoir	IRR_SW	056N	078W	07	SW1/4NE1/4	-106.293162	44.844390
P5363.0R	WHEDON NO. 2 RESERVOIR	10/22/1940	Complete	11.50	Spring Draw		DR. EARL	WHEDON	Reservoir	STO	056N	078W	09	SW1/4NE1/4	-106.253064	44.844444
P1618.0R	WHEDON NO. 2 RESERVOIR	08/30/1909	Fully Adjudicated	0.50	Dry Gulch		EARL	WHEDON	Reservoir	IRR_SW	056N	078W	17	NW1/4NE1/4	-106.272881	44.831825
P5215.0R	WHEDON RESERVOIR	12/15/1939	Complete	10	South Fork North Buffalo Creek		DR. EARL	WHEDON	Reservoir	STO						
P14272.0S	WHITETAIL #1 STOCK RESERVOIR	11/01/2000	Complete		Whitetail Draw		DORA	SLAYBAUGH	Reservoir	STO	051N	081W	19	SE1/4SW1/4	-106.651933	44.370356
CR CR08/695	Whitewater Stock Reservoir	11/25/1974		4.93	Dog Draw		WILLIAM L.	PEASE		STO	054N	080W	02	SW1/4SE1/4	-106.456490	44.675280
P6760.0R	Whitmire Reservoir	01/27/1964	Fully Adjudicated	0.28	North Piney Creek		WILLIAM H. & SYLVIA	LAWRENCE	Reservoir	DOM_SW; FIS; IRR_SW; STO; COMBBU	053N	083W	7	SE1/4NW1/4	-106.904773	44.581991
CR CR03/242	Whitmire Reservoir	01/27/1964		0.28	North Piney Creek		CHARLES C.	LAWRENCE		DOM_SW; FIS; IRR_SW; STO	053N	083W	07	SE1/4NW1/4	-106.904770	44.581990
P9686.0R	Wildlife Reservoir	10/21/1991	Fully Adjudicated	75.60	Cemetery Draw			City of Buffalo	Reservoir	REC; WIL; COMBBU	051N	082W	35	SE1/4NE1/4	-106.682613	44.348544
CR CR14/148	Wildlife Reservoir	10/21/1991		75.60	Cemetery Draw		CITY OF	BUFFALO		REC	051N	082W	35	SE1/4NE1/4	-106.682430	44.348750
P2570.0S	WILLIAM DOOLEY NO. 2 STOCK RESERVOIR	12/31/1958	Complete	2.20	Short Draw		WILLIAM	DOOLEY	Reservoir	STO	057N	078W	29	NE1/4SE1/4	-106.280511	44.884956
P6408.0R	Willow Park Reservoir	08/26/1939	Fully Adjudicated	4457					Reservoir	DOM_SW; IRR_SW; STO; C						

Clear Creek Watershed Storage Water Rights

WR NUMBER	FACILITY NAME	PRIORITY DATE	WATER RIGHT	VOLUME (ac-ft)	SOURCE NAME	COMPANY	FIRST NAME	LAST NAME	FACILITY TYPE	USES	TOWNSHIP	RANGE	SECTION	QTR QTR	LONGITUDE	LATITUDE
CR CR02/400	Willow Park Reservoir	08/26/1939		4457.00	South Fork South Piney Creek			WILLOW PARK RESERVOIR CO.		DOM_SW; FIS; IRR_SW; STO	052N	085W	24	SE1/4NW1/4	-107.034760	44.467510
CR CR02/382	Windmill Stock Reservoir	09/26/1960		0.40	North Fork Hodge Draw		CHARLES K.	LAWRENCE		STO	052N	081W	29	SE1/4NE1/4	-106.621060	44.450260
P12923.0S	WISDOM DRAW STOCK RESERVOIR,,	05/07/1997	Complete	10.70	Wisdom Draw				Reservoir	STO	054N	079W	09	NE1/4SW1/4	-106.380631	44.664425
P2528.0S	WOODS NO. 1 STOCK RESERVOIR	12/04/1958	Complete	6.08	Woods Draw		LARRY	WOODS	Reservoir	STO	056N	077W	07	SW1/4NE1/4	-106.174428	44.843825
P2529.0S	WOODS NO. 2 STOCK RESERVOIR	12/04/1958	Complete	1.83	Larry Draw		LARRY	WOODS	Reservoir	STO	057N	077W	31	NW1/4NW1/4	-106.194267	44.881122
CR CR06/060	Woods No. 7 Stock Reservoir	09/22/1970		4.80	Needwater Draw		LARRY	WOODS		STO	056N	077W	07	NW1/4SW1/4	-106.182640	44.841760
P1941.0S	WORDEN NO. 1 STOCK RESERVOIR	03/25/1957	Complete	6.09	Road Draw		E.D.	WORDEN	Reservoir	STO	055N	079W	21	NE1/4SE1/4	-106.369042	44.723150
P2550.0S	WORDEN NO. 1 STOCK RESERVOIR	12/17/1958	Complete	3.58	Tulley Draw		E. D.	WORDEN	Reservoir	STO	055N	079W	22	SW1/4SE1/4	-106.352936	44.719908
CR CR03/145	Wright Stock Reservoir	10/10/1960		3.57	Wright Draw		CHARLES K.	LAWRENCE		IRR_SW	052N	081W	32	SW1/4NW1/4	-106.636170	44.435750
P13545.0R	YOUNG RESERVOIR	10/05/2009	Complete		Cattail Draw		YOUNG	ORIN	Reservoir	FIS; STO; WL	053N	083W	8	NW1/4SW1/4	-106.890767	44.578044
P1442.0R	Zing Reservoir	11/10/1908	Fully Adjudicated	24.00	North Fork Deadman's Draw		L.L. & Gertrude	Zing	Reservoir	IRR_SW; STO; COMBBU	055N	079W	22	SW1/4NE1/4	-106.354916	44.726470
P19.0S	ZINGG NO. 1 STOCK RESERVOIR	08/01/1941	Complete	6.00	Zingg Draw				Reservoir	STO	053N	079W	21		-106.363783	44.557458
P20.0S	ZINGG NO. 2 STOCK RESERVOIR	08/01/1941	Fully Adjudicated	8.00	Reeder Draw				Reservoir	STO	053N	079W	21		-106.363783	44.557458
CR CR08/161	Zingg No. 2 Stock Reservoir	08/01/1941		8	Reeder Draw		H. R.	ZINGG ESTATE		STO	053N	079W	All			
CR CR16/210		05/24/2000		0.02	Peters Rivulet	Lawrence Zillmer				FIS	053N	083W	07	NW1/4SE1/4	-106.899740	44.578100

Appendix 3H
PGA Ground Motion

Western Extent of Clear Creek Basin



Select Analysis Option: Probabilistic hazard curves

Geographic Region: Conterminous 48 States

Data Edition: 2002 Data

Latitude (Degrees): 44.401867

Longitude (Degrees): -107.199118

(24.7, 50.0)

(-125.0, -65.0)

Select Hazard Curve: Hazard Curve for PGA

Return Period (Years): 5000

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Conterminous 48 States
2002 Data
Hazard Curve for PGA
Latitude = 44.401867
Longitude = -107.199118
Data are based on a 0.05 deg grid spacing
Frequency of Exceedance values less than
1E-4 should be used with caution.
  Ground Motion    Frequency of Exceedance
       (g)                (per year)
      0.005              2.6261E-02
      0.007              2.0174E-02
      0.010              1.4977E-02
      0.014              1.0751E-02
      0.019              7.4514E-03
      0.027              5.0174E-03
      0.038              3.3099E-03
      0.053              2.1359E-03
      0.074              1.3596E-03
      0.103              8.5996E-04
      0.145              5.3228E-04
      0.203              3.2819E-04
      0.284              1.9894E-04
      0.397              1.1754E-04
      0.556              6.6592E-05
      0.778              3.5783E-05
      1.090              1.7699E-05
      1.520              7.7405E-06
      2.130               2.484E-06



 Ground Motion   Freq. of Exceed.    Return Pd.     P.E.     Exp. Time
      (g)           (per year)        (years)        %        (years)
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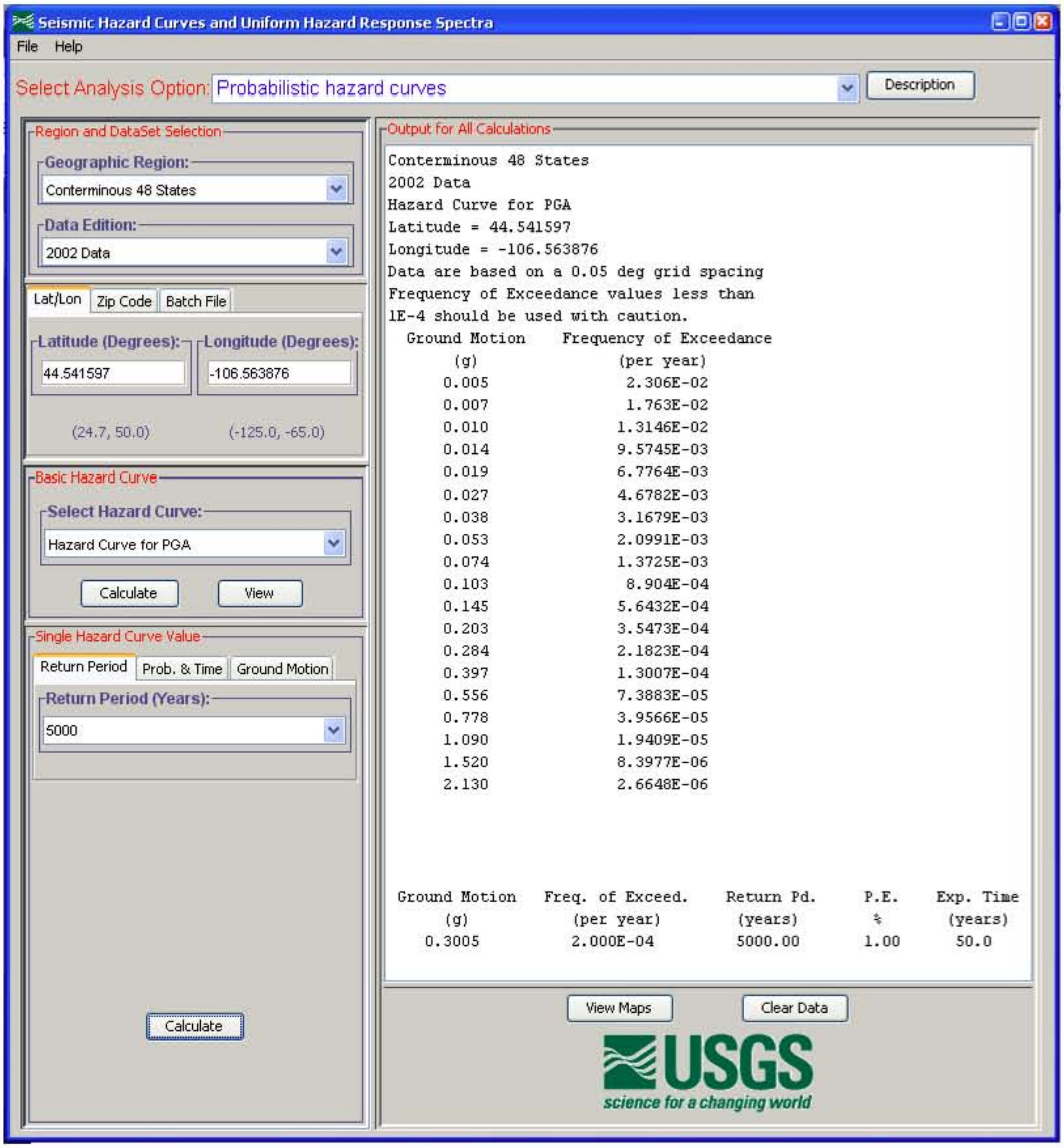
Center of Clear Creek Basin



Select Analysis Option: Probabilistic hazard curves

Geographic Region: Conterminous 48 States

Data Edition: 2002 Data

Latitude (Degrees): 44.541597

Longitude (Degrees): -106.563876

Select Hazard Curve: Hazard Curve for PGA

Return Period (Years): 5000

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Conterminous 48 States
2002 Data
Hazard Curve for PGA
Latitude = 44.541597
Longitude = -106.563876
Data are based on a 0.05 deg grid spacing
Frequency of Exceedance values less than
1E-4 should be used with caution.
  Ground Motion    Frequency of Exceedance
       (g)                (per year)
      0.005                2.306E-02
      0.007                1.763E-02
      0.010               1.3146E-02
      0.014               9.5745E-03
      0.019               6.7764E-03
      0.027               4.6782E-03
      0.038               3.1679E-03
      0.053               2.0991E-03
      0.074               1.3725E-03
      0.103                8.904E-04
      0.145               5.6432E-04
      0.203               3.5473E-04
      0.284               2.1823E-04
      0.397               1.3007E-04
      0.556               7.3883E-05
      0.778               3.9566E-05
      1.090               1.9409E-05
      1.520               8.3977E-06
      2.130               2.6648E-06



 Ground Motion   Freq. of Exceed.   Return Pd.    P.E.    Exp. Time
      (g)          (per year)        (years)       %       (years)
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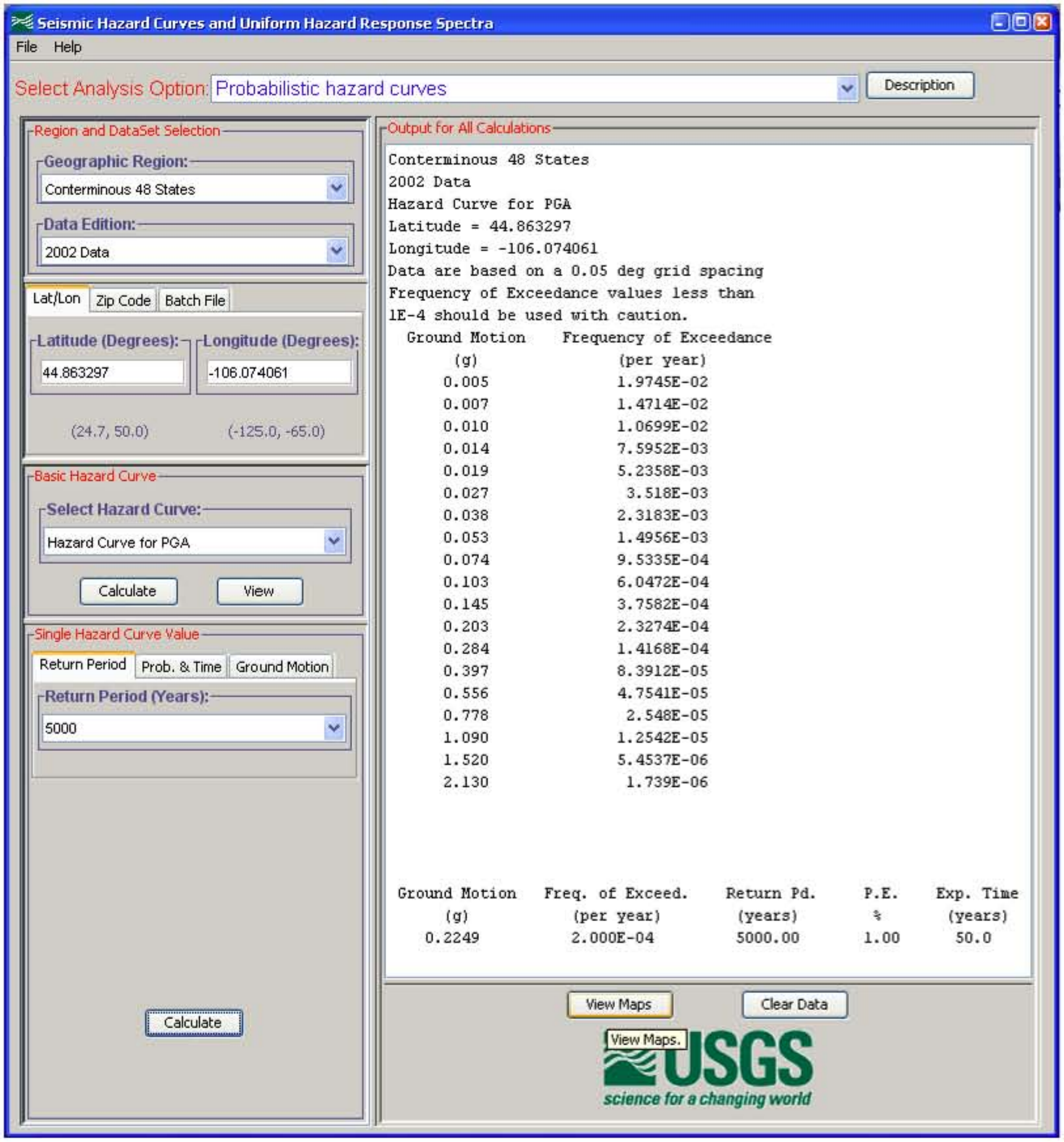
Eastern Extent of Clear Creek Basin



Select Analysis Option: Probabilistic hazard curves

Geographic Region: Conterminous 48 States

Data Edition: 2002 Data

Latitude (Degrees): 44.863297

Longitude (Degrees): -106.074061

(24.7, 50.0)

(-125.0, -65.0)

Select Hazard Curve: Hazard Curve for PGA

Return Period (Years): 5000

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Conterminous 48 States
2002 Data
Hazard Curve for PGA
Latitude = 44.863297
Longitude = -106.074061
Data are based on a 0.05 deg grid spacing
Frequency of Exceedance values less than
1E-4 should be used with caution.
  Ground Motion    Frequency of Exceedance
       (g)              (per year)
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      0.007             1.4714E-02
      0.010             1.0699E-02
      0.014             7.5952E-03
      0.019             5.2358E-03
      0.027              3.518E-03
      0.038             2.3183E-03
      0.053             1.4956E-03
      0.074             9.5335E-04
      0.103             6.0472E-04
      0.145             3.7582E-04
      0.203             2.3274E-04
      0.284             1.4168E-04
      0.397             8.3912E-05
      0.556             4.7541E-05
      0.778              2.548E-05
      1.090             1.2542E-05
      1.520             5.4537E-06
      2.130              1.739E-06

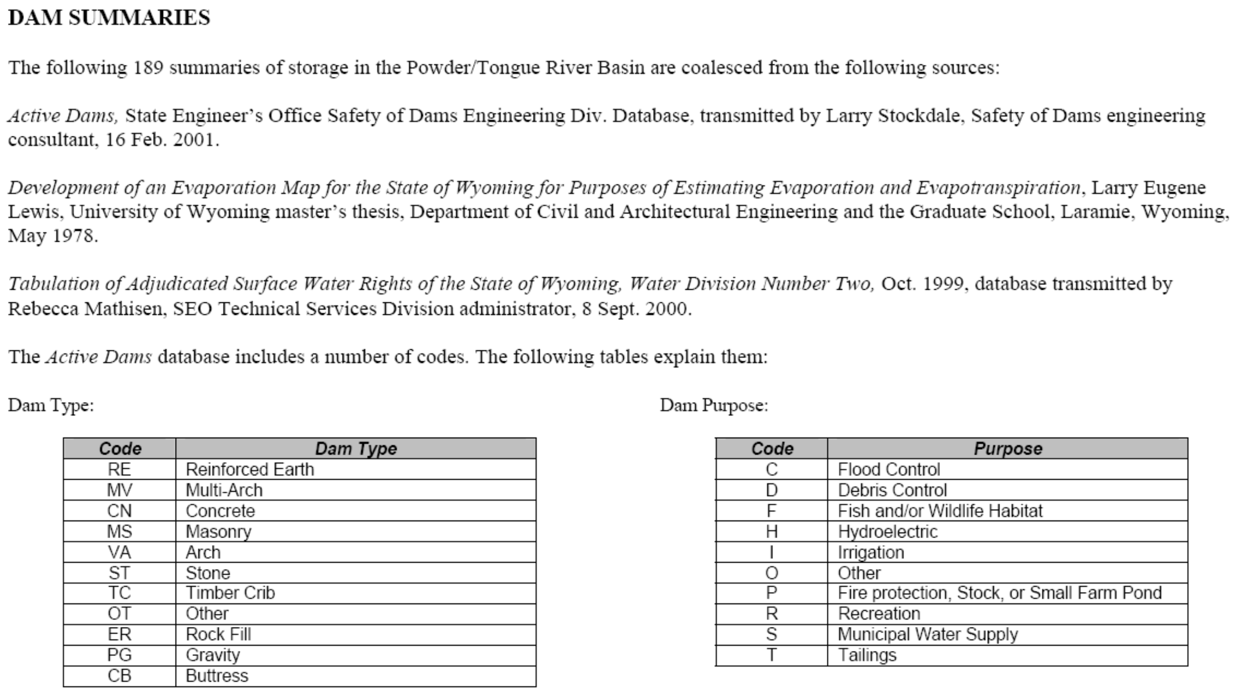


 Ground Motion   Freq. of Exceed.   Return Pd.    P.E.   Exp. Time
      (g)          (per year)        (years)       %      (years)
    0.2249         2.000E-04        5000.00      1.00      50.0
```

Appendix 3I
Water Use Descriptions

The following are excerpts from the Powder / Tongue River Basin Plan (HKM 2002). Contained in this appendix are the following:

1) A summary of the existing storage reservoirs in the Clear Creek watershed which have a capacity greater than 50 acre-feet or are more than 20 feet high,
2) A summary of municipal water uses within the Clear Creek watershed, and
3) A summary of major irrigation water uses in the Clear Creek watershed.



DAM SUMMARIES

The following 189 summaries of storage in the Powder/Tongue River Basin are coalesced from the following sources:

Active Dams, State Engineer's Office Safety of Dams Engineering Div. Database, transmitted by Larry Stockdale, Safety of Dams engineering consultant, 16 Feb. 2001.

Development of an Evaporation Map for the State of Wyoming for Purposes of Estimating Evaporation and Evapotranspiration, Larry Eugene Lewis, University of Wyoming master's thesis, Department of Civil and Architectural Engineering and the Graduate School, Laramie, Wyoming, May 1978.

Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, Oct. 1999, database transmitted by Rebecca Mathisen, SEO Technical Services Division administrator, 8 Sept. 2000.

The *Active Dams* database includes a number of codes. The following tables explain them:

Dam Type:

Code	Dam Type
RE	Reinforced Earth
MV	Multi-Arch
CN	Concrete
MS	Masonry
VA	Arch
ST	Stone
TC	Timber Crib
OT	Other
ER	Rock Fill
PG	Gravity
CB	Buttress

Dam Purpose:

Code	Purpose
C	Flood Control
D	Debris Control
F	Fish and/or Wildlife Habitat
H	Hydroelectric
I	Irrigation
O	Other
P	Fire protection, Stock, or Small Farm Pond
R	Recreation
S	Municipal Water Supply
T	Tailings

BIG BOY

Other Names:	
Tributary:	CAPLE DRAW, Tributary Double Crossing Draw

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	PF	1969	SWNE 14,T52N,R80W	44° 28' 48"N	106° 26' 30"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
33	55	30	4

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

BIG DONALDSON

Other Names:	
Tributary:	DOUBLE CROSSING DRAW, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	P	1973	NWNE 24,T53N,R80W	44° 33' 6"N	106° 26' 6"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
22	92	57	10

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
46	31.648	5.5384	6.424544	7.722112	7.089152	4.873792

CLOUD PEAK

Other Names:	
Tributary:	SOUTH FORK SOUTH PINEY CREEK, Tributary South Piney Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	I	1958	SESE 9,T51N,R85W	44° 24' 11"N	107° 4' 46"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
36	4620	3570	174

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
46	31.648	5.5384	6.424544	7.722112	7.089152	4.873792

CORRALS

Other Names:	
Tributary:	BIG CORRALS DRAW, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	I	1954	NESW 5,T54N,R78W	44° 40' 54"N	106° 16' 42"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
28	117	63	9

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
45	30.96	5.418	6.28488	7.55424	6.93504	4.76784

CULTRA

Other Names:	
Tributary:	LAKE DRAW, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	I	1914	SWNW 7,T55N,R77W	44° 45' 30"N	106° 10' 54"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
29	39	24	3

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
45	30.96	5.418	6.28488	7.55424	6.93504	4.76784

DONALDSON

Other Names:	
Tributary:	DONALDSON DRAW, Tributary Double Crossing Draw

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	P	1970	SWSW 3,T52N,R80W	44° 30' 18"N	106° 28' 12"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
27	61	31	5

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
46	31.648	5.5384	6.424544	7.722112	7.089152	4.873792

FOUR H

Other Names:	
Tributary:	FOUR DRAW OR FOUR H DRAW, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	PC	1967	SWSE 13,T52N,R81W	44° 28' 6"N	106° 32' 48"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
26	53	28	Not Available

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

FOWLER

Other Names:	
Tributary:	DOUBLE CROSSING CREEK, Tributary Double Crossing Draw

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	P	1956	NWSW 19,T53N,R79W	44° 33' 6"N	106° 25' 0"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
21	145	72	11

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
46	31.648	5.5384	6.424544	7.722112	7.089152	4.873792

FRANKOVIC

Other Names:	
Tributary:	CEDAR CREEK, Tributary North Fork Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	F	1981	SWNW 12,T50N,R84W	44° 19' 8"N	106° 55' 9"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
37	Not Available	5	1

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
46	31.648	5.5384	6.424544	7.722112	7.089152	4.873792

HEALY

Other Names:	ENL OF 7289R
Tributary:	CLEAR CREEK, Tributary Powder River

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	P	1975	NWSW 3,T51N,R81W	44° 24' 18"N	106° 36' 39"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
50	6500	5140	246

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
47	32.336	5.6588	6.564208	7.889984	7.243264	4.979744

HUSON

Other Names:	
Tributary:	ROCK CREEK, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	I	1968	NENE 22,T51N,R82W	44° 22' 48"N	106° 42' 30"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
30	59	37	4

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
47	32.336	5.6588	6.564208	7.889984	7.243264	4.979744

KARL

Other Names:	
Tributary:	WALTERS DRAW, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	P	1958	SESW 13,T52N,R81W	44° 28' 0"N	106° 32' 54"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
35	91	54	6

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

KEARNEY LAKE

Other Names:	
Tributary:	NORTH FORK SOUTH PINEY CREEK OR KEARNEY CREEK, Tributary South Piney Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	I	1963	NWNW 29,T52N,R85W	44° 27' 7.1"N	107° 6' 58"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
67	7500	6324	193

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
46	31.648	5.5384	6.424544	7.722112	7.089152	4.873792

LAKE DESMET

Other Names:	ENL OF 973R, 5829R, 6225R
Tributary:	PINEY CREEK, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	S	1975	SESW 31,T53N,R82W	44° 30' 48"N	106° 46' 30"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
80	234987	111827	2653

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

LEITER NO. 1

Other Names:	
Tributary:	LEITER DRAW OR CADIZ DRAW, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	I	1954	NENW 33,T55N,R78W	44° 42' 12"N	106° 15' 0"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
21	90	53	Not Available

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
45	30.96	5.418	6.28488	7.55424	6.93504	4.76784

LITTLE RED

Other Names:	
Tributary:	CLEAR CREEK, Tributary Powder River

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	I	1956	SENW 16,T53N,R80W	44° 34' 6"N	106° 30' 12"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
32	145	89	10

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
46	31.648	5.5384	6.424544	7.722112	7.089152	4.873792

NORWOOD

Other Names:	
Tributary:	COAL CREEK, Tributary Piney Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
Not Available	IPRO	Not Available	NESE 2,T53N,R81W	44° 35' 28"N	106° 34' 19"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
23	Not Available	32	Not Available

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

OIL WELL STOCK

Other Names:	
Tributary:	DAVIS DRAW, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	P	1969	SWSE 26,T55N,R78W	44° 42' 23"N	106° 12' 44"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
26	Not Available	82	9

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
45	30.96	5.418	6.28488	7.55424	6.93504	4.76784

PENCE

Other Names:	
Tributary:	LONE TREE GULCH OR CREEK, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	P	1954	NWSW 23,T54N,R80W	44° 38' 6"N	106° 28' 0"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
28	257	154	18

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

PHIL NO. 2

Other Names:	
Tributary:	ARCHIE DRAW, Tributary Donaldson Draw

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	P	1967	SWSW 10,T52N,R80W	44° 29' 6"N	106° 27' 54"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
27	87	48	7

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

PINHEAD

Other Names:	
Tributary:	PIN HEAD OR PINHEAD CREEK OR DRAW, Tributary Lone Tree Gulch or Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	I	1932	SESE 5,T54N,R80W	44° 40' 30"N	106° 30' 48"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
22	110	57	9

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
45	30.96	5.418	6.28488	7.55424	6.93504	4.76784

POLLARD NO. 1

Other Names:	
Tributary:	LITTLE COTTONWOOD DRAW, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	P	1966	NW 20,T55N,R78W	44° 43' 54"N	106° 16' 30"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
27	60	37	5

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
45	30.96	5.418	6.28488	7.55424	6.93504	4.76784

RATE & HUSON

Other Names:	
Tributary:	PIN HEAD OR PINHEAD CREEK OR DRAW, Tributary Lone Tree Gulch or Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	I	1910	NWSW 14,T54N,R80W	44° 38' 57"N	106° 27' 58"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
22	101	72	8

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
45	30.96	5.418	6.28488	7.55424	6.93504	4.76784

RATTLESNAKE NO. 1

Other Names:	
Tributary:	RATTLESNAKE SPRINGS DRAW, Tributary Double Crossing Draw

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	P	1969	NENW 12,T52N,R80W	44° 29' 54"N	106° 25' 48"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
30	90	56	6

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

REYNOLDS CLEAR CREEK DIVERSION

Other Names:	
Tributary:	CLEAR CREEK, Tributary Powder River

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	PIO	1977	NWSW 9,T51N,R81W	44° 24' 8"N	106° 37' 1"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
17	Not Available	285	40

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

SHELL CREEK RECREATION

Other Names:	
Tributary:	SHELL CREEK, Tributary Piney Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	PFR	1979	SESW 1,T52N,R83W	44° 30' 2"N	106° 47' 47"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
26	Not Available	762	9

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

STEVENS NO. 2

Other Names:	
Tributary:	CLEAR CREEK, Tributary Powder River AND FOUR DRAW OR FOUR H DRAW, Tributary Clear Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	I	1972	SENW 23,T52N,R81W	44° 27' 36"N	106° 34' 0"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
55	594	415	32

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

TEXACO DIVERSION DAM

Other Names: REYNOLDS PINEY CREEK

Tributary: PINEY CREEK, Tributary Clear Creek

Type	Purposes	Year Completed	Location S-T-R	Latitude	Longitude
RE	I	1969	SWSW 25,T53N,R83W	44° 31' 55"N	106° 48' 23"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
22	114	51	10

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

TIE HACK

Other Names: LITTLE SOURDOUGH ENL OF 9489R

Tributary: SOUTH FORK CLEAR CREEK, Tributary Clear Creek

Type	Purposes	Year Completed	Location S-T-R	Latitude	Longitude
CNOT	SH	1997	SESE 23,T50N,R84W	44° 16' 57"N	106° 55' 27"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
110	Not Available	2435	63

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
46	31.648	5.5384	6.424544	7.722112	7.089152	4.873792

WALTERS

Other Names:

Tributary: BOBBITT OR WAEGLE DRAW, Tributary Clear Creek

Type	Purposes	Year Completed	Location S-T-R	Latitude	Longitude
RE	P	1952	SESW 6,T51N,R80W	44° 24' 54"N	106° 31' 42"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
35	78	50	5

Lewis Evaporation Estimates (inches/acre)

Annual	May-Sept.	May	June	July	Aug.	Sept.
48	33.024	5.7792	6.703872	8.057856	7.397376	5.085696

WILLOW PARK

Other Names:	
Tributary:	SOUTH FORK SOUTH PINEY CREEK, Tributary South Piney Creek

Type	Purposes	Year Completed	Location		
			S-T-R	Latitude	Longitude
RE	IPR	1959	SENE 24,T52N,R85W	44° 27' 4"N	107° 1' 48"W

Dam Height (ft)	Max. Capacity (af)	Normal Capacity (af)	Max. Surface Area (acres)
56	6469	4457	213

Lewis Evaporation Estimates (inches/acre)						
Annual	May-Sept.	May	June	July	Aug.	Sept.
46	31.648	5.5384	6.424544	7.722112	7.089152	4.873792

KEY STORAGE FACILITIES

Reservoir: **CLOUD PEAK**

Date: 20 Feb. 2001

Note: This reservoir began as a natural lake on the main stem of South Piney Creek. It was expanded with dams and Cloud Peak has been considered and operated as part of Willow Park reservoir.

Location: SESE 9,T51N,R85W

Owner: ROCK CREEK AND PINEY RES. & DITCH CO.

Year of Construction: 1896

Enlargement History: 1933 (with a re-survey and subsequent filing in 1961), 1968

Total Storage: 4620 acre-feet

Active Storage: 3570 acre-feet

Dead Storage: Information not available. The dead storage is considerable because Cloud Peak was originally a natural mountain lake.

Area/Capacity Data: (*Source: undated table on file with State Engineer's Office, Water Div. II*)

Feet	Elevation	Area	Average Area	Volume Released	Volume Remaining
0.0	9725.0	171.11	165.86	000.00	3385.13
1.0	9724.0	171.11	165.86	165.86	3219.27
2.0	9723.0	171.11	165.86	331.72	3053.41
3.0	9722.0	171.11	165.86	497.58	2887.55
4.0	9721.0	171.11	165.86	663.44	2721.69
5.0	9720.0	160.62	165.86	829.30	2555.83
6.0	9719.0	160.62	157.14	986.44	2398.69
7.0	9718.0	160.62	157.14	1143.58	2241.55
8.0	9717.0	153.66	157.14	1300.72	2085.11
9.0	9716.0	153.66	150.17	1450.89	1934.24
10.0	9715.0	146.69	150.17	1601.06	1784.07
11.0	9714.0	146.69	150.17	1740.80	1644.33
12.0	9713.0	146.69	139.74	1880.54	1504.59
13.0	9712.0	146.69	139.74	2020.28	1364.85
14.0	9711.0	146.69	139.74	2160.02	1225.11
15.0	9710.0	132.79	139.74	2299.76	1085.37
16.0	9709.0	132.79	125.88	2425,64	959.49
17.0	9708.0	132.79	125.88	2551.52	833.61
18.0	9707.0	132.79	125.88	2677.40	707.73
19.0	9706.0	132.79	125.88	2803.28	581.85
20.0	9705.0	118.98	125.88	2929.16	455.97
21.0	9704.0	118.98	113.99	3043.15	341.98
22.0	9703.0	118.98	113.99	3157.14	227.99
23.0	9702.0	118.98	113.99	3271.13	114.00
24.0	9701.0	0	113.99	3385.13	0

Dam Construction Type: Earth Fill

End-of-Month Storage Records: No

Water Rights: *(Source:* Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, *Oct. 1999.)*

Reservoir	Permit Number	Permitted Use	Priority Date	Volume (af)	Headgate Location (S-T-R)
Cloud Peak Res.	65R	I	07-13-1896	2720	9-51-085
Enl. Cloud Peak	6223R	I	09-28-1933	677.68	9-51-085
Enl. Cloud Peak	6906R	I	09-22-1961	172.72	9-51-085

Designated Use: Irrigation

Recreational Use: Fishing

Associated Irrigation Diversions: Because of its high elevation and connection to Piney Creek irrigators through the South Fork of Piney Creek and connection with Rock and South Piney Ditch, Cloud Peak Reservoir provides water to a number of irrigators.

(Source: Carmine LoGuidice, Div. II water commissioner/hydrographer)

Diversion	Tributary
Mowry Basin (exchange water)	Rock Creek
Jim Crow	Rock Creek
Sonnesberger	Rock Creek
Fenton	Rock Creek
Hallie	Rock Creek
Fox	Rock Creek
Lilly	Rock Creek
Johnny Come Early	Rock Creek
Lake DeSmet	Rock Creek
Last Chance	Rock Creek
Rounder	Rock Creek
Tay	Rock Creek
Ono	Rock Creek
Rock Crk. & Piney Ditch Canal Co.	Piney Creek
Piney Divide	Piney Creek
Mueller & Leitner	Piney Creek
Six Mile (exchange water)	Clear Creek

Operational Discussion: Cloud Peak Reservoir has been considered a unit with Willow Park Reservoir downstream. In the past, operators have been able to store water higher than the top of the dam, thanks to snow drifting across the spillway and ice buildup on the dam. As a result, operators tend to empty the reservoir's active capacity into Willow Park toward the end of the season to avoid carrying water into the next year. Water commissioners point out that operators prefer to drain the reservoir for winter as much as possible (to avoid buildup and possible overtopping) or not drain it at all (to store more water than is apparently possible).

First release timing, Cloud Peak Reservoir

Wet Year	Average Year	Dry Year
2nd week of July	4th week of June	2nd week of June

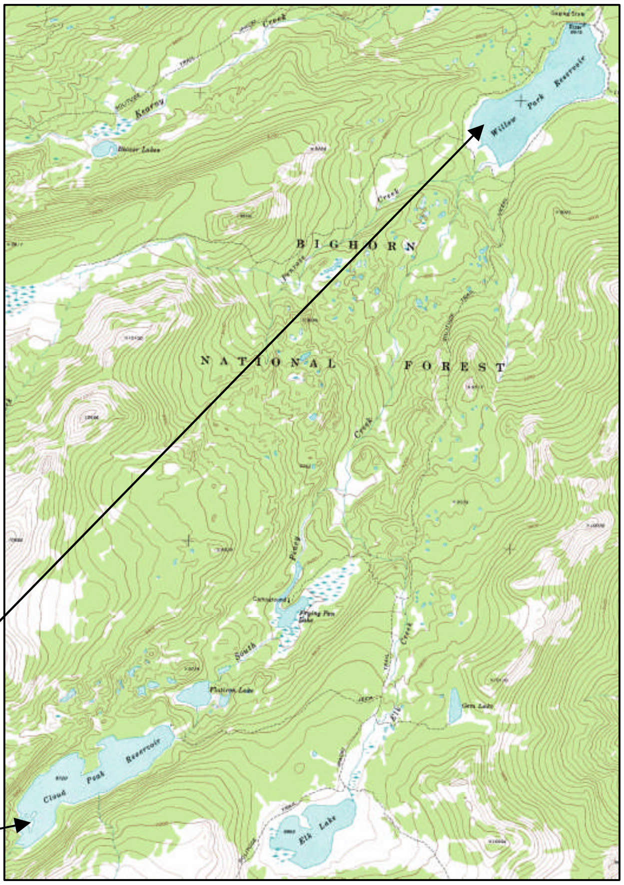
Operators end irrigation releases from the dam on Oct. 1 (the end of the water year). Through an agreement with the U.S. Forest Service, operators release approx. 5 cfs for winter flows.

References:

Carmine LoGuidice, water commissioner, interview, State Engineer’s Office, Sheridan, Wyoming, 13 Feb. 2001

Active Dams, State Engineer’s Office Safety of Dams Engineering Div. Database, transmitted by Larry Stockdale, Safety of Dams engineering consultant, 16 Feb. 2001.

Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, Oct. 1999, database transmitted by Rebecca Mathisen, SEO Technical Services Division administrator, 8 Sept. 2000.



Net Evaporation from Cloud Peak Reservoir:

Lewis Annual Evaporation (in.)	46
Total Storage (acre-feet)	4,620

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average percent of total storage	56.72	57.55	57.87	60.80	71.16	72.71	68.17	64.03	57.62	57.03	58.79	60.84
Generated storage (acre-feet)	2621	2659	2674	2809	3288	3359	3149	2958	2662	2635	2716	2811
Corresponding area (acres)	165.86	165.86	165.86	165.86	165.86	165.86	165.86	165.86	165.86	165.86	165.86	165.86

Calculations:

Monthly Lewis Evap. (inches)	1.242	1.15	1.794	3.68	5.29	6.026	7.866	7.176	5.29	3.496	1.794	1.196	
Monthly Precipitation (inches)	2.25	2.25	3.25	3.75	4.25	3.25	1.75	1.25	2.25	2.25	2.25	1.75	
Net Evaporation (inches)	0	0	0	0	1.04	2.776	6.116	5.926	3.04	1.246	0	0	***TOTAL***
Net Evaporation (acre-feet)	0	0	0	0	14	38	85	82	42	17	0	0	***278***

KEY STORAGE FACILITIES

Reservoir: **HEALY RESERVOIR** (or ENL OF 7289R)

Date: 27 Feb.2001

Location: NWSW 3,T51N,R81W

Owner: Lake DeSmet Energy Co.

Healy Reservoir diversion dam

Year of Construction: 1975

Total Storage: 6500 acre-feet

Active Storage: 5140 acre-feet

Area/Capacity Data: *(Source: Undated table on file with State Engineer's Office, Water Div. II)*

Healy Reservoir dam

Elev. (ft)	Area (acres	Capacity (af)									
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
4361	68	406	413	420	427	434	441	448	455	462	470
4362	75	477	485	492	500	58	515	523	531	539	547
4363	82	555	563	571	580	588	596	605	613	622	630
4364	89	639	648	657	666	675	684	693	702	711	720
4365	96	730	740	749	759	769	779	789	799	809	819
4366	102	829	840	850	860	871	881	892	903	913	924
4367	109	935	946	957	968	979	990	1002	1013	1024	1036
4368	115	1047	1059	1070	1082	1094	1106	1118	1130	1142	1154
4369	122	1166	1178	1190	1203	1215	1228	1240	1253	1265	1278
4370	128	1291	13043	1317	1330	1343	1356	1369	1382	1396	1409
4371	135	1423	1436	1450	1463	1477	1491	1505	1519	1533	1547
4372	141	1561	1575	1589	1603	1618	1632	1647	1661	1676	1691
4373	148	1705	1720	1735	1750	1765	1780	1795	1810	1826	1841
4374	154	1856	1872	1887	1903	1919	1934	1950	1966	1982	1998
4375	161	2014	2030	2046	2063	2079	2095	2112	2128	2145	2161
4376	167	2178	2195	2212	2229	2245	2262	2280	2297	2314	2331
4377	174	2349	2366	2383	2401	2419	2436	2454	2472	2490	2508
4378	180	2526	2544	2562	2580	2598	2616	2635	2653	2672	2690
4379	187	2709	2728	2747	2765	2784	2803	2822	2841	2860	2880
4380	193	2899	2918	2938	2957	2977	2996	3016	3036	3056	3076
4381	200	3095	3115	3136	3156	3176	3196	3216	3237	2357	3278
4382	206	3298	3319	3340	3360	3381	3402	3423	3444	3465	3487
4383	213	3508	3529	3550	3572	2593	3615	3637	3658	3680	3702
4384	219	3724	3746	3768	3790	3812	3834	3856	3879	3901	3923
4385	226	3946	3969	3991	4014	4037	4060	4083	4106	4129	4152
4386	232	4175	4198	4221	4245	4268	4292	4315	4339	4363	4386
4387	239	4410	4434	4458	4482	4506	4530	4554	4579	4603	4627
4388	245	4652	4676	4701	4726	4750	4775	4800	4825	4850	4875
4389	252	4900	4925	4951	4976	5001	5027	5052	5078	5104	5129
4390	258	5155									

Dam Construction Type: Earth Fill

Outlet: Healy Reservoir has no gravity-fed outlet. It uses several electric pumps to lift water through a pipeline with a capacity of 200 cfs to Lake DeSmet and another, smaller pipeline with a capacity of 30 cfs to Clear Creek.

End-of-Month Storage Records: Yes

Water Rights: *(Source:* Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, *Oct. 1999.)*

Reservoir	Permit Number	Permitted Use	Priority Date	Volume (af)	Headgate Location (S-T-R)
Healy Res	7289R	D,I,Ind	04-15-1957	41,974	9-51-081
First Enl. Healy Res.	7290R	D,I,Ind	10-14-1957	13,725	31-53-083

Note: As much as 36,824 af of permit 7289R is appropriated for Lake DeSmet; 5,140 af remain in Healy. Another 2,190 af from permit 7290R are reserved for the use of irrigators downstream of the reservoir on Clear Creek. The remainder of the second permit, 11,545 af, has been transferred to Lake DeSmet.

Designated Use: Industrial use, stock watering, and irrigation

Recreational Use: Fishing

Associated Irrigation Diversions: *(Source: Carmine LoGuidice, Div. II water commissioner/hydrographer)*

Diversion	Tributary
Hillyer & Onslow	Clear Creek
Frank G. Hopkins	Clear Creek
L.X.	Clear Creek
DesMoines	Clear Creek
Watt	Clear Creek
Big Bonanza	Clear Creek

Associated Industrial Diversions: Though DeSmet (through Healy rights) stores water for industrial use, none of it is being appropriated.

Operational Discussion: Healy was constructed as a feeder reservoir for Lake DeSmet, a way of diverting Clear Creek water into DeSmet to supplement the Piney Creek water in anticipation of industrial consumption. As of Feb. 2001, DeSmet has been turned over to three county governments (Sheridan, Johnson, and Campbell).

Healy’s off-channel status on Clear Creek means storage is accomplished by raising the head (closing headgates) in Healy Diversion Dam. Similarly, downstream releases are accomplished by lowering the head at the dam to release flows through the intake pipe. Much of the reservoir’s storage lies lower than the level of the intake/outlet pipe. As a result, operators must pump to release water below the level of the pipe.

Lack of demand for Healy’s water and the cost of pumping has kept the owners from exercising their pumps more than rarely to satisfy obligations in Lake DeSmet and to downstream Clear Creek users.

Releases to irrigators are based on their requests.

The Clear Creek Diversion Dam (adjoining Healy Reservoir) is also required to allow at least 10 cfs to pass down Clear Creek from Oct. 15 – April 15.

References:

Carmine Loguidice, water commissioner, State Engineer's Office Water Div. 2, 20 Feb. 2001.

Healy Area-Capacity Table, from permit application, State Engineer's Office.

Active Dams, State Engineer's Office Safety of Dams Engineering Div. Database, transmitted by Larry Stockdale, Safety of Dams engineering consultant, 16 Feb. 2001.

Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, Oct. 1999, database transmitted by Rebecca Mathisen, SEO Technical Services Division administrator, 8 Sept. 2000.

Net Evaporative Loss from Healy Reservoir:

Healy Reservoir End-of-Month Elevations of Water Surface

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970												
1971												
1972												
1973												
1974												
1975												
1976												
1977												
1978												
1979												
1980	4384.7	4384.45	4384.35	4385.8	4385.4	4387	4386.45	4384.25	4383	4384.2	4385.6	4380.8
1981	4375.9	4370.9	4371	4372.6	4370.25	4379.1	4382.6	4381.65	4378.6	4385.9	4382.1	4380.35
1982	4375.3	4372.45	4378.8	4379.75	4385.3	4386	4385.5	4381.5	4380.3	4380.1	4380	4379.85
1983	4379.8	4379.7	4379.7	4379.65	4379.65	4384.1	4384.9	4384.75	4382.4	4382.1	4381.9	4381.7
1984		4381.5	4381.45	4381.35	4381	4376.6	4374	4368.2	4364.8	4367.85	4379.8	4383
1985	4384.35	4385.4	4385.9	4385.6	4385.7	4386	4385.7	4380.4	4376.4	4377.8	4378.35	4378.3
1986	4378.2	4378.2	4378.1	4378.05	4386.15	4386.65	4386.85	4386.05	4385.6	4384.55	4384.5	4384.45
1987	4384.35	4384.25	4384.25	4384.05	4384.85	4385.15	4380.5	4375.1	4370.3	4369.9	4370.9	4374.55
1988	4378	4379	4380.35	4384.55	4387	4386.65	4387.25	4386.15	4384.65	4384.2	4384	
1989		4383.8	4383.75	4383.35	4383.25	4383.75	4387.4	4385	4383.35	4383.45	4383.15	4383
1990	4382.7	4382.6	4382.55		4385.35		4385.2	4381.2	4376.3	4375.18		
1991	4380.1	4379.96	4380.1	4380.72	4384.6	4386.53		4387.19	4386.13	4385.17	4384.82	4384.7
1992				4384.41	4384.65	4386.14	4386.28	4386.08	4385.95			4385.15
1993	4384.95		4385.39	4385.47		4383.5	4378.5		4375.1	4380.95		4381.8
1994	4381.7		4381.6			4386.65		4386.3	4381.5		4381.25	
1995												
1996												
1997												
1998												
1999												
Historical Ave. Elevation	4380.84	4380.18	4381.24	4381.95	4383.32	4384.56	4383.93	4382.42	4379.63	4380.10	4381.36	4381.47
Corresponding Area (acres)	193	193	200	200	213	219	213	206	187	193	200	200

Calculations:

Monthly Lewis Evap. (inches)	1.296	1.2	1.872	3.84	5.52	6.288	8.208	7.488	5.52	3.648	1.872	1.248	
Monthly Precipitation (inches)	0.75	0.75	0.75	1.75	2.75	2.25	1.25	0.75	1.75	1.25	0.75	0.75	
Net Evaporation (inches)	0.546	0.45	1.122	2.09	2.77	4.038	6.958	6.738	3.77	2.398	1.122	0.498	***TOTAL***
Total Net Evaporation (acre-feet)	9	7	19	35	49	74	124	116	59	39	19	8	***556***

KEY STORAGE FACILITIES

Reservoir: **KEARNEY LAKE**

Date: 27 Feb. 2001

Location: NWNW 29,T52N,R85W

Owner: KEARNEY LAKE LAND & RES. CO.-JIM WAGNER

Year of Construction: 1928

Total Storage: 7,500 acre-feet

Active Storage: 6,324 acre-feet

Dead Storage: Not available

Area/Capacity Data: *(Source: Undated table on file with State Engineer's Office, Water Div. II)*

Feet	Elevation	Area	Average Area	Volume Released	Volume Remaining
0.0	9194.0	176.8	173.6	000.00	6130.55
1.0	9193.0	176.8	173.6	173.60	5956.95
2.0	9192.0	176.8	173.6	347.20	5783.35
3.0	9191.0	176.8	173.6	520.80	5609.75
4.0	9190.0	170.4	173.6	694.40	5436.15
5.0	9189.0	170.4	166.35	868.00	5262.55
6.0	9188.0	170.4	166.35	1034.35	5096.20
7.0	9187.0	170.4	166.35	1200.70	9429.85
8.0	9186.0	170.4	166.35	1367.05	4763.50
9.0	9185.0	162.3	158.30	1533 40	4597.15
10.0	9184.0	162.3	158.30	1691.70	4438.85
11.0	9183.0	162.3	158.30	1850.00	4280.55
12.0	9182.0	162.3	158.30	2008.30	4112.25
13.0	9181.0	162.3	158.30	2166.60	3936.95
14.0	9180.0	154.3	149.25	2324.90	3805.65
15.0	9179.0	154.3	149.25	2474.15	3656.40
16.0	9178.0	154.3	149.25	2623.40	3507.15
17.0	9177.0	154.3	149.25	2772.65	3357.90
18.0	9176.0	154.3	149.25	2921.90	3208.65
19.0	9175.0	144.2	139.60	3071.15	3059.40
20.0	9174.0	144.2	139.60	3210.75	2919.80
21.0	9173.0	144.2	139.60	3350.35	2780.20
22.0	9172.0	144.2	139.60	3489.95	2640.60
23.0	9171.0	144.2	139.60	3629.55	2501.00
24.0	9170.0	135.0	128.65	3769.15	2361.40
25.0	9169.0	135.0	128.65	3897.80	2232.75
26.0	9168.0	135.0	128.65	4026.45	2104.10
27.0	9167,0	135.0	128.65	4155.10	1975.45
28.0	9166.0	122.3	113.95	4283.75	1846.80
29.0	5165.0	122.3	113.95	4397.50	1733.05
30.0	9164.0	111.8	113.95	4511.45	1690.10
31.0	9163.0	111.8	105.30	4625.40	1505.10

Area/Capacity Table cont'd:

Feet	Elevation	Area	Average Area	Volume Released	Volume Remaining
32.0	9162.0	111.8	105.30	4730.70	1399.80
33.0	9161.0	111.8	105.30	4836.00	1294.50
34.0	9160.0	111.8	105.30	4941.30	1189.20
35.0	9159.5	98.8	94.35	5046.60	1084.90
36.0	9158.0	98.8	94.35	5140.95	989.60
37.0	9157.0	98.8	94.35	5235.30	895.24
38.0	9156.0	98.8	94.35	5329.65	800.90
39.0	9155.0	98.8	94.35	5424.00	706.55
40.0	9154.5	89.9	82.75	5518.35	612.20
41.0	9153.0	89.9	82.75	5601.10	529.45
42.0	9152.0	89.9	82.75	5683.85	446.70
43.0	9151.0	89.9	82.75	5766.60	363.95
44.0	9150.0	89.9	82.75	5849.35	281.20
45.0	9149.5	76.6	70.40	5932.10	198.45
46.0	9148.0	76.6	70.40	6002.50	128.05
47.0	9147.0	76.6	27.80	6072.90	57.65
48.0	9146.5	65.2	27.80	6100.70	29.85
49.0	9145.0	23.5	27.80	6128.50	2.05

Note: The *Safety of Dams Database* active storage volume (6,342 acre-feet) does not correlate with published area-capacity table maximum (6,130.55 acre-feet). The State Engineer's Office uses the area-capacity table number.

Dam Construction Type: Earth Fill

End-of-Month Storage Records: No

Water Rights: *(Source:* Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, *Oct. 1999.)*

Reservoir	Permit Number	Permitted Use	Priority Date	Volume (af)	Headgate Location (S-T-R)
Kearney Lake Res.	962R	D,I,S	11-22-1906	1854.05	30-52-085
Enl. Kearney Lake	6555R	I	07-14-1950	4276.5	29-52-085
Enl. Kearney Lake	6826R	I	12-31-1964	193.79	29-52-085

Designated Use: Irrigation

Recreational Use: Fishing and boating

Associated Irrigation Diversions: *(Source: Carmine LoGuidice, Div. II water commissioner/hydrographer)*

Diversion	Tributary
Mead & Coffeen (Crossover & 1°)	Piney Creek
Piney & Cruse (Crossover & 1°)	Piney Creek
Mueller	Piney Creek
Prairie Dog (Crossover & 1°)	Piney Creek
Sturdevant	Piney Creek

Associated Industrial Diversions: None

Operational Discussion: Kearney Lake is one of the high-elevation reservoirs that have been built on old lakebeds in the Piney Creek drainage. At 9,200 feet, Kearney Lake closes earlier than many of the other lakes, usually on Sept. 15. It begins releases with the following timing:

First release timing, Kearney Lake Reservoir

Wet Year	Average Year	Dry Year
2nd week of July	4th week of June	2nd week of June

References:

Carmine Loguidice, State Engineer's Office Water Div. 2 water commissioner, interview, 20 Feb. 2001.

Active Dams, State Engineer's Office Safety of Dams Engineering Div. Database, transmitted by Larry Stockdale, Safety of Dams engineering consultant, 16 Feb. 2001.

Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, Oct. 1999, database transmitted by Rebecca Mathisen, SEO Technical Services Division administrator, 8 Sept. 2000.

Net Evaporative Loss from Kearney Reservoir:

Lewis Annual Evaporation (in.)	46
Total Storage (acre-feet)	7,500

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average percent of total storage	56.72	57.55	57.87	60.80	71.16	72.71	68.17	64.03	57.62	57.03	58.79	60.84
Generated storage (acre-feet)	4254	4316	4340	4560	5337	5453	5113	4802	4321	4277	4410	4563
Corresponding area (acres)	158.3	158.3	158.3	158.3	166.35	173.6	166.35	166.35	158.3	158.3	158.3	158.3

Calculations:

Monthly Lewis Evap. (inches)	1.242	1.15	1.794	3.68	5.29	6.026	7.866	7.176	5.29	3.496	1.794	1.196	
Monthly Precipitation (inches)	1.75	1.75	2.75	3.25	3.75	3.25	1.75	1.25	2.25	2.25	2.25	1.75	
Net Evaporation (inches)	0	0	0	0.43	1.54	2.776	6.116	5.926	3.04	1.246	0	0	***TOTAL***
Total Net Evaporation (acre-feet)	0	0	0	6	21	40	85	82	40	16	0	0	***291***

KEY STORAGE FACILITIES

Reservoir:	**LAKE DESMET** (or ENL OF 973R, 5829R, 6225R)
Date:	28 Feb. 2001
Location:	SESW 31,T53N,R82W
Owner:	Tri-County Coalition (Sheridan, Johnson, and Campbell counties)
Year of Construction:	1921
Enlargement History:	Lake DeSmet began as two separate natural lakes fed by Shell Creek and runoff. Water rights were first granted in 1907 to divert water from Piney Creek. By 1919, an inlet and dam expanded the 1,500-acre lake to 2,106 acres by raising its level 22 feet. Reynolds Mining Co. expanded the lake by 32 feet in 1958, then seven more feet in 1972. Finally, Texaco raised the level by 40 feet to its present-day maximum capacity.
Total Storage:	234,987 acre-feet
Active Storage:	196,027 acre-feet
Inactive Storage:	38,960 acre-feet
Area/Capacity Data:	(*Source: Undated table by Tipton & Kalmbach for Texaco, Inc. on file with State Engineer's Office, Water Div. II)*

Elev. (ft)	Area (acres)	Capacity (af)	Intermediate Capacity for 0.1 ft. Intervals (af)								
			.1	.2	.3	.4	.5	.6	.7	.8	.9
4500	2	0	2	3	5	6	8	10	11	13	14
4501	30	16	20	25	30	34	39	43	48	52	57
4502	59	61	68	76	83	90	98	105	112	119	128
4503	87	134	144	154	164	174	185	195	205	215	225
4504	116	235	248	261	274	287	300	313	326	339	352
4505	144	365	382	399	417	434	451	468	485	503	520
4506	200	537	560	583	605	628	651	674	697	719	742
4507	256	765	793	822	850	879	907	935	964	992	1,021
4508	312	1,049	1,083	1,117	1,151	1,185	1,219	1,253	1,287	1,321	1,355
4509	368	1,389	1,429	1,468	1,508	1,547	1,587	1,627	1,666	1,706	1,745
4510	424	1,785	1,829	1,874	1,918	1,962	2,007	2,051	2,096	2,140	2,185
4511	464	2,229	2,278	2,326	2,375	2,423	2,472	2,520	2,569	2,617	2,666
4512	505	2,714	2,767	2,819	2,872	2,924	2,977	3,029	3,082	3,134	3,187
4513	545	3,239	3,296	3,352	3,409	3,465	3,522	3,579	3,635	3,692	3,748
4514	585	3,805	3,866	3,926	3,987	4,047	4,108	4,168	4,229	4,289	4,350
4515	625	4,410	4,475	4,540	4,604	4,669	4,734	4,799	4,964	4,928	4,993
4516	673	5,058	5,128	5,197	5,267	5,337	5,407	5,476	5,546	5,516	5,685
4517	721	5,755	5,829	5,904	5,978	6,053	6,127	6,201	6,276	6,350	6,425
4518	768	6,499	6,578	6,657	6,736	6,815	6,894	6,974	7,053	7,132	7,211
4519	816	7,290	7,374	7,458	7,542	7,626	7,710	7,794	7,878	7,962	8,046
4520	864	8,130	8,218	8,306	8,393	8,481	8,569	8,657	8,745	8,832	8,920
4521	890	9,008	9,093	9,189	9,279	9,369	9,460	9,550	9,640	9,730	9,821
4522	916	9,911	10,004	10,097	10,190	10,283	10,376	10,469	10,562	10,655	10,748
4523	943	10,841	10,937	11,032	11,128	11,224	11,320	11,415	11,511	11,607	11,702
4524	969	11,798	11,895	11,994	12,093	12,191	12,289	12,387	12,485	12,584	12,682

Area/Capacity table cont'd:

Elev. (ft)	Area (acres)	Capacity (af)	Intermediate Capacity for 0.1 ft. Intervals (af)								
			.1	.2	.3	.4	.5	.6	.7	.8	.9
4525	995	12,780	12,881	12,981	13,082	13,183	13,284	13,384	13,485	13,586	13,686
4526	1018	13,787	13,890	13,993	14,096	14,199	14,302	14,405	14,508	14,611	14,714
4527	1041	14,817	14,922	15,028	15,133	15,238	15,344	15,449	15,554	15,459	15,765
4529	1087	16,946	17,056	17,166	17,276	17,386	17,496	17,605	17,715	17,925	17,935
4530	1110	18,045	18,157	18,270	18,382	18,494	18,607	18,715	18,831	18,943	19,056
4531	1136	19,168	19,283	19,398	19,513	19,628	19,743	19,857	19,972	20,087	20,202
4532	1163	20,317	20,435	20,552	20,670	20,787	20,905	21,023	21,140	21,258	21,375
4533	1189	21,493	21,613	21,734	21,854	21,974	22,095	22,215	22,335	22,455	22,576
4534	1216	22,696	22,819	22,942	23,065	23,188	23,311	23,433	23,556	23,679	23,802
4535	1242	23,925	24,052	24,178	24,305	24,432	24,559	24,685	24,812	24,939	25,065
4536	1291	25,192	25,324	25,455	25,587	25,718	25,850	25,982	26,113	26,245	26,376
4537	1340	26,508	26,645	26,781	26,918	27,054	27,191	27,327	27,464	27,600	27,737
4538	1389	27,873	28,014	28,156	28,297	28,439	28,580	28,721	28,863	29,004	29,146
4539	1438	29,287	29,433	29,580	29,726	29,872	30,019	30,165	30,311	30,457	30,604
4540	1487	30,750	30,900	31,050	31,200	31,350	31,500	31,649	31,799	31,949	32,099
4541	1511	32,249	32,401	32,554	32,706	32,858	33,011	23,163	33,315	33,467	33,620
4542	1534	33,772	33,927	34,081	34,236	34,390	34,545	34,700	34,854	35,009	35,163
4543	1558	35,318	35,475	35,632	35,789	35,946	36,103	36,260	36,417	36,574	36,731
4544	1581	36,885	37,047	37,207	37,366	37,525	37,685	37,844	38,803	38,162	38,322
4545	1605	38,481	38,641	38,801	38,960	39,123	39,285	39,448	39,610	39,773	39,936
4546	1629	40,098	40,262	40,426	40,590	40,754	40,908	41,082	41,246	41,410	41,574
4547	1652	41,738	41,904	42,071	42,237	42,404	42,570	42,736	42,903	43,069	43,236
4548	1676	43,402	43,571	43,739	43,908	44,077	44,246	44,414	44,583	44,752	44,920
4549	1699	45,089	45,260	45,431	45,602	45,773	45,944	46,115	46,286	46,457	46,628
4550	1723	46,799	46,973	47,945	47,320	47,493	47,657	47,841	48,014	48,188	48,361
4551	1748	48,535	48,711	48,987	49,063	49,239	49,415	49,592	49,768	49,944	50,120
4552	1773	50,296	50,475	50,653	50,832	51,010	51,189	51,367	51,546	51,724	51,903
4553	1797	52,081	52,262	52,443	52,624	52,805	52,986	53,166	53,347	53,528	53,709
4554	1822	53,890	54,073	54,257	54,440	54,624	54,807	54,990	55,174	55,357	55,541
4555	1847	55,724	55,910	56,395	56,283	56,469	56,655	56,941	57,027	57,214	57,400
4556	1877	57,586	57,775	57,964	58,154	58,343	58,532	58,721	58,910	59,100	59,289
4557	1906	59,478	59,670	59,862	60,054	60,246	60,438	60,630	60,622	61,014	61,206
4558	1936	61,398	61,593	61,788	61,984	62,179	62,374	62,569	62,764	62,960	63,155
4559	1966	63,350	63,545	63,740	63,937	64,136	64,335	64,534	64,734	64,933	65,132
4560	2000	65,337	65,533	65,784	65,936	66,138	66,340	66,541	66,743	66,945	67,146
4561	2035	67,348	67,553	67,759	67,964	68,169	68,375	68,580	68,785	68,990	69,198
4562	2071	69,401	69,610	69,819	70,027	70,236	70,445	70,654	70,863	71,071	71,280
4563	2106	71,489	71,701	71,914	72,126	72,339	72,551	72,763	72,976	73,188	73,401
4564	2142	73,613	73,829	74,045	74,261	74,477	74,693	74,908	75,124	75,340	75,556
4565	2177	75,772	75,991	76,210	76,429	76,648	76,867	77,086	77,305	77,524	77,743
4566	2202	77,962	78,184	78,405	78,627	78,848	79,070	79,291	79,513	79,734	79,956
4567	2227	80,177	80,401	80,625	80,849	81,073	81,217	81,521	81,745	81,969	82,193
4568	2252	82,417	82,644	82,870	83,097	83,323	83,550	83,776	84,003	84,229	84,456
4569	2277	84,682	84,911	85,140	85,369	85,598	85,827	86,056	86,285	86,514	86,743
4570	2302	86,972	87,204	87,436	87,668	87,900	88,132	88,364	88,596	88,828	89,060
4571	2339	89,292	89,528	89,763	89,999	90,234	90,471	90,706	90,942	91,178	91,413
4572	2376	91,649	91,888	92,128	92,367	92,607	92,846	93,085	93,325	93,564	93,804
4573	2412	94,043	94,286	94,530	94,773	95,016	95,260	95,503	95,746	95,989	96,233
4574	2455	96,476	96,723	96,971	97,219	97,466	97,714	97,962	98,209	98,457	98,704
4575	2498	98,953	99,203	99,459	99,706	99,957	100,209	100,460	100,711	100,962	101,214
4576	2529	101,465	101,719	101,974	102,228	102,483	102,757	102,991	103,246	103,500	103,755
4577	2560	104,009	104,267	104,524	104,782	105,039	105,297	105,554	105,812	106,069	106,327

Area/Capacity table cont'd:

Elev. (ft)	Area (acres)	Capacity (af)	Intermediate Capacity for 0.1 ft. Intervals (af)								
			.1	.2	.3	.4	.5	.6	.7	.8	.9
4578	2591	106,584	106,845	107,105	107,366	107,626	107,887	108,148	108,408	108,669	108,929
4579	2622	109,190	109,454	109,717	109,981	110,245	110,509	110,772	111,036	111,300	111,563
4580	2653	111,827	112,094	112,361	112,628	112,895	113,162	113,428	113,695	113,962	114,229
4581	2680	114,494	114,763	115,033	115,302	115,571	115,840	116,110	116,379	116,648	116,918
4582	2707	117,187	117,456	117,726	117,994	118,264	118,533	118,803	119,072	119,341	119,611
4583	2735	119,908	120,183	120,458	120,732	121,007	121,282	121,557	121,832	122,106	122,381
4584	2762	122,656	122,934	123,211	123,489	123,766	124,044	124,322	124,599	124,877	125,154
4585	2789	125,432	125,712	125,992	126,272	126,552	126,832	127,113	127,393	127,673	127,953
4586	2813	128,233	128,515	128,798	129,080	129,363	129,645	129,928	130,210	130,493	130,775
4587	2838	131,058	131,343	131,628	131,913	132,198	132,483	132,768	133,053	133,338	133,623
4588	2862	133,908	134,195	134,483	134,770	135,058	135,345	135,633	135,920	136,208	136,495
4589	2887	136,783	137,073	137,363	137,653	137,943	138,232	138,522	138,812	139,102	139,392
4590	2911	139,682	139,974	140,266	140,558	140,850	141,142	141,435	141,727	142,019	142,311
4591	2931	142,603	142,897	143,191	143,485	143,779	144,073	144,367	144,662	144,956	145,250
4592	2952	145,544	145,840	146,136	146,433	146,729	147,025	147,321	147,617	147,914	148,210
4593	2972	148,506	148,804	149,103	149,401	149,699	149,997	150,296	150,594	150,892	151,191
4594	2993	151,489	151,789	152,090	152,390	152,690	152,990	153,291	153,591	153,891	154,192
4595	3013	154,492	154,794	155,097	155,399	155,701	156,003	156,306	156,608	156,910	157,213
4596	3033	157,515	157,819	158,123	158,428	158,732	159,036	159,340	159,644	159,949	160,253
4597	3052	160,557	160,863	161,170	161,476	161,782	161,088	162,395	162,701	163,007	163,314
4598	3072	163,620	163,928	164,236	164,544	164,852	165,160	165,469	165,777	166,085	166,393
4599	3091	166,701	167,011	167,321	167,631	167,941	168,251	168,562	168,872	169,182	169,492
4600	3111	169,802	170,114	170,426	170,738	171,050	171,361	171,673	171,985	172,297	172,609
4601	3127	172,921	173,234	173,548	173,861	174,175	174,488	174,801	175,115	175,428	175,742
4602	3142	176,055	176,370	176,685	177,000	177,315	177,630	177,945	178,260	178,575	178,890
4603	3158	179,205	179,522	179,838	180,155	180,471	180,788	181,105	181,421	181,738	182,054
4604	3173	182,371	182,689	183,007	183,325	183,643	183,961	184,280	184,598	184,916	185,234
4605	3189	185,552	185,572	186,191	186,511	186,830	187,150	187,470	187,789	188,109	188,428
4606	3204	188,748	189,062	189,390	189,712	190,033	190,354	190,675	190,996	191,318	191,639
4607	3219	191,960	192,283	192,605	192,928	193,251	193,573	193,896	194,219	194,542	194,864
4608	3235	195,187	195,511	195,835	196,160	196,484	196,808	197,132	197,456	197,781	198,105
4609	3250	198,429	198,755	199,081	199,406	199,732	200,058	200,384	200,710	201,035	201,361
4610	3265	201,687	202,014	202,341	202,668	202,995	203,322	203,650	203,977	204,304	204,631
4611	3278	204,958	205,286	205,615	205,943	206,672	206,600	206,929	207,257	207,586	207,914
4612	3291	208,243	208,573	208,902	209,232	209,562	209,891	210,221	210,551	210,881	211,210
4613	3303	211,540	211,871	212,202	212,533	212,864	213,194	213,525	213,856	214,187	214,518
4614	3316	214,849	215,181	215,514	215,840	216,178	216,510	216,843	217,175	217,507	217,840
4615	3329	218,172	218,506	218,839	219,173	219,506	219,840	220,174	220,507	220,841	221,174
4616	3343	221,508	221,843	222,178	222,513	222,848	223,182	223,517	223,852	224,187	224,522
4617	3356	224,857	225,193	225,530	225,866	226,202	226,539	226,875	227,211	227,547	227,884
4618	3370	228,220	228,558	228,895	229,233	229,571	229,908	230,246	230,584	230,922	231,259
4619	3383	231,597	231,936	232,275	232,614	232,953	233,292	233,631	233,970	234,309	234,648
4620	3397	234,987									

Dam Construction Type:	Earth Fill
Outlet:	North Dam: Single, 48-inch pipe controlled with two 36-inch butterfly valves and slide gates. South Dike: Single, 54-inch diameter outlet.

Spillway:

Service spillway: 16-foot-diameter “morning glory” spill, 10-foot drop pipe, and 6.5-foot outlet pipe

The auxiliary spillway channel is 220 feet wide, opening at a 1:1 slope to release to Piney Creek.

Flow Measurement:

Because Lake DeSmet stores water from two major drainages, flow measurement is critical to understanding how rights are stored and distributed there. Flow measurement devices are positioned on:

- the tunnel from Piney Creek
- north outlet
- pipeline from Healy Reservoir
- Healy outlet/inlet
- Shell Creek

End-of-Month Storage Records: Yes

Water Rights:

(Source: Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, *Oct. 1999 and Tipton and Kalmbach Inc.’s* Level I Reconnaissance Study of Supplemental Municipal Water Supply for the City of Buffalo, Wyoming, Part I – Report, *Nov. 1984.)*

Reservoir	Permit Number	Permitted Use	Priority Date	Volume (af)	Headgate Location (S-T-R)
Cloud Peak	65R	I	07-13-1896	2720	9-51-085
Kearney Lake	962R	D,I,S	11-22-1906	1854	30-52-085
Moore Res.	1300R		08-31-1906	875	23-52-082
Lake DeSmet Res	973R	D,I,S	01-12-1907	25000	6-52-082
Cloud Peak Enl.	6223R	I	09-28-1933	665	9-51-085
Camp Comfort Res.	7533R	D,I,S,Ind	08-16-1939	11640	31-53-082
Willow Park	6408R	D,I,S	08-26-1939	4132	24-52-085
Enl. Lake DeSmet Res.	5829R	D,I,Ind,S	04-03-1950	30129	6-52-082
Kearney Lake Enl.	6555R	I	07-14-1950	4276	29-52-085
Second Enl. Lake DeSmet Res	6225R	Ind	02-02-1955	38960	31-53-082
Reynolds Box Elder Res.	6226R	I,Ind,S	02-04-1955	8902	31-53-082
Third Enl. Lake DeSmet Res.	7009R	I,Ind	02-25-1955	17738	31-53-082
Reynolds Shell Creek Reservoir	6227R	I,Ind	03-08-1955	1304	31-53-082
Healy Reservoir	7289R	D,I,Ind,Power	04-15-1957	36834	9-51-081
Enl. Reynolds Shell Creek Reservoir	7532R	I,Ind,S	04-16-1957	740	31-53-082
First Enl. Healy Res.	7290R	D,I,Ind,S,Rec,Power	10-14-1957	13725	31-53-083
Reynolds High Dam	7291R	I,Ind,Power,S	11-13-1963	37340	31-53-082
Lower Clear Creek Res.	7292R	I,Ind,Power,S	02-21-1968	11800	31-53-082
Reynolds Clear Creek Diversion Dam Res.	8729R	I,Ind,S	09-28-1977	285.4	9-51-081

Designated Use: Industrial, Irrigation, Water Supply

Note: The largest current use is not mentioned in any official records. Nevertheless, now that the three counties own the lake, recreational uses could find official recognition.

Recreational Use: Boating, fishing, camping

Associated Irrigation Diversions: *(Source: Carmine LoGuidice, Div. II water commissioner/hydrographer)*

Diversion	Tributary
Sturgis	Piney Creek
Senf	Piney Creek
Upper Flying E	Piney Creek
Lower Flying E	Piney Creek
Maverick	Piney Creek
Sturdevant	Piney Creek
W.J.D.	Piney Creek
Athorpe-Rodgers	Piney Creek
Dunlap	Piney Creek
Pratt & Ferris No. 1	Piney Creek
Hillyer & Onslow	Clear Creek
Frank G. Hopkins	Clear Creek
L.X.	Clear Creek
DesMoines	Clear Creek
Watt	Clear Creek
Big Bonanza	Clear Creek
Roberts	Clear Creek
Pratt & Ferris No. 2	Clear Creek
Pratt & Ferris No. 3	Clear Creek
Box Elder	Boxelder Creek

Associated Industrial Diversions: None of the industrial rights permitted in Lake DeSmet are being allocated currently.

Operational Discussion: Just less than 10,000 acre-feet are permanently contracted.
Approximately 1,900 acre-feet are reserved for irrigation for Texaco's ranch lands as part of agreement with three counties.

Leases are infrequent. Irrigators call for water three times/week during irrigation season. The operator sets the release, which is reported to the state. For special events (like Clairmont's annual Splash and Dash), the operator releases water on request.

Lake DeSmet diverts water throughout the winter – whenever water flows in Piney Creek.

Part of DeSmet's operation includes allowing 10 cfs to pass the Piney Creek diversion for stock water.

According to water commissioner Carmine Loguidice, Lake DeSmet is not filled above the 213,000 acre-foot capacity because of the leakage experienced in the scoria hills on the northern side of the reservoir. He also notes that releases from the South Dike are restricted to irrigation releases to Box Elder Creek.

References:

Lake DeSmet Technical Record of Design and Construction, Tipton & Kalmbach, Inc., May 1977.

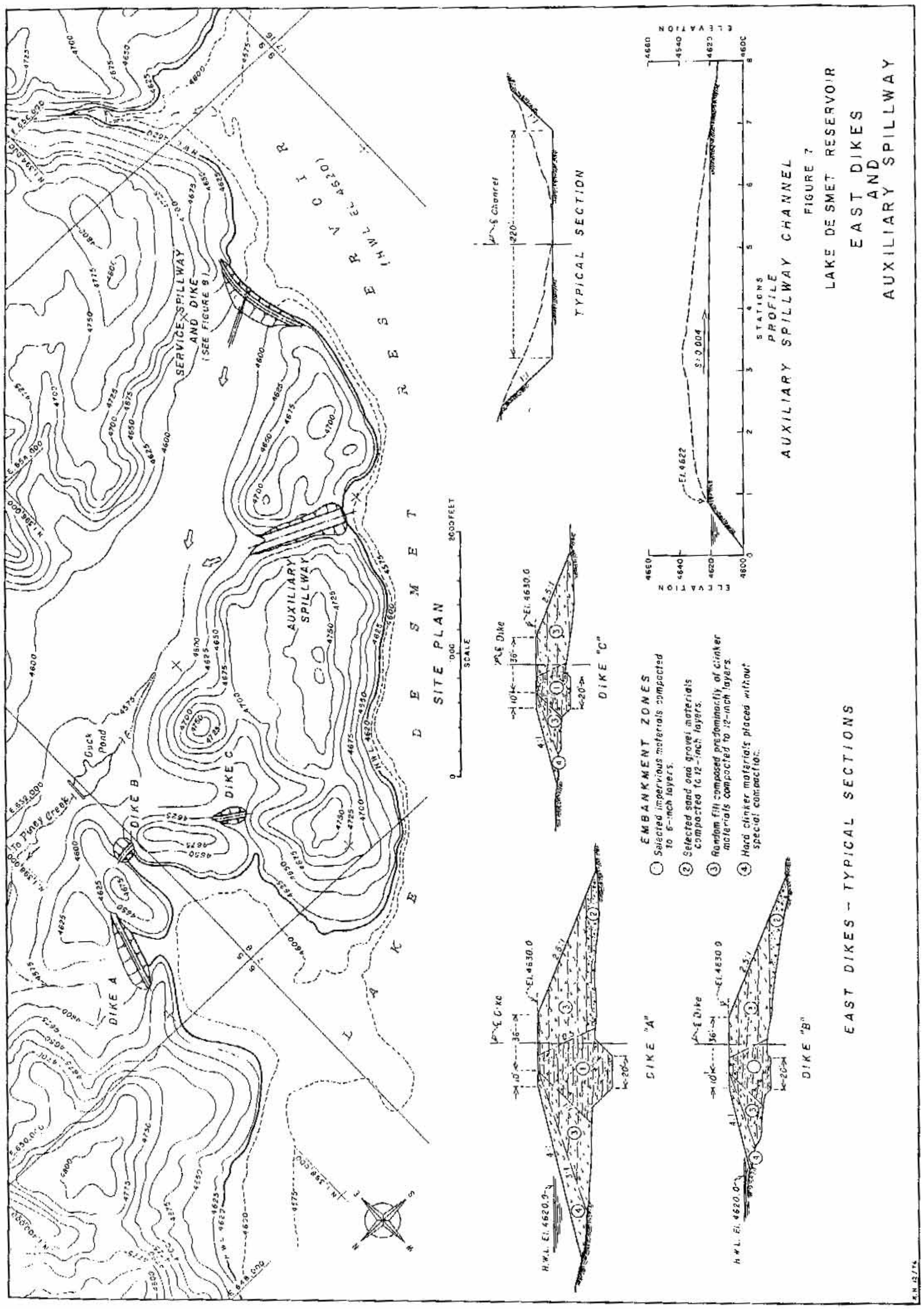
Bruce Yates, Sheridan County granstman, interview, 26 Feb. 2001

Carmine Loguidice, State Engineer's Office Div. 2 water commissioner, interview, 20 Feb. 2001.

Active Dams, State Engineer's Office Safety of Dams Engineering Div. Database, transmitted by Larry Stockdale, Safety of Dams engineering consultant, 16 Feb. 2001.

Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, Oct. 1999, database transmitted by Rebecca Mathisen, SEO Technical Services Division administrator, 8 Sept. 2000.

Tipton & Kalmbach's renderings of the dikes on the southern end of DeSmet:



Net Evaporative Loss from Lake DeSmet:

Lake DeSmet End-of-Month Elevations of Water Surface

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970												
1971					4565.74	4569.44	4568.62	4566.36		4564.59	4565.85	4567.17
1972			4570.27	4571.17	4575.74	4580.05	4579.27	4577.78	4577.27	4576.35	4573.90	4573.04
1973	4573.58	4573.74	4574.11	4574.98	4577.04	4579.81	4578.98	4577.54	4576.87	4576.49	4576.90	4577.05
1974	4577.15	4577.10	4577.10	4577.28	4577.44	4577.11	4574.33	4570.20	4566.45	4565.00		
1975	4565.00		4565.00						4562.64			
1976						4561.97	4561.94			4557.56		
1977	4559.76		4562.00	4563.00	4566.00	4574.45	4572.85	4571.67	4570.99	4571.13	4571.52	4572.16
1978	4572.69	4573.31	4574.13	4575.26	4579.84	4579.95	4579.93	4580.20		4579.40	4580.17	4581.79
1979	4583.24	4584.5	4585.16	4587.87	4590.65	4597.26	4599.71	4597.61		4596.88	4598.3	4599.81
1980	4600.83	4601.78	4602.92	4604.61	4608.5	4612	4611	4605.53	4601.76	4598.15	4594.63	4591.73
1981	4587.52	4585.22	4584.53	4584.54	4585.02	4585.28	4584.44	4582.51	4581.42	4580.95	4581.37	4582.25
1982	4583.22	4584.52	4585.5	4587.01	4589.16	4593.24	4602.82	4601.88	4601.1	4603.61	4607.48	4609.8
1983	4611.68	4612.94	4613.69	4614.35	4616.06	4618.83	4619.54	4617.63	4615.92	4615.4	4615.05	4614.78
1984	4614.74	4614.77	4614.81	4615.03	4615.58	4619.66	4619.52	4617.62	4615.69	4615.25	4614.92	4614.69
1985		4614.56	4614.53	4614.61	4614.35	4613	4610.63	4609.53	4608.47	4607.91	4607.94	4608.25
1986	4608.69	4609.1	4609.76	4611.25	4613.22	4614.62	4613.97	4611.4	4609.26	4609.07	4608.9	4608.73
1987	4608.77	4608.93	4609.52	4610.33	4612.03	4613.97	4612.41	4611.36	4610.34	4609.6	4609.45	4609.08
1988	4608.98	4609.02	4609.06	4609.31	4612.2	4612.9	4611.37	4609.39	4607.81	4607.24	4606.94	4607.01
1989	4607.05	4607.09	4607.13	4607.72	4609.61	4608.8	4609.24	4607.59	4606.42	4606.22	4606.4	4607.81
1990			4608.3	4609.1	4611.62	4612.45	4612.7	4611.39	4610.27	4609.34	4609.09	4608.83
1991	4608.76	4608.76	4608.96			4611.07	4613.19	4611.15	4609.5	4608.59		
1992	4608.59	4608.38	4608.43	4608.42	4608.4	4611.2		4612.01	4611.15	4610.45	4609.9	4609.7
1993			4610.01	4609.84	4610.02	4612.08	4612.11	4610.81		4609.26		4608.75
1994	4608.69		4608.9	4609.21		4611.45	4609.21		4607.3	4606.73		4606.47
1995	4606.4		4606.91		4611.06	4612.61	4612.49	4611.75	4610.5		4609.63	4609.55
1996		4609.6		4609.97	4611.56	4612.6	4612.51	4610.51		4608.67		
1997			4609	4609.5	4610.58	4612.16	4612.23	4612.62		4611.62		4611.15
1998			4611.37	4611.64		4611.7	4612.28			4610.8	4610.5	4610.45
1999	4610.33	4610.34	4610.45	4610.47	4611.01	4612.74	4612.57		4609.87	4609.3	4609.2	4609.06
Historical Ave. Elevation	4595.28	4599.65	4597.75	4599.44	4599.27	4601.16	4600.74	4599.84	4598.62	4597.24	4598.48	4599.96
Corresponding Area (acres)	3013	3091	3052	3091	3091	3127	3111	3091	3072	3052	3072	3091

Calculations:

Monthly Lewis Evap. (inches)	1.296	1.2	1.872	3.84	5.52	6.288	8.208	7.488	5.52	3.648	1.872	1.248	
Monthly Precipitation (inches)	0.75	0.75	0.75	1.75	2.75	2.25	1.25	0.75	1.75	1.25	0.75	0.75	
Net Evaporation (inches)	0.546	0.45	1.122	2.09	2.77	4.038	6.958	6.738	3.77	2.398	1.122	0.498	***TOTAL***
Total Net Evaporation (acre-feet)	137	116	285	538	714	1052	1804	1736	965	610	287	128	***8,372***

KEY STORAGE FACILITIES

Reservoir: **TIE HACK** (or LITTLE SOURDOUGH ENL OF 9489R)

Date: 28 Feb. 2001

Location: SESE 23,T50N,R84W

Owner: CITY OF BUFFALO

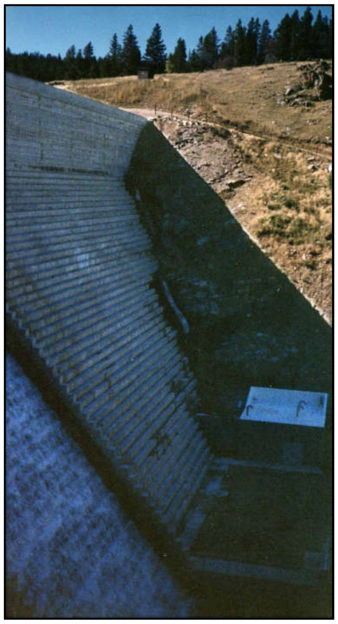
Year of Construction: 1997

Total Storage: 2,435 acre-feet

Active Storage: 1,647 acre-feet

Dead Storage: 2.6 acre-feet

Area/Capacity Data: *(Source: Permit on file with Safety of Dams Office, State Engineer's Office, Cheyenne)*



Elevation (ft)	Area (acres)	Ave. Area (acres)	Incremental Capacity (af)	Accumulated Capacity (af)
7315	0			0
		0.007	0.035	
7320	0.014			0.035
		0.05	0.250	
7325	0.085			0.285
		0.09	0.450	
7330	0.1			0.735
		0.16	0.80	
7335	0.23			1.54
		0.3	1.50	
7340	0.36			3.04
		0.42	2.10	
7345	0.49			5.14
		0.68	3.40	
7350	0.88			8.54
		1.31	6.55	
7355	1.74			15.09
		2.72	13.60	
7360	3.70			28.69
		4.92	24.60	
7365	6.13			53.29
		6.79	33.95	
7370	7.45			87.24
		8.08	40.40	
7375	8.72			127.64
		9.50	47.50	
7380	10.28			175.14
		11.17	55.85	
7385	12.06			230.99
		13.43	67.15	
7390	14.80			298.14
		16.55	82.75	

Area/Capacity table cont'd:

Elevation (ft)	Area (acres)	Ave. Area (acres)	Incremental Capacity (af)	Accumulated Capacity (af)
7395	18.30			380.89
		21.30	106.50	
7400	24.30			487.39
		25.43	127.15	
7405	26.56			614.54
		27.94	139.70	
7410	29.32			754.24
		29.71	35.40	
7411.19	30.10			789.64
		31.35	119.40	
7415	32.61			909.04
		36.12	180.60	
7420	39.36			1,089.64
		41.93	209.65	
7425	44.23			1,299.29
		44.98	224.90	
7430	45.72			1,524.19
		47.77	238.85	
7435	49.82			1,763.04
		52.22	261.10	
7440	54.63			2,024.14
		57.59	287.95	
7445	60.55			2,312.09
		61.51	123.02	
7447 H.W.L.	62.46			2,435.11
TOTAL CAPACITY, ENLARGEMENT = 788.44 A.F.				
TOTAL CAPACITY UNDER PERMIT 9489R = 1,646.67 A.E.				
TOTAL AVAILABLE CAPACITY = 2,435.11 A.F.				

Dam Construction Type: Concrete and other

Outlet: 48-inch conduit controlled by three 36-inch and two 48-inch sluice gates with a flow capacity of 740 cfs.

Spillway: 50-foot slot in concrete crest.

End-of-Month Storage Records: No

Water Rights: *(Source:* Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, *Oct. 1999.)*

Reservoir	Permit Number	Permitted Use	Priority Date	Volume (af)	Headgate Location (S-T-R)
Tie Hack Res.	9489R	Mun,Power, Fish prop.,Rec.	10-18-1933	1646.67	23-50-084
Enl. Tie Hack	9700R	Rec	09-12-1989	788.44	23-50-084

Designated Use: Water supply and hydropower

Recreational Use: Fishing, non-motorized boats, picnic area

Associated Irrigation Diversions: All irrigation from Tie Hack Reservoir is accommodated by the City of Buffalo through its city intake.

Associated Industrial Diversions: The City of Buffalo's storage in Tie Hack Reservoir supplements direct-flow rights for a small hydroelectric generator at the end of four miles of pipe installed to terminate just upstream of the city's treatment plant.

Operational Discussion: Tie Hack Reservoir is situated on the confluence of the South Fork of Clear Creek and Sourdough Creek. As an on-channel facility, Tie Hack is required to bypass at least 6 cfs into the South Fork of Clear Creek.

As of February, 2001, Tie Hack has not yet had a release to the Town of Buffalo. In part, this is because the stored water supplements Buffalo's direct flow rights. But this is also because the town has a 150 acre-foot exchange in Willow Park for direct flow in Clear Creek – which is used before Tie Hack water.

The operator is also required to maintain a 700 acre-foot fish pool in the reservoir.

References: Carmine Loguidice, State Engineer's Office Water Div. 2 water commissioner, interview, 20 Feb. 2001.

Ken Gross, Town of Buffalo administrative assistant, interview, 28 Feb. 2001.

Active Dams, State Engineer's Office Safety of Dams Engineering Div. Database, transmitted by Larry Stockdale, Safety of Dams engineering consultant, 16 Feb. 2001.

Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, Oct. 1999, database transmitted by Rebecca Mathisen, SEO Technical Services Division administrator, 8 Sept. 2000.

Net Evaporative Loss from Tie Hack:

Tie Hack Reservoir End-of-Month Storage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet (1997)	2450	2450	2450	2450	2450	2450	2450	2450	2450	2450	2450	2450
Average (1999)	2450	2450	2450	2450	2450	2450	2450	2450	2450	2450	2450	2450
Dry (2001)	2450	2450	2450	2450	2450	2450	2447	2241	2014	2034	2079	2055
Historical Ave. Storage (acre-feet)	2450	2450	2450	2450	2450	2450	2449	2380	2305	2311	2326	2318
Corresponding Area (acres)	54.63	54.63	54.63	54.63	54.63	54.63	54.63	54.63	54.63	54.63	54.63	54.63

Calculations:

Monthly Lewis Evap. (inches)	1.296	1.2	1.872	3.84	5.52	6.288	8.208	7.488	5.52	3.648	1.872	1.248	
Monthly Precipitation (inches)	0.75	0.75	0.75	1.75	2.75	2.25	1.25	0.75	1.75	1.25	0.75	0.75	
Net Evaporation (inches)	0.546	0.45	1.122	2.09	2.77	4.038	6.958	6.738	3.77	2.398	1.122	0.498	***TOTAL***
Total Net Evaporation (acre-feet)	2	2	5	10	13	18	32	31	17	11	5	2	***148***

Note: Because Tie Hack Dam was completed so recently, its records were culled for the wet, average, and dry years identified by Wyoming State Engineer's Office water commissioner-hydrographers. These were averaged to provide the basis for the evaporative loss calculations.

KEY STORAGE FACILITIES

Reservoir:	**WILLOW PARK**
Date:	27 Feb. 2001
Location:	SENE 24,T52N,R85W
Owner:	WILLOW PARK RES. CO.(BILL DOOLEY-SEC.)

Willow Park Reservoir's upstream dam face and outlet structure

Year of Construction:	1959
Total Storage:	6,469 acre-feet
Active Storage:	4,457 acre-feet
Area/Capacity Data:	*(Source: Undated table on file in the State Engineer's Office, Water Div. II)*

Feet	Elevation	Area	Average Area	Volume Released	Volume Remaining
0.0	8616.5			0000.0	4457.0
0.5	8616.0			104.5	4352.5
1.0	8615.5			208.9	4248.1
1.5	8615.0			313.3	4143.7
2.0	8614.5			409.2	4047.8
2.5	8614.0			505.1	3851.9
3.0	8613.5			601.0	3856.0
3.5	8613.0			696.0	3760.1
4.0	8612.5			792.8	3664.2
4.5	8612.0			888.6	3568.4
5.0	8611.5			984.4	3472.6
5.5	8611.0			1080.2	3376.8
6.0	8610.5			1176.0	3281.0
6.5	8610.0			1271.8	3185.2
7.0	8609.5			1354.3	3102.7
7.5	8609.0			1436.7	3020.3
8.0	8608.5			1519.1	2937.9
8.5	8608.0			1601.5	2855.5
9.0	860?.5			1683.9	2773.1
9.5	8607.0			1766.3	2690.7
10.0	8606.5			1848.7	2608.3
10.5	8606.0			1931.1	2525.9
11.0	8605.5			2013.5	2443.5
11.5	8605.0			2095.9	2361.1
12.0	8604.5			2165.0	2292.0
12.5	8604.0			2234.1	2222.9
13.0	8603.5			2303.2	2153.8
13.5	8603.0			2372.3	2084.7

Area/Capacity table cont'd:

Feet	Elevation	Area	Average Area	Volume Released	Volume Remaining
14.0	8602.5			2441.3	2015.7
14.5	8602.0			2510.3	1946.7
15.0	8601.5			2579.3	1877.7
15.5	8601.0			2648.3	1808.7
16.0	8600.5			2717.3	1739.7
16.5	8600.0			2186.3	1670.7
17.0	8599.5			2842.4	1614.6
17.5	8599.0			2898.5	1558.5
18.0	8598.5			2954.6	1502.4
18.5	8598.0			3010.7	1446.3
19.0	8597.5			3066.7	1390.3
19.5	8597.0			3122.7	1334.3
20.0	8596.5			3178.7	1278.3
20.5	8596.0			3234.7	1222.3
21.0	8595.5			3290.7	1166.3
21.5	8595.0			3346.7	1110.3
22.0	8594.5			3389.9	1067.1
22.5	8594.0			3433.1	1023.9
23.0	8593.5			3476.2	980.8
23.5	8593.0			3519.3	937.7
24.0	8592.5			3562.4	894.6
24.5	8592.0			3605.5	851.5
25.0	8591.5			3648.6	808.4
25.5	8591.0			3691.7	765.3
26.0	8590.5			3734.8	722.2
26.5	8590.0			3777.9	679.1
27.0	8589.5			3810.6	646.4
27.5	8589.0			3843.2	613.8
28.0	8588.5			3875.8	581.2
28.5	8588.0			3908.4	548.6
29.0	8587.5			3941.0	516.0
29.5	8587.0			3973.6	483.3
30.0	8586.5			4006.2	450.8
30.5	8586.0			4038.8	418.2
31.0	8585.5			4071.4	385.6
31.5	8585.0			4104.0	353.0
32.0	8584.5			4132.0	325.0

Note: Area information is not provided in the State Engineer's Office table.

Dam Construction Type: Earth Fill

End-of-Month Storage Records: No

Water Rights: *(Source:* Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, *Oct. 1999.)*

Reservoir	Permit Number	Permitted Use	Priority Date	Volume (af)	Headgate Location (S-T-R)
Willow Park	6408R	D,I,S	08-26-1939	4457	24-52-085

Designated Use: Irrigation, Stock, Recreation

Recreational Use: Fishing, boating

Associated Irrigation Diversions: *(Source: Carmine LoGuidice, Div. II water commissioner/hydrographer)*

Diversion	Tributary
Jim Crow	Rock Creek
Sonnesberger	Rock Creek
Fenton	Rock Creek
Hallie	Rock Creek
Fox	Rock Creek
Lilly	Rock Creek
Lake DeSmet	Rock Creek
Johnny Come Early	Rock Creek
Last Chance	Rock Creek
Rounder	Rock Creek
Steady Run	Rock Creek
Tay	Rock Creek
Dee	Rock Creek
Ono	Rock Creek
Rock Crk. & Piney Ditch Co. Canal	Piney Creek
Mead & Coffeen (Crossover & 1°)	Piney Creek
Upper Harvey	Piney Creek
Lower Harvey	Piney Creek
Piney & Cruse (Crossover & 1°)	Piney Creek
Mueller	Piney Creek
Piney Divide	Piney Creek
Cleo	Piney Creek
Mueller & Leitner	Piney Creek
Prairie Dog (Crossover & 1°)	Piney Creek
Hilyer & Onslow	Clear Creek
Frank G. Hopkins	Clear Creek
Des Moines	Clear Creek
Watt	Clear Creek
City of Buffalo (exchange)[1]	Clear Creek

[1] *The City of Buffalo's exchange right out of Willow Park Reservoir is limited to 150 acre-feet at a rate not to exceed 2 cfs.*

Associated Industrial Diversions: None

Operational Discussion: Cloud Peak Reservoir has been considered a unit with Willow Park Reservoir downstream. As a result, operators tend to empty the reservoir's active capacity into Willow Park toward the end of the season to avoid carrying water into the next year.

First release timing, Willow Park Reservoir

Wet Year	Average Year	Dry Year
2nd week of July	4th week of June	2nd week of June

Operators end irrigation releases from the dam on Oct. 1 (the end of the water year).

References:

Carmine Loguidice, State Engineer's Office Water Div. 2 water commissioner, interview, 20 Feb. 2001.

Active Dams, State Engineer's Office Safety of Dams Engineering Div. Database, transmitted by Larry Stockdale, Safety of Dams engineering consultant, 16 Feb. 2001.

Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two, Oct. 1999, database transmitted by Rebecca Mathisen, SEO Technical Services Division administrator, 8 Sept. 2000.

Willow Park Reservoir

Cloud Peak Reservoir

Net Evaporative Loss from Willow Park Reservoir:

Lewis Annual Evaporation (in.)	46
Total Storage (acre-feet)	6,469

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average percent of total storage	56.72	57.55	57.87	60.80	71.16	72.71	68.17	64.03	57.62	57.03	58.79	60.84
Generated storage (acre-feet)	3669	3723	3744	3933	4603	4703	4410	4142	3727	3689	3803	3936
Corresponding area (acres)												

Calculations:

Monthly Lewis Evap. (inches)	1.242	1.15	1.794	3.68	5.29	6.026	7.866	7.176	5.29	3.496	1.794	1.196	
Monthly Precipitation (inches)	1.75	1.75	2.25	3.25	3.75	2.75	1.75	1.25	2.25	1.75	1.75	1.75	
Net Evaporation (inches)	0	0	0	0.43	1.54	3.276	6.116	5.926	3.04	1.746	0.044	0	***TOTAL***
Total Net Evaporation (acre-feet)													***N.A.***

Note: Because an area-capacity table for Willow Park Reservoir was not available, evaporative loss could not be calculated.

Municipal Water Use Summary

Entity: City of Buffalo

Introduction: The city of Buffalo obtains its water from Clear Creek and Tie Hack Reservoir. A water treatment plant is located west of Buffalo along Clear Creek.

Service Area Population: 3900

Number of Taps: 1688

Water Supply: Diversion from Clear Creek. This includes both a direct diversion of stream flow and diversion of stored water in Tie Hack Dam.

Water Treatment: Chemical addition, sedimentation, filtration, disinfection.

Raw Water Storage: 12,000,000 gallons

Finished Water Storage: 1,400,000 gallons

Wastewater Treatment Discharge: Lagoon System. Average discharge 0.8 MGD.

Monthly Water Rates: Base rate of $17.80, plus $1.10 per 1000 gallons for more then 10,000 gallons. Average water bill is $17.80.

Annual Water Use: About 456 million gallons (average day = 1,250,000 gallons)

Per Capita Use: Average day = 325 gallons, Peak day = 700 gallons

Peak Day Demand: 3,200,000 gallons

Water Supply System Capacity: 5385 gpm

Municipal Water Rights:

Direct Flow Rights Owned by the City of Buffalo

Permit No	Ditch	Appropriator	Priority	Use	Cfs
Terr.	Buffalo Water Wagon Pipeline and Ditch	City of Buffalo	-1879	I, D, Mun. & Mfg.	4.00
Terr.	Snider No. 4	Farm Invest. Co.	4- -1883	Mun.	0.43
Terr.	Snider Nos. 1 & 3	Farm Invest. Co.	Spring 1883	Mun.	0.52
Terr.	Buffalo Mill Co.	Town of Buffalo	6-1-1887	Mun.	4.00
5105E	Enl. McNeese	City of Buffalo	2-14-1938	I, S, D	2.08
19276	Pipe Line	City of Buffalo	12-7-1939	I, D, Mun. & Ind.	2.00
23403	Buffalo Water Wagon Pipeline and Ditch	City of Buffalo	11-21-1968	Mun.	150.00 af Sec. Sup.

18 and 25 foot deep wells adjacent to Clear Creek - 2.2 cfs, 1 cfs.

Water Rights Capacity: See above table. Also Tie Hack Reservoir with a capacity of 1646.67 ac-ft provides stored water.

Near Future Improvements: 1.0 to 1.5 million gallon storage tank.

References:

1. Wyoming Water Development Commission, *2000 Water System Survey Report.*
2. City of Buffalo, response to questionnaire.

Municipal Water Use Summary

Entity: Clearmont

Introduction: The town of Clearmont is an incorporated community located in eastern Sheridan County.

Service Area Population: 125

Number of Taps: 60

Water Supply: The water supply for Clearmont consists of two 1100-foot deep wells with a capacity of about 100 gpm each.

Water Treatment: Disinfection

Raw Water Storage: None

Finished Water Storage: 400,000 gallons

Wastewater Treatment Discharge: Non-discharging lagoons

Monthly Water Rates: Base rate of $8.00 for residential and $9.75 for commercial (6000 gallons), plus $0.80 per 1000 gallons up to 15,000, then $0.60 per 1000 gallons.

Annual Water Use: About 10 million gallons (average day = 27,500 gallons)

Per Capita Use: Average day = 220 gallons, Peak day = 336 gallons

Peak Day Demand: 40,000 gallons

Water Supply System Capacity: 100 gpm

Municipal Water Rights:

Water Rights Capacity:

Near Future Improvements: None.

References:

1. Wyoming Water Development Commission, *2000 Water System Survey Report.*
2. Anna Suitzer, Town Clerk, telephone conversation 2-26-01.

CLEAR CREEK

BIG BONANZA DITCH DIVERSION
CLEAR CREEK LAND & DITCH CO. DITCH DIVERSION
CROWN DITCH DIVERSION
DES MOINES DITCH DIVERSION
FOUR LAKES & FRENCH CREEK DITCH DIVERSION
FRANK G. HOPKINS DITCH DIVERSION
HILLYER & ONSLOW DITCH DIVERSION
JOHNSON-HOLT DITCH DIVERSION
KENDRICK DITCH DIVERSION
PRATT & FERRIS NO. 2 DITCH DIVERSION
PRATT & FERRIS NO. 3 DITCH DIVERSION
REDMAN DITCH DIVERSION
ROBERTS DITCH DIVERSION
SIX MILE DITCH DIVERSION

CLEAR CREEK DRAINAGE
INTRODUCTION

BACKGROUND

Clear Creek flows out of the east slope of the Bighorn Mountains, gathering French, Piney, Rock, Double Crossing, Bull, and Sand creeks in addition to its own North, South, and Middle forks. It finally joins the Powder River well north of Arvada, Wyoming. The Powder River crosses the Montana state line north of Spotted Horse, Wyoming.

CHARACTERISTICS

Losses on upper Clear Creek are low, thanks to the stream's steep descent to the foothills of the Bighorn Mountains. But it becomes a slow-moving, relatively high-loss stream just before it enters Buffalo. Releases from Lake DeSmet are calculated to take 33 hours to reach Pratt & Ferris No. 3, the first diversion downstream from Clearmont. Clear Creek also passes through Buffalo and Clearmont. The slower velocities and meanders of the lower elevation passage and low-volume pumps tapping Clear Creek's flows through the two towns contribute to its losses; its storage (see below) helps ameliorate much of this for irrigators. Nevertheless, water commissioners work carefully with irrigators to ensure that Clear Creek normally dries up at least twice before it can reach the Powder. Return flows recharge the creek's flows downstream of Pratt & Ferris No. 3 enough to provide flows for the Kendrick Canal, which in turn diverts all of the creek's flows.

Clear Creek drainage also contains many transbasin diversions. Four Lakes diversion moves water out of Clear Creek into its tributaries through French Creek, then to Penrose to deliver the water to Johnson Creek (a tributary of Rock Creek, which is a tributary of Clear Creek), where the water is used.

USAGE

Clear Creek's diversions are used primarily by agricultural irrigation, but also find municipal, industrial, and recreation uses.

Regulation

Water commissioners estimate that regulation is imposed on Clear Creek drainage diversions with the following timing:

Wet Year	*Average Year*	*Dry Year*
mid-August	mid-July	mid-June

Agriculture

Growers in the Clear Creek drainage tend to plant acreage in the following pattern:

- 45 percent alfalfa
- 30 percent grass hay
- 10 percent grains
- 15 percent corn

The grains (usually barley or oats) are used to rejuvenate the soil after approximately five years of alfalfa/grass growth. Corn is used as a silage crop.

The typical irrigation season runs from April 15-May 1 (depending on whether the spring runoff is delayed by colder weather) to early/mid October (depending on when the first snows fall and the ground freezes). Approximately 40 percent of the irrigators practice post-season irrigation, though they usually do not use their entire right to do so.

Irrigation Practices

Type of irrigation	*Percentage of irrigated land*
Ditch-flood	65
Gated pipe	15
Sprinkler	20

Water commissioners calculate the “shrinkage,” or instream loss from reservoir requests depending on the distance between the reservoir and diversion. In general, for Clear and Rock creeks, irrigators are charged approximately one percent loss per mile of travel from reservoir release to headgate, as long as the headgate is upstream of Lake DeSmet. The system changes there. A summary of the major reservoir shrinkage schemes used by the water commissioners follow:

Lake DeSmet

DeSmet’s shrinkage is experientially based for each headgate downstream from the reservoir. Numbers are essentially independent of the amount of water available to the system in any given year:

Diversion	Flow loss (%)
Upper E	1
Lower E	2
Maverick	2
Sturdevant	2
WJD	3
Athorpe	4
Dunlop	5
Pratt & Ferris No. 1	10
Roberts	15
Pratt & Ferris No. 2	23
Pratt & Ferris No. 3	25
Ucross Pumps	15
Smith Pumps	15
Ucross Lower Pumps	20

Willow Park and Cloud Peak Reservoirs

Irrigators requesting water from rights in Willow and Cloud Peak reservoirs are assessed flat shrinkages depending on location. Water commissioners estimate the shrinkage based on distance downstream from the high-elevation reservoirs:

At mouth of canyon (HF Bar):

Type of water year	Shrinkage (% of flow/volume)
Wet	0
Average	10
Dry	20

Downstream of Buffalo:

Type of water year	Shrinkage (% of flow/volume)
Wet	25
Average	50
Dry	50

Double Appropriation

Irrigation water rights with priority dates of March 1, 1945 or earlier are entitled to an additional 1cfs per 70 acres under Wyoming's surplus water statutes. Whenever the supply in a stream exceeds the amount required to satisfy all existing appropriations established prior to March 1, 1985, the stream is said to be in an excess flow condition and water right holders with priorities between March 2, 1945 and March 1, 1985 may use an additional 1 cfs for each 70 acres irrigated.

In Clear Creek, this practice is limited primarily by the condition of ditches that follow the diversions from the creek. Many of the ditches are not capable of carrying all of the water an irrigator could use.

% of appropriation	% of ditches in drainage capable of flow
200	20
150	60
100-150	90
0-100	90

Permitted Uses

Permits granted for water appropriation are granted for specific uses. The following pages contain tables of permits and their associated uses. The following table provides a key to those uses:

Code	Use
Chem	Chemical
Com	Commercial
Cul	Culinary
D	Domestic
Drl	Drilling
Eng	Steam Engines
Fire	Fire Protection
Fish	Fish Propogation
F.C.	Flood Control
I	Irrigation
Ind	Industrial
I.F.	Instream Flow
Mech	Mechanical
Mfg	Manufacturing
Mil	Milling

Code	Use
Min	Mining
Misc	Miscellaneous
Mun	Municipal
Oil	Oil Refining or Production
P.C.	Pollution Control
Power	Power Development
R.R.	Railroad
Rec	Recreational
Ref	Refining
Res. Supply	Supply Facility for a Reservoir
S	Stock
T	Transportation

WATER RIGHTS

Two water rights summary tables are provided for each diversion serving irrigation referenced here. The first, included in the body of the diversion synopsis, refers to the rights on record with the State Engineer's Office and is derived from that office's *Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two* (Oct. 1999).

Because this rights summary is pulled directly from the SEO *Tab,* the rights cited follow the SEO's priority order:

Hierarchy	Format of right	Example
1	Day, Month, Year	05-15-1884
2	Month and Year	05-00-1884
3	Specified Season and Year	Spring 1884
4	Year Only	1884
5	Before Year	Before 1884

Board orders or court orders may also establish a specific priority.

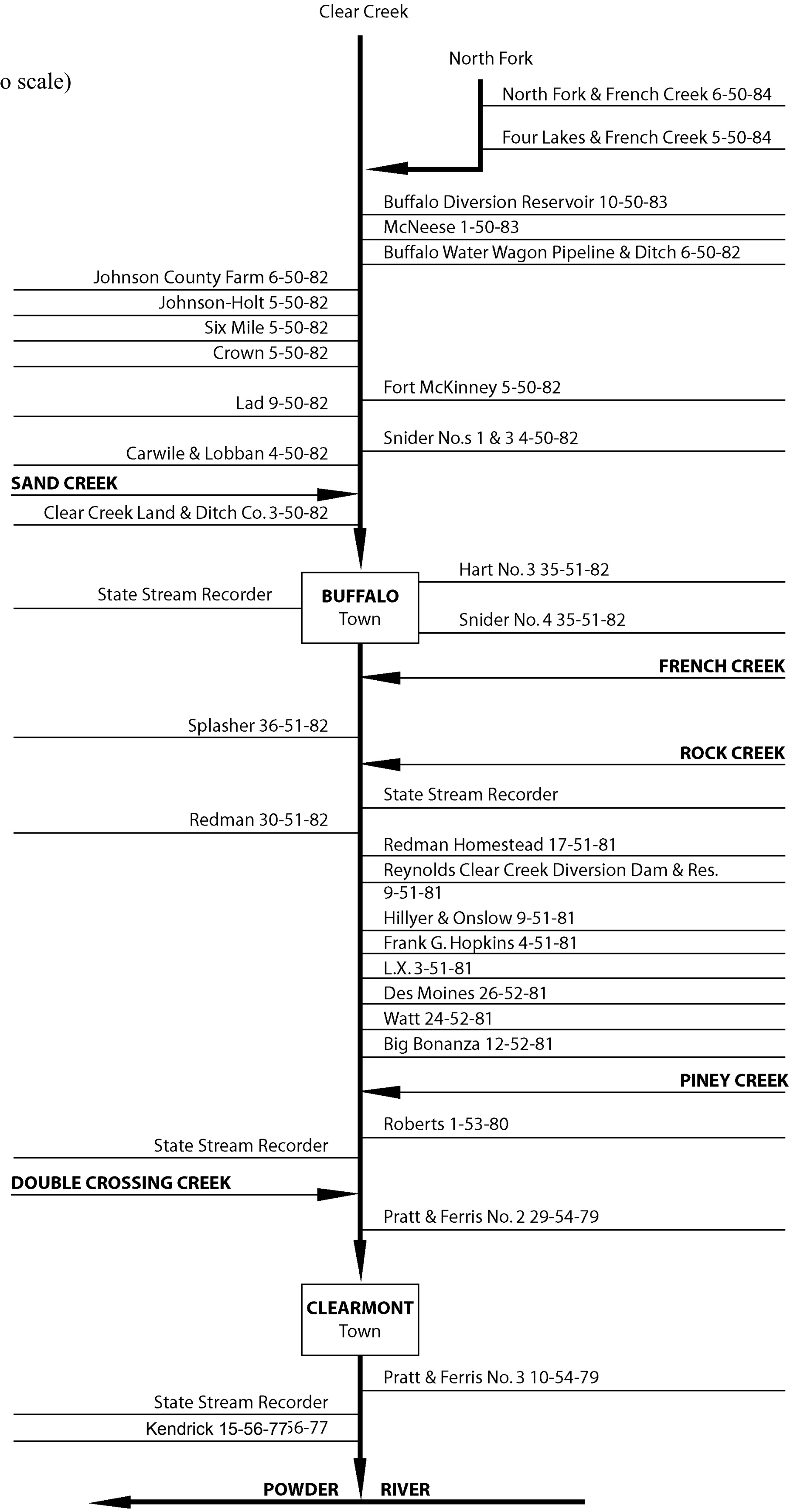
Irrigated Lands Water Rights Database

The second table, which follows the diversion synopsis, is taken from the irrigated lands water rights database developed for the basin plan. It can be used as a reference with the following caveats: It only lists water rights associated with the irrigated lands polygons mapped by HKM. The table does not include nonirrigation rights devoted to reservoir supply, municipal, fish propagation, etc. The rights on this table are associated only with those irrigated lands identified through the course of this study, both actively irrigated and currently idle.

Column Heading Key

PerNo	Permit Number	“Terr” denotes a territorial right.
PerSfx	Permit Suffix	D = direct flow E = enlargement R = reservoir
Facility Name		Parentheses denote the former means of conveyance for the water right.
Unit	Flow or volume	CFS = cubic feet per second AF = acre-feet GPM = gallons per minute
SupTyp	Supply Type	OS = original supply SS = supplement supply, for lands having an original supply from another source Sec = secondary supply, for water stored in a reservoir
Status	Status of adjudication	Adj = adjudicated Una = unadjudicated
Source	Source water	Parentheses denote the permit number of the related storage right.

Schematic of Clear Creek stream and diversions:


(Not to scale)

KEY DIVERSIONS

Diversion: **BIG BONANZA DITCH DIVERSION**

Date: 4 Oct. 2000

Diversion Description: Headgate consists of a single, 1 x 6-foot rectangular steel gate operated with Waterman-type screw (missing handle), mounted in concrete headwall.

Big Bonanza headgate

Diversion Location: The Big Bonanza Ditch diversion is located on the main stem of Clear Creek just upstream of the creek's confluence with Piney Creek.

Headgate:

Lat.	Long.
N 44° 29' 32.2"	W 106° 33' 23.8"

Flume:

Lat.	Long.
N 44° 29' 45.4"	W 106° 33' 8.9"

Big Bonanza flume

Conveyance Description: Open channel canal, approximately 4.9 mi. long, well above Clear Creek channel.

Direct Flow Water Rights:

Permit	Priority	Use	Acres	Flow (cfs)	Cumulative Flow (cfs)
Terr.	04-30-1882	I	520	7.43	7.43
Terr.	-1883	I	1000	14.28	21.71
6396E	04-28-1971	I	33.41	0.49	22.20

Associated Storage Rights: Irrigators on the Big Bonanza Ditch have rights in Healy and Lake DeSmet reservoirs.

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	5	2.5	2.5

Losses: Approximately 15 percent by the end of the ditch

References: Carmine Loguidice, Interview, State Engineer's Office, 4 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Big Bonanza, 1st Appropriation	April 30, 1882	520	7.43	CFS	OS	Adj	Clear Creek
Terr	D	Big Bonanza, 2nd Appropriation	Dec. 31, 1883	1000	14.28	CFS	OS	Adj	Clear Creek
1174	E	Enl. Des Moinse L&C CO (Big Bonanza)	Jan. 19, 1904	205	2.92	CFS	OS	Adj	Clear Creek
6396	E	Enl. Big Bonanza	April 28, 1971	33.51	0.48	CFS	OS	Una	Clear Creek

Name	Big Bonanza Ditch Diversion
Source	Clear Creek
District	2
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								728.91	1274.10	1614.60	0.00	0.00	3617.61
1975													
1976													
1977													
1978													
1979													
1980													
1981								588.42	1253.74	1304.61	838.01	764.40	4749.18
1982								0.00	695.63	1379.42	1254.90	543.27	3873.22
1983								111.97	1274.27	1069.58	0.00	0.00	2455.82
1984								0.00	930.53	1560.60	1403.23	562.71	4457.07
1985								0.00	186.55	1374.17	1161.25	508.20	3230.17
1986								865.42	1445.76	1289.11	1007.63	298.05	4905.97
1987								872.00	856.49	850.91	989.15	3.97	3572.52
1988								1145.47	1010.49	1247.97	747.27	271.43	4422.63
1989								641.77	1233.13	1263.66	395.27	100.01	3633.84
1990								667.95	1017.10	1065.00	613.67	673.40	4037.12
1991								289.48	330.02	1132.74	1359.67	588.10	3700.01
1992								1426.50	451.43	368.32	692.53	204.31	3143.09
1993								234.61	588.19	227.51	290.43	321.51	1662.25
1994								212.37	836.99	637.75	295.19	0.00	1982.30
1995								120.95	709.33	1041.61	742.67	167.70	2782.26
1996								305.66	467.83	908.74	687.53	61.67	2431.43
1997								137.76	571.97	129.21	56.15	0.00	895.09
1998								610.97	1047.35	1153.80	390.06	0.00	3202.18
1999								0.00	542.28	825.32	798.15	0.00	2165.75
Mean								448.01	836.16	1022.23	686.14	253.44	3245.98
Max								1426.50	1445.76	1614.60	1403.23	764.40	4905.97
Min								0.00	186.55	129.21	0.00	0.00	895.09

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Big Bonanza Ditch Diversion
Source	Clear Creek
District	2
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	14-May	20-Jul	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	15-May	24-Sep	14
1982	13-Jun	12-Sep	12
1983	22-May	24-Jul	9
1984	2-Jun	11-Sep	9
1985	25-Jun	18-Sep	5
1986	20-May	8-Sep	5
1987	15-May	3-Sep	6
1988	20-May	15-Sep	4
1989	16-May	14-Sep	8
1990	21-May	13-Sep	12
1991	18-May	14-Sep	8
1992	15-May	27-Sep	27
1993	26-May	30-Sep	19
1994	20-May	24-Aug	40
1995	26-May	18-Sep	17
1996	21-May	16-Sep	19
1997	29-May	13-Aug	27
1998	15-May	19-Aug	9
1999	3-Jun	30-Aug	13
Avg.	24-May	5-Sep	13
Earliest	14-May	20-Jul	0
Latest	25-Jun	30-Sep	40

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **CLEAR CREEK LAND & DITCH CO. DITCH DIVERSION**

Date: 4 Oct. 2000

Diversion Description: Headgate consists of two, 2.9 x 2.7-foot rectangular steel gates operated with Waterman-type screws, mounted in concrete headwall.


Clear Creek Land & Ditch Co. headgate

Diversion Location: The Clear Creek Land & Ditch Co. diversion is located on the main stem of Clear Creek just upstream from the town of Buffalo.

Headgate:

Lat.	Long.
N 44° 20' 2.1"	W 106° 42' 53.2"

Flume:

Lat.	Long.
N 44° 20' 4.6"	W 106° 42' 50.7"


Clear Creek Land & Ditch Co. flume

Conveyance Description: Open channel canal, approximately 4.0 mi. long.

Direct Flow Water Rights:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	Spring 1883	I	75	1.07	1.07
Terr.	Spring 1883	I	160	2.28	3.35
Terr.	Spring 1883	I	160	2.28	5.63
Terr.	Spring 1883	I	250	3.57	9.20
Terr.	Spring 1883	I	400	5.71	14.91
Terr.	03-24-1884	I	240	3.43	18.34
Terr.	05-00-1887	I	350	5	23.34
4220E	09-23-1920	I	454.35	6.49	29.83

Associated Storage Rights: None

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	15	10	5

Losses: Approximately 10-5 percent by the end of the ditch

References: Dave Pelloux, Interview, State Engineer’s Office, 25 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Clear Creek Land & Ditch Co.	June 20, 1883	1045	14.91	CFS	OS	Adj	Clear Creek
Terr	D	Clear Creek Land & Ditch Co.	March 24, 1884	240	3.43	CFS	OS	Adj	Clear Creek
Terr	D	Clear Creek Land & Ditch Co., 2nd App.	May 31, 1887	350	5	CFS	OS	Adj	Clear Creek
4220	E	Enl. Clear Creek Land & Ditch Co.	Sep. 23, 1920	80	0		SS	Adj	Clear Creek

Name	Clear Creek Land & Ditch Co. Ditch Diversion
Source	Clear Creek
District	2
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								632.59	1468.05	709.51	0.00	0.00	2810.15
1975													
1976													
1977													
1978													
1979													
1980													
1981								409.17	574.22	441.24	246.97	0.00	1671.60
1982								0.00	652.95	867.10	828.66	398.90	2747.61
1983								0.00	250.01	795.98	0.00	0.00	1045.99
1984								10.69	627.59	693.23	679.72	222.72	2233.95
1985								0.00	161.34	749.18	659.63	346.79	1916.94
1986								308.38	1085.12	680.71	764.89	194.02	3033.12
1987								460.90	660.07	981.54	745.30	146.55	2994.36
1988													
1989								647.24	1258.07	1133.15	699.34	366.99	4104.79
1990								632.47	1129.67	873.03	983.48	53.66	3672.31
1991								102.99	1037.98	1064.49	1043.43	384.44	3633.33
1992								694.43	578.35	166.28	925.78	329.40	2694.24
1993								506.24	789.25	356.56	940.61	341.96	2934.62
1994								694.19	1125.77	990.93	603.53	0.00	3414.42
1995								63.50	1142.81	521.74	984.14	416.51	3128.70
1996								202.86	732.38	916.45	727.13	320.86	2899.68
1997								91.21	571.89	328.61	0.00	0.00	991.71
1998								192.30	786.85	836.08	686.18	547.27	3048.68
1999								0.00	544.98	599.09	780.10	180.89	2105.06
Mean								297.32	798.81	721.31	647.31	223.73	2688.49
Max								694.43	1468.05	1133.15	1043.43	547.27	4104.79
Min								0.00	161.34	166.28	0.00	0.00	991.71

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Clear Creek Land & Ditch Co. Ditch Diversion
Source	Clear Creek
District	2
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	16-May	28-Jul	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	6-May	25-Aug	19
1982	3-Jun	15-Sep	19
1983	17-Jun	26-Jul	11
1984	31-May	12-Sep	8
1985	25-Jun	18-Sep	4
1986	15-May	8-Sep	6
1987	14-May	10-Sep	5
1988			
1989	15-May	15-Sep	6
1990	15-May	13-Sep	12
1991	28-May	14-Sep	8
1992	15-May	27-Sep	28
1993	17-May	30-Sep	16
1994	12-May	24-Aug	40
1995	26-May	18-Sep	17
1996	21-May	16-Sep	19
1997	29-May	29-Jul	19
1998	21-May	28-Sep	9
1999	3-Jun	8-Sep	11
Avg.	23-May	6-Sep	14
Earliest	6-May	26-Jul	0
Latest	25-Jun	30-Sep	40

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **CROWN DITCH DIVERSION**

Date: 4 Oct. 2000

Diversion Description: Headgate consists of a single, 3.7 x 1-foot rectangular steel gate operated with Waterman-type screw, mounted in concrete headwall.

Crown Ditch Headgate

Diversion Location: The Crown diversion is located on the main stem of Clear Creek between the confluences of Clear Creek and North Fork and Sand creeks.

Crown Ditch Flume

Headgate:

Lat.	Long.
N 44° 19' 28.8"	W 106° 44' 24.6"

Flume:

Lat.	Long.
N 44° 19' 27.7"	W 106° 44' 22.1"

Conveyance Description: Open channel canal, approximately 5.3 mi. long.

Direct Flow Water Rights:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	12-31-1884	I	79.75	1.14	1.14
Terr.	12-31-1884	I	160	2.28	3.42
Terr.	12-31-1884	I	160	2.28	5.70
Terr.	12-31-1884	I	240	3.43	9.13
1347E	01-23-1905	I	157	2.24	11.37
2151E	08-06-1909	I	76	1.08	12.45
2404E	01-27-1911	I	110.8	1.58	14.03
3965E	02-01-1919	I	20	0.28	14.31
4051E	12-05-1919	D,I	138.5	1.97	16.28
4221E	09-23-1920	I	108	1.54	17.82

Associated Storage Rights: None

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	5	2	0

Losses: Approximately 15 percent by the end of the ditch

References: Dave Pelloux, Interview, State Engineer’s Office, 4 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Crown	Dec. 31, 1884	639.75	9.13	CFS	OS	Adj	Clear Creek
1269	E	Enl. Crown	Aug. 24, 1904	48.39	0		SS	Adj	Clear Creek
1347	E	Enl. Crown	Jan. 23, 1905	157	2.24	CFS	OS	Adj	Clear Creek
2151	E	Enl. Crown	Aug. 6, 1909	76	1.08	CFS	OS	Adj	Clear Creek
2404	E	Enl. Crown	Jan. 27, 1911	110.8	1.59	CFS	OS	Una	Clear Creek
3965	E	Enl. Crown	Feb. 1, 1919	20	0.28	CFS	OS	Adj	Clear Creek
4051	E	Enl. Crown	Dec. 5, 1919	138.5	1.97	CFS	OS	Adj	Clear Creek
4221	E	Enl. Crown	Sep.. 23, 1920	108	1.54	CFS	OS	Una	Clear Creek
5292	E	Enl. Crown	April 24, 1935	13	0		SS	Adj	Clear Creek

Name	Crown Ditch Diversion
Source	Clear Creek
District	2
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								314.08	844.30	618.84	0.00	0.00	1777.22
1975													
1976													
1977													
1978													
1979													
1980													
1981								547.99	484.11	306.76	308.11	152.33	1799.30
1982								0.00	845.24	729.11	606.37	266.66	2447.38
1983								82.16	333.46	458.42	0.00	0.00	874.04
1984								0.00	482.60	729.84	571.48	210.71	1994.63
1985								0.00	133.63	359.24	88.62	0.00	581.49
1986								531.06	1037.84	678.09	251.55	85.79	2584.33
1987								650.14	741.97	805.35	490.68	84.52	2772.66
1988								434.39	848.44	322.76	195.20	149.05	1949.84
1989								444.30	1025.02	872.34	518.33	43.40	2903.39
1990								450.01	819.64	652.60	552.02	174.55	2648.82
1991								79.21	696.66	672.98	490.92	92.81	2032.58
1992								584.70	559.16	477.47	401.52	374.40	2397.25
1993								221.11	661.30	315.58	542.67	451.36	2192.02
1994								415.78	708.99	654.84	381.08	0.00	2160.69
1995								54.15	755.99	762.86	344.69	244.25	2161.94
1996								98.74	798.02	682.98	335.92	133.17	2048.83
1997								187.56	679.56	658.01	58.46	0.00	1583.59
1998								395.99	1049.91	839.27	742.12	429.96	3457.25
1999								0.00	735.80	794.90	480.84	128.03	2139.57
Mean								274.57	712.08	619.61	368.03	151.05	2125.34
Max								650.14	1049.91	872.34	742.12	451.36	3457.25
Min								0.00	133.63	306.76	0.00	0.00	581.49

Notes:

1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement
3. May 1974 data included interpolated data using WRDS records.

Name	Crown Ditch Diversion
Source	Clear Creek
District	2
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	16-May	28-Jul	1
1975			
1976			
1977			
1978			
1979			
1980			
1981	1-May	15-Sep	19
1982	3-Jun	15-Sep	19
1983	25-May	28-Jul	13
1984	8-Jun	12-Sep	6
1985	25-Jun	19-Aug	8
1986	15-May	8-Sep	7
1987	14-May	10-Sep	6
1988	16-May	15-Sep	50
1989	15-May	4-Sep	6
1990	15-May	13-Sep	12
1991	28-May	14-Sep	8
1992	15-May	27-Sep	28
1993	21-May	30-Sep	16
1994	12-May	24-Aug	40
1995	26-May	18-Sep	17
1996	21-May	16-Sep	19
1997	19-May	11-Aug	19
1998	21-May	28-Sep	9
1999	3-Jun	8-Sep	11
Avg.	22-May	6-Sep	16
Earliest	1-May	28-Jul	1
Latest	25-Jun	30-Sep	50

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Des Moines headgate

Diversion: **DES MOINES DITCH DIVERSION**

Date: 4 Oct. 2000

Diversion Description: Headgate consists of a single, 6.2 x 1.5-foot rectangular steel gate operated with Waterman-type screw (badly bent), mounted in concrete headwall, adjacent to a rock dam.

Diversion Location: The Des Moines Ditch diversion is located on the main stem of Clear Creek between the confluences of Clear Creek with Piney and Rock creeks.

Headgate:

Lat.	Long.
N 44° 26' 52.4"	W 106° 34' 34.3"

Flume:

Lat.	Long.
N 44° 27' 19.6"	W 106° 34' 6.7"

Des Moines flume

Conveyance Description: Open channel canal, approximately 3.7 mi. long

Direct Flow Water Rights:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	09-15-1884	I	200	2.86	2.86
Terr.	06-01-1885	I	160.9	2.30	5.16
Terr.	06-01-1885	I	458.6	6.55	11.71
1174E	01-19-1904	I	205	2.92	14.63

Associated Storage Rights: Irrigators on the Des Moines Ditch use water stored in Willow Park, Lake DeSmet, and Healy reservoirs.

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	10	5	2

Losses: Approximately 10 percent by the end of the ditch

References: Carmine Loguidice, Interview, State Engineer’s Office, 4 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Des Moines, 1st Appropriation	Sep. 15, 1884	200	2.86	CFS	OS	Adj	Clear Creek
1174	E	Enl. Des Moines L&C CO (Big Bonanza)	Jan. 19, 1904	205	2.92	CFS	OS	Adj	Clear Creek
6270	E	Enl. Des Moines	Oct. 5, 1960	11.2	0.16	CFS	OS	Adj	Clear Creek

Name	Des Moines Ditch Diversion
Source	Clear Creek
District	2
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								278.54	289.51	268.96	0.00	0.00	837.01
1975													
1976													
1977													
1978													
1979													
1980													
1981								350.78	314.03	471.87	224.42	192.79	1553.89
1982								0.00	623.43	679.81	761.75	571.24	2636.23
1983								40.34	707.38	618.84	0.00	0.00	1366.56
1984								0.00	531.79	700.94	476.71	221.55	1930.99
1985								0.00	84.73	481.85	218.58	95.61	880.77
1986								326.80	665.44	533.10	480.65	162.86	2168.85
1987								398.94	298.11	660.91	329.09	48.48	1735.53
1988								281.94	536.14	504.57	375.16	137.58	1835.39
1989								231.15	235.86	339.24	338.48	71.83	1216.56
1990								106.13	188.34	287.84	180.30	146.43	909.04
1991								123.65	174.35	281.10	174.31	169.86	923.27
1992								209.39	187.85	205.21	367.60	148.93	1118.98
1993								108.61	117.53	236.36	254.48	29.35	746.33
1994								95.76	271.27	258.25	185.45	0.00	810.73
1995								3.58	146.70	446.96	177.93	87.86	863.03
1996								93.22	267.39	358.96	144.72	43.14	907.43
1997								54.88	61.64	193.42	5.53	0.00	315.47
1998								777.23	768.85	1356.61	410.56	75.98	3389.23
1999								0.00	88.13	451.67	265.78	0.00	805.58
Mean								174.05	327.92	466.82	268.58	110.17	1347.54
Max								777.23	768.85	1356.61	761.75	571.24	3389.23
Min								0.00	61.64	193.42	0.00	0.00	315.47

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Des Moines Ditch Diversion
Source	Clear Creek
District	2
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	14-May	20-Jul	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	4-May	24-Sep	14
1982	3-Jun	24-Sep	12
1983	30-May	26-Jul	9
1984	2-Jun	11-Sep	9
1985	25-Jun	18-Sep	5
1986	20-May	8-Sep	5
1987	15-May	10-Sep	7
1988	16-May	15-Sep	4
1989	16-May	14-Sep	7
1990	23-May	14-Sep	12
1991	21-May	14-Sep	8
1992	15-May	27-Sep	27
1993	7-May	14-Sep	16
1994	20-May	24-Aug	40
1995	26-May	18-Sep	38
1996	17-May	16-Sep	19
1997	19-May	13-Aug	21
1998	15-May	28-Sep	9
1999	3-Jun	30-Aug	20
Avg.	21-May	7-Sep	14
Earliest	4-May	20-Jul	0
Latest	25-Jun	28-Sep	40

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **FOUR LAKES & FRENCH CREEK DITCH DIVERSION**
AKA: Four Lakes (at French Creek)

Date: 18 Oct. 2000

Four Lakes & French Creek headgates

Diversion Description: Headgate consists of two, 5.5 x 13.5-foot rectangular steel gates in steel slider raised/lowered by Waterman-type screws mounted in a corrugated steel headwall.

Diversion Location: The Four Lakes & French Creek Ditch diversion is located on the North Fork of Clear Creek and diverts water to Johnson Creek (a tributary to Rock Creek) through French Creek and Penrose Ditch.

Four Lakes & French Creek flume

Headgate:

Lat.	Long.
N 44° 20' 15.9"	W 106° 59' 56.6"

Flume:

Lat.	Long.
N 44° 20' 16.5"	W 106° 59' 53.7"

Conveyance Description: Open channel canal, approximately 2 mi. long.

Direct Flow Water Rights: The direct-flow rights summary follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	06-01-1884	I	40	0.43	0.43
Terr.	06-01-1884	I	60	0.86	1.29
Terr.	06-01-1884	I	80	1.14	2.43
Terr.	06-01-1884	D,I	105	1.50	3.93
Terr.	06-01-1884	I	120	1.73	5.66
Terr.	06-01-1884	I	120	1.73	7.39
Terr.	06-01-1884	I,S	148	2.11	9.50
Terr.	06-01-1884	I	200	2.86	12.36
Terr.	06-01-1884	I	368	5.26	17.62
Terr.	06-01-1884	I	378.3	5.40	23.02
Terr.	06-01-1884	I	562.1	8.03	31.05
Terr.	06-01-1884	I	1041	14.00	45.05
Terr.	06-01-1886	I	130	1.86	46.91
307E	01-28-1898	I	135	1.92	48.83
1369E	04-07-1905	I	53	0.75	49.58
1404E	07-17-1905	I	52	0.75	50.33
2492E	08-30-1911	Supply Ditch	0	0.00	50.33

Note: Permit No. 2492E is adjudicated from Clear Creek to Moeller No. 3 and Robbin's ditches from French Creek.

Because Four Lakes diverts water from one tributary of Clear Creek to another (North Fork to French Creek), the waters destined for Johnson Creek are for supplemental supply, making those flows officially 0 cfs. But because Johnson Creek's direct flow is notoriously poor, this supplemental supply is put to *maximum use for most of the season. As a result, the flow destined for Penrose Ditch and Johnson Creek can reasonably be calculated using the Wyoming State Engineer's Office baseline allocation:*

*1 cfs/70 acres * 144.04 acres = 2.06 cfs*

The supplemental supply summary follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
4731E	01-28-1931	I	62.92	0	0
4731E	01-28-1931	I	81.12	0	0

Associated Storage Rights: None

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	2	0	0

Losses: Typical (10 percent) by the end of the ditch

References: Dave Pelloux, interview, State Engineer's Office, 25 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Four Lakes & French Creek Ditch and Flume Co.	June 1, 1884	3222.4	45.05	CFS	OS	Adj	North Fork Clear Creek
Terr	D	Four Lakes & French Creek	June 1, 1886	130	1.86	CFS	OS	Adj	North Fork Clear Creek
307	E	Enl. Four Lakes & French Creek	Jan. 28, 1898	135	1.92	CFS	OS	Adj	North Fork Clear Creek
1369	E	Enl. Four Lakes & French Creek Ditch and Flume Co.	April 7, 1905	53	0.75	CFS	OS	Adj	North Fork Clear Creek
1404	E	Enl. Four Lakes & French Creek	July 17, 1905	52	0.75	CFS	OS	Adj	North Fork Clear Creek
4731	E	Enl. Four Lakes & French Creek	Jan. 28, 1931	81.12	0		SS	Adj	North Fork Clear Creek
5285	E	Enl. Four Lakes & French Creek	April 24, 1935	113.3	0		SS	Una	North Fork Clear Creek
5308	E	Enl. Four Lakes & French Creek	Jan. 10, 1941	347.1	0		SS	Una	North Fork Clear Creek

Name	Four Lakes & French Creek Ditch Diversion
Source	North Fork Clear Creek
District	2
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972								0.00	244.76	1355.31	1200.40	604.32	3404.79
1973								0.00	1107.03	726.88	360.50	355.14	2549.55
1974								0.00	940.80	937.78	209.36	0.00	2087.94
1975								0.00	3209.33	3788.75	2112.02	1082.60	10192.70
1976								0.00	1092.57	3041.33	1027.60	1064.69	6226.19
1977								0.00	1111.83	1491.99	2046.88	1856.83	6507.53
1978								0.00	0.00	2091.81	2410.07	1154.52	5656.40
1979													
1980								0.00	3415.00	3025.00	1246.00	1094.00	8780.00
1981								0.00	0.00	3133.00	1780.00	1395.00	6308.00
1982								0.00	0.00	4380.00	3170.00	2010.00	9560.00
1983								0.00	0.00	3380.00	2320.00	1740.00	7440.00
1984								0.00	0.00	4320.00	2860.00	1440.00	8620.00
1985								1195.00	2229.00	2867.00	806.00	1121.00	8218.00
1986								0.00	3416.00	3867.00	2644.00	2482.00	12409.00
1987								0.00	3839.26	3591.00	2488.00	2083.00	12001.26
1988								0.00	2870.20	1261.70	2.70	0.00	4134.60
1989								2090.70	3969.40	3953.00	2060.50	160.30	12233.90
1990								683.06	3244.97	2850.49	1536.66	589.62	8904.80
1991								30.00	3393.90	2375.10	931.60	0.00	6730.60
1992								1740.10	3643.70	2876.20	1302.60	634.00	10196.60
1993								825.30	2698.70	2893.10	1858.30	535.10	8810.50
1994								1304.90	2639.20	1591.60	1443.70	741.40	7720.80
1995								5.40	2512.50	3843.30	1197.90	725.60	8284.70
1996								0.00	4091.00	2950.00	888.10	1045.20	8974.30
1997								0.00	0.00	3244.30	1657.90	1106.10	6008.30
1998								751.60	2987.60	3718.30	1739.90	1049.70	10247.10
1999								0.00	2404.80	2893.60	1296.10	1069.10	7663.60
Mean								319.48	2039.32	2831.39	1577.66	1005.16	7773.01
Max								2090.70	4091.00	4380.00	3170.00	2482.00	12409.00
Min								0.00	0.00	726.88	2.70	0.00	2087.94

Notes:
1. Monthly data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement
3. Monthly data for June 1987 is derived from spot measurements in the Hydrographers' Annual Reports.

Name	Four Lakes & French Creek Ditch Diversion
Source	North Fork Clear Creek
District	2
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972	26-Jun	30-Sep	0
1973	6-Jun	28-Sep	0
1974	1-Jun	14-Aug	0
1975	1-Jun	30-Sep	0
1976	17-Jun	30-Sep	0
1977	15-Jun	30-Sep	0
1978	13-Jul	30-Sep	0
1979			
1980	1-Jun	30-Sep	0
1981	1-Jul	30-Sep	0
1982	1-Jul	26-Sep	0
1983	1-Jul	30-Sep	0
1984	1-Jul	30-Sep	0
1985	20-May	30-Sep	0
1986	11-Jun	30-Sep	0
1987	4-Jun	30-Sep	5
1988	7-Jun	1-Aug	0
1989	11-May	5-Sep	0
1990	22-May	24-Sep	0
1991	31-May	26-Aug	0
1992	7-May	30-Sep	0
1993	20-May	30-Sep	0
1994	18-May	30-Sep	0
1995	31-May	30-Sep	0
1996	1-Jun	30-Sep	0
1997	1-Jul	30-Sep	0
1998	24-May	30-Sep	0
1999	10-Jun	21-Sep	0
Avg.	7-Jun	23-Sep	0
Earliest	7-May	1-Aug	0
Latest	13-Jul	30-Sep	5

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **FRANK G. HOPKINS DITCH DIVERSION**
AKA: Hopkins (on Clear Creek)

Frank G. Hopkins headgate

Date: 4 Oct. 2000

Diversion Description: Headgate consists of a single, 5 x 1-foot rectangular steel gate operated with Waterman-type screw (bent), mounted in concrete headwall.

Diversion Location: The Frank G. Hopkins diversion is located on the main stem of Clear Creek between the confluences of Clear Creek with Piney and Rock creeks.

Headgate:

Lat.	Long.
N 44° 24' 50.3"	W 106° 36' 2.2"

Flume:

Lat.	Long.
N 44° 24' 51.1"	W 106° 36' 0.7"

Frank G. Hopkins flume

Conveyance Description: Open channel canal, approximately 3.2 mi. long.

Direct Flow Water Rights:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
617	11-27-1893	I	167.7	2.39	2.39
3854E	02-01-1918	I	146.00	2.08	4.47
4463E	05-21-1925	I	115.32	1.64	6.11
5455E	05-07-1903	I	70	1.00	7.11

Associated Storage Rights: Irrigators on the Frank G. Hopkins Ditch use water stored in Willow Park, Lake DeSmet, and Healy reservoirs.

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	4	2	0

Losses: Approximately 10 percent by the end of the ditch

References: Carmine Loguidice, Interview, State Engineer's Office, 4 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
617	D	Frank G. Hopkins	Nov. 27, 1893	167.7	2.39	CFS	OS	Adj	Clear Creek
5455	D	Smith (Frank G. Hopkins)	May 7, 1903	70	1	CFS	OS	Adj	Clear Creek
3854	E	Enl. Frank G. Hopkins	Feb. 1, 1918	146	2.08	CFS	OS	Adj	Clear Creek
4463	E	Frank G. Hopkins	May 21, 1925	115.32	1.64	CFS	OS	Adj	Clear Creek

Name	Frank G. Hopkins Ditch Diversion
Source	Clear Creek
District	2
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								569.43	846.74	745.55	0.00	0.00	2161.72
1975													
1976													
1977													
1978													
1979													
1980													
1981								1032.90	1400.67	1112.20	168.21	0.00	3713.98
1982								0.00	816.58	474.15	406.16	557.40	2254.29
1983								38.42	1153.60	373.05	0.00	0.00	1565.07
1984								0.00	1182.06	968.04	963.33	445.92	3559.35
1985								0.00	0.00	644.51	260.39	239.10	1144.00
1986								365.02	939.61	521.28	621.97	52.00	2499.88
1987								312.09	442.91	333.40	312.40	0.00	1400.80
1988								66.03	662.11	468.70	38.68	0.00	1235.52
1989								268.35	373.88	509.75	176.77	138.84	1467.59
1990								176.53	263.14	567.93	96.20	0.00	1103.80
1991								204.06	227.26	380.29	263.73	166.61	1241.95
1992								321.32	245.96	149.36	232.04	0.00	948.68
1993								192.79	213.40	431.46	154.11	117.92	1109.68
1994								331.76	712.05	553.14	404.27	0.00	2001.22
1995								41.61	351.89	842.20	279.01	0.00	1514.71
1996								31.43	766.70	596.43	202.32	103.15	1700.03
1997								2.53	443.08	678.04	0.00	0.00	1123.65
1998								507.29	345.85	650.97	1062.16	355.63	2921.90
1999								0.00	226.59	766.23	395.31	0.00	1388.13
Mean								223.08	580.70	588.33	301.85	108.83	1802.80
Max								1032.90	1400.67	1112.20	1062.16	557.40	3713.98
Min								0.00	0.00	149.36	0.00	0.00	948.68

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Frank G. Hopkins Ditch Diversion
Source	Clear Creek
District	2
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	14-May	20-Jul	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	3-May	9-Aug	14
1982	13-Jun	24-Sep	17
1983	30-May	26-Jul	9
1984	2-Jun	11-Sep	9
1985	7-Jul	18-Sep	17
1986	25-May	5-Sep	7
1987	19-May	12-Aug	17
1988	29-May	8-Aug	7
1989	16-May	14-Sep	8
1990	16-May	15-Aug	17
1991	15-May	12-Sep	13
1992	15-May	25-Aug	28
1993	26-May	14-Sep	27
1994	20-May	24-Aug	40
1995	26-May	1-Sep	22
1996	21-May	16-Sep	19
1997	29-May	23-Jul	40
1998	21-May	15-Sep	30
1999	3-Jun	30-Aug	30
Avg.	25-May	26-Aug	19
Earliest	3-May	20-Jul	0
Latest	7-Jul	24-Sep	40

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **HILLYER & ONSLOW DITCH DIVERSION**

Date: 4 Oct. 2000

Diversion Description: Diversion consists of a large concrete dam and adjacent headgate incorporated into it.

Diversion Location: The Hillyer & Onslow Ditch diversion is located on the main stem of Clear Creek between the confluences of Clear Creek with Rock and Piney creeks.

Hillyer & Onslow diversion

Diversion:

Lat.	Long.
N 44° 24' 6.3"	W 106° 36' 52.2"

Conveyance Description: Open channel canal, approximately 2.7 mi. long, approximately 600 feet of which is in pipe.

Direct Flow Water Rights:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	07-01-1881	I	129	1.84	1.84
11100	10-01-1911	I	52.00	0.74	2.58

Associated Storage Rights: Irrigators on the Hillyer & Onslow Ditch use water from Willow Park, Lake DeSmet, and Healy reservoirs.

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg.Yr.	Dry Yr.
Clear Creek	10	5	2

Losses: Approximately 15 percent by the end of the ditch

References: Carmine Loguidice, Interview, State Engineer’s Office, 4 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Hillyer & Onslow	July 1, 1881	129	1.84	CFS	OS	Adj	Clear Creek

Name	Hillyer & Onslow Ditch Diversion
Source	Clear Creek
District	2
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								322.35	750.09	592.26	0.00	0.00	1664.70
1975													
1976													
1977													
1978													
1979													
1980													
1981													
1982													
1983													
1984													
1985								0.00	68.43	236.63	0.00	0.00	305.06
1986								0.00	411.28	114.80	23.68	0.00	549.76
1987								115.20	297.50	322.54	0.00	0.00	735.24
1988								45.68	244.49	128.44	0.00	0.00	418.61
1989								347.87	603.09	616.02	153.24	0.00	1720.22
1990								55.88	216.20	280.04	50.34	26.92	629.38
1991								77.30	156.86	308.74	144.74	0.00	687.64
1992								129.32				10.23	
1993								81.64	74.81	121.72	96.89	0.00	375.06
1994								40.31	230.02	191.10	27.64	0.00	489.07
1995								5.91	242.11	367.91	2.25	0.00	618.18
1996								9.34	99.18	99.93	121.55	115.97	445.97
1997													
1998								48.66	116.96	309.30	266.78	45.85	787.55
1999								0.00	276.52	675.60	206.59	37.02	1195.73
Mean								85.30	270.54	311.79	78.12	15.73	758.73
Max								347.87	750.09	675.60	266.78	115.97	1720.22
Min								0.00	68.43	99.93	0.00	0.00	305.06

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Hillyer & Onslow Ditch Diversion		
Source	Clear Creek		
District	2		
Data	First & Last Dates, Max. Days		
Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	14-May	20-Jul	0
1975			
1976			
1977			
1978			
1979			
1980			
1981			
1982			
1983			
1984			
1985	25-Jun	22-Jul	7
1986	5-Jun	4-Aug	11
1987	29-May	27-Jul	34
1988	29-May	21-Jul	14
1989	16-May	10-Aug	6
1990	23-May	14-Sep	35
1991	24-May	19-Aug	35
1992	15-May	4-Sep	58
1993	26-May	18-Aug	42
1994	26-May	19-Aug	40
1995	26-May	3-Aug	46
1996	21-May	16-Sep	19
1997			
1998	26-May	15-Sep	34
1999	3-Jun	8-Sep	35
Avg.	26-May	16-Aug	28
Earliest	14-May	20-Jul	0
Latest	25-Jun	16-Sep	58

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **JOHNSON-HOLT DITCH DIVERSION**
AKA: Johnson (on Clear Creek)

Date: 4 Oct. 2000

Diversion Description: Headgate consists of a single, 4.2 x 2.6-foot rectangular steel gate operated with Waterman-type screw, mounted in concrete headwall, adjacent to a rock dam.

Johnson-Holt headgate

Diversion Location: The Johnson-Holt diversion is located on the main stem of Clear Creek between the confluences of Clear Creek and North Fork and Sand creeks.

Headgate:

Lat.	Long.
N 44° 19' 46.3"	W 106° 45' 28.9"

Flume:

Lat.	Long.
N 44° 19' 46.1"	W 106° 45' 27.4"

Johnson-Holt flume

Conveyance Description: Open channel canal, approximately 6.0 mi. long.

Direct Flow Water Rights:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
5688	12-01-1903	I	135.47	1.93	1.93
1334E	01-14-1905	I	14.16	0.20	2.13
1334E	01-14-1905	D,I	576.00	8.22	10.35
2391E	01-25-1911	I	203.96	2.91	13.26
2621E	06-17-1912	I	209.00	2.98	16.24
2627E	06-17-1912	I	174.00	2.48	18.72
3896E	04-22-1918	I	111.00	1.58	20.30
4383E	06-28-1923	I	143.77	2.06	22.36

Associated Storage Rights: None

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	5	2	0

Losses: Approximately 20 percent by the end of the ditch

References: Dave Pelloux, Interview, State Engineer’s Office, 25 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
1334	E	Enl. Johnson or Johnson-Holt	Jan. 14, 1905	590.16	8.42	CFS	OS	Adj	Clear Creek
2391	E	Enl. Johnson-Holt	Jan. 25, 1911	203.96	2.91	CFS	OS	Adj	Clear Creek
2627	E	Enl. Johnson or Johnson-Holt	June 17, 1912	174	2.48	CFS	OS	Adj	Clear Creek
4383	E	Enl. Johnson/Johnson-Holt	June 28, 1923	143.77	2.06	CFS	OS	Adj	Clear Creek

Name	Johnson-Holt Ditch Diversion
Source	Clear Creek
District	2
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								461.08	620.65	348.20	0.00	0.00	1429.93
1975													
1976													
1977													
1978													
1979													
1980													
1981								483.48	405.47	482.08	27.15	0.00	1398.18
1982								0.00	437.70	900.57	713.87	238.02	2290.16
1983								187.02	833.52	696.84	0.00	0.00	1717.38
1984								0.00	539.85	726.71	570.81	197.97	2035.34
1985								0.00	100.73	101.32	0.00	0.00	202.05
1986								444.74	923.58	616.58	123.11	0.00	2108.01
1987								526.30	373.24	665.46	408.54	49.60	2023.14
1988								526.08	727.54	80.77	0.00	0.00	1334.39
1989								495.30	900.99	589.98	539.32	0.00	2525.59
1990								326.21	855.08	611.04	487.71	0.00	2280.04
1991								164.18	705.75	392.65	146.45	101.75	1510.78
1992								377.53	601.21	188.03	174.35	84.40	1425.52
1993								116.65	331.29	162.88	500.62	92.21	1203.65
1994								352.94	355.14	221.48	280.96	0.00	1210.52
1995								48.03	554.89	620.39	227.82	65.89	1517.02
1996								70.16	402.78	300.35	194.03	160.83	1128.15
1997								266.25	486.51	464.32	24.03	0.00	1241.11
1998								364.70	523.56	479.83	221.10	176.28	1765.47
1999								0.00	249.90	170.00	21.02	0.00	440.92
Mean								260.53	546.47	440.97	233.04	58.35	1539.37
Max								526.30	923.58	900.57	713.87	238.02	2525.59
Min								0.00	100.73	80.77	0.00	0.00	202.05

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement
3. May 1974 data includes interpolated data using WRDS records.

Name	Johnson-Holt Ditch Diversion
Source	Clear Creek
District	2
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	16-May	28-Jul	1
1975			
1976			
1977			
1978			
1979			
1980			
1981	1-May	2-Aug	27
1982	3-Jun	15-Sep	19
1983	25-May	28-Jul	13
1984	8-Jun	12-Sep	6
1985	25-Jun	7-Jul	9
1986	15-May	14-Aug	5
1987	14-May	10-Sep	5
1988	16-May	5-Jul	8
1989	15-May	29-Aug	6
1990	15-May	22-Aug	12
1991	20-May	14-Sep	8
1992	15-May	27-Sep	28
1993	21-May	14-Sep	16
1994	12-May	24-Aug	40
1995	26-May	18-Sep	28
1996	21-May	16-Sep	35
1997	19-May	11-Aug	19
1998	15-May	28-Sep	14
1999	3-Jun	24-Aug	11
Avg.	21-May	25-Aug	16
Earliest	1-May	5-Jul	1
Latest	25-Jun	28-Sep	40

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **KENDRICK DITCH DIVERSION**

Date: 4 Oct. 2000

Diversion Description: Landowner would not permit access.

Diversion Location: The Kendrick Ditch diversion is located on the main stem of Clear Creek just upstream of the creek's confluence with the Powder River. Clear Creek itself is a tributary to the Powder River.

Headgate:

Lat.	Long.
N 44° 26' 52.4"	W 106° 34' 34.3"

Flume:

Lat.	Long.
N 44° 27' 19.6"	W 106° 34' 6.7"

Conveyance Description: Open channel canal, approximately 5 mi. long.

Direct Flow Water Rights:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
10735	10-18-1911	I	135	1.93	1.93
10735	10-18-1911	I	240	3.43	5.36
10735	10-18-1911	I	745	10.64	16.00
2763E	05-17-1912	Power	0	35.00	51.00
5532E	12-27-1949	I	62.4	0.89	51.89
5532E	12-27-1949	I	141.9	2.02	53.91
5604E	02-25-1952	I	103.6	1.48	55.39
6773E	06-01-1977	I	73	1.04	56.43
6766E	02-12-1979	I	145.6	2.09	58.52

Associated Storage Rights: None.

Irrigation Practices: See introduction to Clear Creek drainage

Some sprinkling in K Ranch; majority is flood.

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Powder River	50	35	25

Losses: Approximately 10 percent

References: Carmine Loguidice, Interview, State Engineer's Office, 4 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
10735	D	Kendrick	Oct. 18, 1911	1120	16	CFS	OS	Adj	Clear Creek
2763	E	Enl. Kendrick	May 17, 1912	1120	16	CFS	OS	Adj	Clear Creek
5532	E	Enl. Kendrick Canal	Dec. 27, 1949	204.3	2.91	CFS	OS	Adj	Clear Creek
5604	E	Enl. Kendrick Canal	Feb. 25, 1952	103.6	1.48	CFS	OS	Adj	Clear Creek
6773	E	Enl. Kendrick Canal	June 1, 1977	73	1.04	CFS	OS	Adj	Clear Creek

Name	Kendrick Ditch Diversion
Source	Clear Creek
District	9
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								0.00	156.59	1134.64	1282.39	0.00	2573.62
1975								0.00	857.63	1493.89	1359.75	0.00	3711.27
1976								0.00	0.00	420.50	1230.43	827.29	2478.22
1977								239.01	811.24	795.57	1607.40	1343.01	4796.23
1978								238.71	441.18	777.34	858.05	777.68	3092.96
1979													
1980								1200.00	1225.00	1248.00	1444.00	978.00	6095.00
1981								1260.00	646.00	466.00	533.00	405.00	3310.00
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
Mean								419.67	591.09	905.13	1187.86	618.71	3722.47
Max								1260.00	1225.00	1493.89	1607.40	1343.01	6095.00
Min								0.00	0.00	420.50	533.00	0.00	2478.22

Notes:
1. Monthly data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement
3. June 1977 data contains interpolated data using the WRDS records.

Name	Kendrick Ditch Diversion
Source	Clear Creek
District	9
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	26-Jun	29-Aug	0
1975	1-Jun	31-Aug	0
1976	19-Jul	30-Sep	0
1977	26-May	30-Sep	14
1978	1-May	30-Sep	0
1979			
1980	6-May	30-Sep	0
1981	1-May	30-Sep	0
1982			
1983			
1984			
1985			
1986			
1987			
1988			
1989			
1990			
1991			
1992			
1993			
1994			
1995			
1996			
1997			
1998			
1999			
Avg.	29-May	21-Sep	2
Earliest	1-May	29-Aug	0
Latest	19-Jul	30-Sep	14

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **PRATT & FERRIS NO. 2 DITCH DIVERSION**
AKA: P&F No. 2

Date: 4 Oct. 2000

Note: The Pratt & Ferris No. 2 diversion diverts more than 50 cfs.

Pratt & Ferris No. 2 diversion structure

Diversion Description: Headgate consists of a single, 3 x 4.3-foot rectangular steel gate operated with Waterman-type screw, mounted in concrete headwall.

Pratt & Ferris No. 2 flume

Diversion Location: The Pratt & Ferris No. 2 diversion is located on the main stem of Clear Creek just upstream of the town of Clearmont.

Headgate:

Lat.	Long.
N 44° 37' 1.1"	W 106° 24' 7.3"

Flume:

Lat.	Long.
N 44° 37' 13.1"	W 106° 23' 57.3"

Conveyance Description: Open channel canal, approximately 4.4 mi. long, terminates into Pratt & Ferris No. 3, where tailwaters are distributed.

Direct Flow Water Rights:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	Summer 1884	I	750.00	10.71	10.71
966E	01-09-1903	I	115.00	1.64	12.35
1040E	05-09-1903	I	119.43	1.71	14.06
1853E	01-10-1908	I	20.00	0.28	14.34
1853E	01-10-1908	I	125.00	1.79	16.13
2672E	11-06-1912	I	572.00	8.17	24.30
5580E	07-20-1951	D,I,S	15.40	0.21	24.51
6532E	07-02-1973	I	176.90	2.53	27.04
6533E	05-24-1974	I	87.80	1.25	28.29

Associated Storage Rights: Irrigators on the Pratt & Ferris No. 2 Ditch use water from Lake DeSmet reservoir.

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	50	35	25

Losses: Approximately 10 percent by the end of the ditch

References: Carmine LoGuidice, water commissioner, State Engineer's Office, interview, 4 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr.	D	Pratt & Ferris No. 2 (Roebling Pump and Pipe Line)	Sep. 21, 1884	750	10.71	CFS	OS	Adj	Clear Creek
966	E	Enl. Pratt & Ferris No. 2	Jan. 9, 1903	115	1.64	CFS	OS	Adj	Clear Creek
1040	E	Enl. Pratt & Ferris No. 2	May 9, 1903	119.43	1.71	CFS	OS	Adj	Clear Creek
1853	E	Enl. Pratt & Ferris No. 2	Jan. 10, 1908	20	0.28	CFS	OS	Adj	Clear Creek
1853	E	Enl. Pratt & Ferris No. 2	Jan. 10, 1908	145	2.07	CFS	OS	Adj	Clear Creek
2672	E	Enl. Pratt & Ferris No. 2	Nov. 6, 1912	572	8.17	CFS	OS	Adj	Clear Creek
5580	E	Enl. Pratt & Ferris No. 2	July 20, 1951	15.4	0.21	CFS	OS	Adj	Clear Creek
6532	E	Enl. Pratt & Ferris No. 2	July 2, 1973	176.9	2.53	CFS	OS	Adj	Clear Creek
6533	E	Enl. Pratt & Ferris No. 2	May 24, 1974	87.8	1.25	CFS	OS	Adj	Clear Creek

Name	Pratt & Ferris No. 2 Ditch Diversion
Source	Clear Creek
District	9
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								0.00	728.85	1905.90	1672.16	0.00	4306.91
1975													
1976													
1977													
1978													
1979													
1980													
1981								1919.55	1151.46	2426.18	1618.71	999.47	8115.37
1982								805.03	1235.93	1881.08	1872.13	776.66	6570.83
1983								0.00	1531.44	2561.92	1805.57	963.34	6862.27
1984								0.00	1061.73	2133.82	1690.66	248.74	5134.95
1985								1671.67	1281.62	1668.00	1781.55	927.57	7330.41
1986								777.77	2168.78	5238.34	1999.34	195.97	10380.20
1987								1485.58	1592.34	1694.73	1315.48	0.00	6088.13
1988								0.00	740.96	2051.41	2075.37	447.07	5314.81
1989								1017.72	2224.56	2401.29	1827.77	889.98	8361.32
1990								927.57	1757.19	2224.43	2474.48	798.84	8182.51
1991								871.74	889.19	2038.31	2039.80	1009.78	6848.82
1992								1131.47	1541.95	2219.40	2052.79	959.11	7904.72
1993								1875.34	1167.80	1146.18	2006.35	1451.90	7647.57
1994								827.98	2178.73	2319.99	1845.52	1553.16	8725.38
1995								19.54	831.36	2299.30	1709.10	1838.56	6697.86
1996								267.08	368.75	2366.75	1966.20	671.44	5640.22
1997								0.00	1161.29	1931.69	528.08	403.49	4024.55
1998								627.92	1174.42	1499.41	1533.51	689.09	5524.35
1999								0.00	384.59	1699.95	1584.18	925.39	4594.11
Mean								711.30	1258.65	2185.40	1769.94	787.48	6712.76
Max								1919.55	2224.56	5238.34	2474.48	1838.56	10380.20
Min								0.00	368.75	1146.18	528.08	0.00	4024.55

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Pratt & Ferris No. 2 Ditch Diversion
Source	Clear Creek
District	9
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	17-Jun	31-Aug	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	1-May	28-Sep	13
1982	17-May	20-Sep	16
1983	3-Jun	30-Sep	8
1984	1-Jun	4-Sep	11
1985	9-May	16-Sep	10
1986	19-May	12-Sep	8
1987	12-May	21-Aug	21
1988	21-Jun	8-Sep	13
1989	15-May	15-Sep	5
1990	18-May	14-Sep	11
1991	15-May	13-Sep	17
1992	15-May	18-Sep	11
1993	5-May	29-Sep	9
1994	23-May	30-Sep	7
1995	31-May	27-Sep	5
1996	7-May	20-Sep	20
1997	3-Jun	11-Sep	15
1998	22-May	16-Sep	22
1999	10-Jun	20-Sep	18
Avg.	22-May	16-Sep	12
Earliest	1-May	21-Aug	0
Latest	21-Jun	30-Sep	22

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **PRATT & FERRIS NO. 3 DITCH DIVERSION**
AKA: P&F No. 3

Date: 4 Oct. 2000

Pratt & Ferris No. 3 headgate

Diversion Description: Headgate consists of two, 2 x 3.9-foot rectangular steel gates operated with Waterman-type screws, mounted in concrete throats adjacent to a concrete dam.

Pratt & Ferris No. 3 flume

Diversion Location: The Pratt & Ferris No. 3 Ditch diversion is located on the main stem of Clear Creek just downstream of the town of Clearmont.

Headgate:

Lat.	Long.
N 44° 39' 46.7"	W 106° 21' 55.1"

Flume:

Lat.	Long.
N 44° 40' 16.3"	W 106° 21' 47.9"

Conveyance Description: Open channel canal, approximately 9 mi. long.

Direct Flow Water Rights:

Permit	Priority date	Use	Acres	Flow (cfs)	Cumulative Flow (cfs)
Terr.	06-01-1884	I	1500	21.43	21.43
1041E	05-09-1903	I	45	0.64	22.07
1041E	05-09-1903	I	55	0.78	22.85
1041E	05-09-1903	I	1205	17.21	40.06
5593E	11-13-1951	I,S	15	0.21	40.27

Associated Storage Rights: Irrigators on the Pratt & Ferris No. 3 Ditch use water from Lake DeSmet reservoir.

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	50	35	25

Losses: Approximately 10 percent by the end of the ditch

References: Carmine Loguidice, Interview, State Engineer's Office, 4 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Pratt & Ferris No. 3	Aug. 1, 1884	1500	21.43	CFS	OS	Adj	Clear Creek
1041	E	Enl. Pratt & Ferris No. 3	May 9, 1903	1305	19.28	CFS	OS	Adj	Clear Creek
3872	E	Enl. Pratt & Ferris No. 3	Feb. 13, 1918	526.6	7.53	CFS	OS	Una	Clear Creek
5593	E	Enl. Pratt & Ferris No. 3	Nov. 13, 1951	15	0.21	CFS	OS	Adj	Clear Creek

Name	Pratt & Ferris No. 3 Ditch Diversion
Source	Clear Creek
District	9
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								0.00	973.71	1657.31	2648.79	0.00	5279.81
1975													
1976													
1977													
1978													
1979													
1980													
1981								2146.91	1520.73	2691.97	1720.36	1469.06	9549.03
1982								341.19	1252.63	2033.82	1464.66	1360.73	6453.03
1983								316.19	1895.68	1949.50	1960.07	1153.00	7274.44
1984								0.00	1643.59	2564.21	1433.55	219.13	5860.48
1985								1823.80	2113.98	2905.44	1385.85	692.73	8921.80
1986								599.93	1437.50	3023.30	1902.91	746.03	7709.67
1987								1558.31	2159.65	2472.26	1229.22	0.00	7419.44
1988								0.00	913.85	2205.87	2083.73	344.43	5547.88
1989								512.23	2716.60	3079.20	2699.21	1132.56	10139.80
1990								1077.12	2616.30	2655.77	2603.70	956.93	9909.82
1991								728.53	1800.48	2718.46	2015.96	1092.00	8355.43
1992								1159.73	2095.73	2146.71	2050.11	160.07	7612.35
1993								1501.98	1240.96	1547.64	2094.16	1822.86	8207.60
1994								534.73	2382.64	2223.70	2273.00	1845.38	9259.45
1995								0.00	535.75	1556.30	2161.05	1260.50	5513.60
1996								26.28	240.69	2265.46	2247.72	855.41	5635.56
1997								0.00	1069.04	1727.64	974.62	463.64	4234.94
1998								672.91	1802.35	1781.11	1994.44	1222.88	7473.69
1999								0.00	305.45	2050.11	2100.15	1173.37	5629.08
Mean								649.99	1535.87	2262.79	1952.16	898.54	7299.35
Max								2146.91	2716.60	3079.20	2699.21	1845.38	10139.80
Min								0.00	240.69	1547.64	974.62	0.00	4234.94

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Pratt & Ferris No. 3 Ditch Diversion
Source	Clear Creek
District	9
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	17-Jun	31-Aug	0
1975			
1976			
1977	Erroneous	Data	
1978			
1979			
1980			
1981	1-May	28-Sep	14
1982	21-May	20-Sep	16
1983	26-May	30-Sep	8
1984	1-Jun	4-Sep	10
1985	9-May	16-Sep	10
1986	19-May	12-Sep	8
1987	12-May	21-Aug	21
1988	21-Jun	8-Sep	13
1989	15-May	15-Sep	5
1990	18-May	14-Sep	11
1991	15-May	13-Sep	17
1992	15-May	2-Sep	7
1993	7-May	29-Sep	7
1994	23-May	30-Sep	7
1995	2-Jun	25-Sep	7
1996	7-May	20-Sep	21
1997	3-Jun	11-Sep	15
1998	22-May	16-Sep	22
1999	10-Jun	20-Sep	18
Avg.	22-May	15-Sep	12
Earliest	1-May	21-Aug	0
Latest	21-Jun	30-Sep	22

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion:	**REDMAN DITCH DIVERSION**
Date:	4 Oct. 2000
Diversion Description:	Headgate consists of a single, 6.2 x 1.7-foot rectangular steel gate operated with a Waterman-type screw, mounted in a concrete headwall.


Redman flume

Diversion Location: The Redman diversion is located on the main stem of Clear Creek between the confluences of Clear Creek with Piney and Rock creeks.

Headgate:

Lat.	Long.
N 44° 21' 47.2"	W 106° 38' 59.1"

Flume:

Lat.	Long.
N 44° 21' 57.6"	W 106° 38' 52.3"

Conveyance Description: Open channel canal, approximately 4.5 mi. long.

Direct Flow Water Rights:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	03-20-1884	I	55	0.78	0.78
Terr.	03-20-1884	I	165	2.36	3.14
Terr.	03-20-1884	I	340	4.86	8
Terr.	03-20-1884	I	658	9.4	17.4

Associated Storage Rights: None

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	5	2	0

Side cuts drain to draws feeding other fields, lowering return.

Losses: Approximately 20 percent by the end of the ditch

References: Carmine Loguidice, Interview, State Engineer’s Office, 4 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Redman	March 20, 1884	1218	17.4	CFS	OS	Adj	Clear Creek

Name	Redman Ditch Diversion
Source	Clear Creek
District	2
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								358.49	762.39	487.50	0.00	0.00	1608.38
1975													
1976													
1977													
1978													
1979													
1980													
1981								363.24	292.29	190.06	99.59	0.00	945.18
1982								0.00	572.73	296.82	1000.63	124.87	1995.05
1983								175.39	480.88	138.03	0.00	0.00	794.30
1984								0.00	303.72	250.66	261.54	90.05	905.97
1985								0.00	51.29	158.01	103.79	67.89	380.98
1986								50.05	364.40	331.65	74.18	0.00	820.28
1987								0.00	0.00	395.53	961.17	0.00	1356.70
1988								14.88	744.42	418.96	782.75	395.09	2356.10
1989								0.00	604.97	772.95	325.02	406.57	2109.51
1990								0.00	235.82	666.59	519.29	412.09	1833.79
1991								0.00	284.34	471.96	975.34	633.31	2364.95
1992								299.90				628.99	
1993								0.00	0.00	0.00	302.28	649.84	952.12
1994								0.00	90.52	275.22	119.40	0.00	485.14
1995								22.34	216.88	518.54	964.94	0.00	1722.70
1996								12.47	202.81	933.84	556.68	279.48	1985.28
1997								1.94	340.02	530.76	0.00	0.00	872.72
1998								111.04	480.32	469.67	357.05	2.52	1420.60
1999								0.00			700.61	59.86	
Mean								70.49	334.88	405.93	426.54	187.53	1383.88
Max								363.24	762.39	933.84	1000.63	649.84	2364.95
Min								0.00	0.00	0.00	0.00	0.00	380.98

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Redman Ditch Diversion
Source	Clear Creek
District	2
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	14-May	20-Jul	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	3-May	16-Aug	14
1982	3-Jun	12-Sep	12
1983	22-May	26-Jul	9
1984	3-Jun	11-Sep	10
1985	25-Jun	18-Sep	6
1986	20-May	14-Aug	8
1987	20-Jul	27-Aug	17
1988	29-May	15-Sep	4
1989	14-Jun	14-Sep	27
1990	6-Jun	14-Sep	12
1991	21-Jun	14-Sep	22
1992	25-May	27-Sep	69
1993	18-Aug	30-Sep	13
1994	22-Jun	16-Aug	40
1995	26-May	1-Sep	47
1996	21-May	16-Sep	35
1997	29-May	23-Jul	49
1998	26-May	2-Sep	20
1999	3-Jun	8-Sep	54
Avg.	6-Jun	31-Aug	23
Earliest	3-May	20-Jul	0
Latest	18-Aug	30-Sep	69

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **ROBERTS DITCH DIVERSION**

Date: 4 Oct. 2000

Roberts Ditch headgate

Roberts Ditch flume

Diversion Description: Headgate consists of two 2 x 2.5-foot rectangular steel gates on slides operated with Waterman-type screws in a steel headwall.

Diversion Location: The Roberts Ditch diversion is located on the main stem of Clear Creek between the confluences of Clear Creek with Piney Creek and Double Crossing Creek.

Headgate:

Lat.	Long.
N 44° 34' 40.9"	W 106° 27' 31.7"

Flume:

Lat.	Long.
N 44° 34' 55.9"	W 106° 26' 50.7"

Conveyance Description: Open channel canal, approximately 4 mi. long.

Direct Flow Water Rights:

Permit	Priority	Use	Acres	Flow (cfs)	Cumulative Flow (cfs)
710	05-04-1894	I	257	3.67	3.67
466E	08-24-1899	I	10	0.14	3.71
1705E	04-23-1907	I	90	1.29	5.00
3076E	12-07-1914	I	55	0.78	5.78
20242	07-06-1948	I	40.3	0.57	6.35
5947E	01-09-1958	I	53	0.63	6.98

Associated Storage Rights: Irrigators on the Roberts Ditch use water from Lake DeSmet reservoir.

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	50	35	25

Losses: Approximately 10 percent by the end of the ditch

References: Carmine Loguidice, Interview, State Engineer’s Office, 4 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
542	D	Huson (Roberts)	July 7, 1893	110	1.57	CFS	OS	Adj	Clear Creek
710	D	Roberts	May 4, 1894	257	3.67	CFS	OS	Adj	Clear Creek
1032	E	Enl. Huson (Roberts)	May 6, 1903	60	0.85	CFS	OS	Adj	Clear Creek
1705	E	Enl. Roberts	April 23, 1907	90	1.29	CFS	OS	Adj	Clear Creek
1898	E	Enl. Huson (Roberts)	June 18, 1908	30	0.42	CFS	OS	Adj	Clear Creek
9800	D	Winter No. 1 (Roberts)	May 10, 1910	24	0.34	CFS	OS	Adj	Clear Creek
9801	D	Winter No. 2 (Roberts)	May 10, 1910	29	0.41	CFS	OS	Adj	Clear Creek
9802	D	Winter No. 2 (Roberts)	May 10, 1910	23	0.33	CFS	OS	Adj	Clear Creek
2820	E	Enl. Roberts	June 26, 1913	85	1.21	CFS	OS	Una	Clear Creek
3076	E	Enl. Roberts	Dec. 7, 1914	55	0.78	CFS	OS	Adj	Clear Creek
20242	D	Roberts	July 6, 1948	40.3	0.57	CFS	OS	Adj	Clear Creek
5947	E	Enl. Roberts	Jan. 9, 1958	52.9	0.63	CFS	OS	Adj	Clear Creek

Name	Roberts Ditch Diversion
Source	Clear Creek
District	9
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								0.00	233.28	644.67	568.09	0.00	1446.04
1975													
1976													
1977													
1978													
1979													
1980													
1981								394.48	547.13	555.41	444.10	0.00	1941.12
1982								358.93	453.28	520.45	415.87	0.00	1748.53
1983								0.00	1103.11	519.17	604.76	172.86	2399.90
1984								0.00	458.02	753.52	528.04	0.00	1739.58
1985								519.07	191.21	505.59	0.00	0.00	1215.87
1986								173.75	495.62	541.64	189.50	89.97	1490.48
1987								212.13	365.98	251.06	48.56	0.00	877.73
1988								0.00	0.00	298.72	387.27	80.37	766.36
1989								16.66	795.37	438.09	622.31	75.07	1947.50
1990								211.04	721.69	748.07	545.26	108.59	2334.65
1991								117.52	304.11	679.09	491.70	157.88	1750.30
1992								247.24	314.83	260.54	608.47	28.46	1459.54
1993								375.27	511.64	200.93	307.64	216.79	1612.27
1994								177.86	425.18	345.77	225.48	214.45	1388.74
1995								0.00	0.00	618.80	551.94	71.81	1242.55
1996													
1997								0.00	90.06	452.96	103.71	25.60	672.33
1998								272.81	244.17	458.70	394.84	52.21	1422.73
1999								0.00	215.90	425.81	637.92	50.08	1329.71
Mean								161.93	393.19	485.21	403.97	70.74	1515.05
Max								519.07	1103.11	753.52	637.92	216.79	2399.90
Min								0.00	0.00	200.93	0.00	0.00	672.33

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

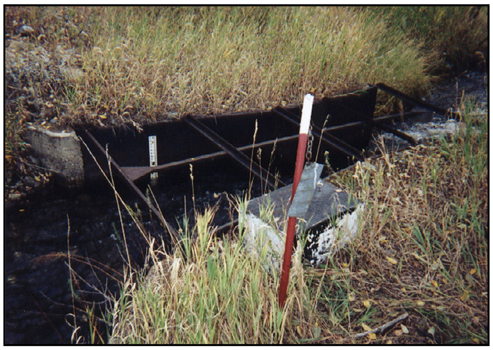
Name	Roberts Ditch Diversion
Source	Clear Creek
District	9
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	17-Jun	31-Aug	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	19-May	26-Aug	26
1982	13-May	16-Aug	11
1983	3-Jun	13-Sep	8
1984	1-Jun	27-Aug	10
1985	9-May	26-Jul	25
1986	24-May	5-Sep	20
1987	12-May	17-Aug	27
1988	12-Jul	6-Sep	30
1989	30-May	15-Sep	9
1990	28-May	14-Sep	11
1991	17-May	13-Sep	17
1992	15-May	15-Sep	16
1993	17-May	27-Sep	7
1994	23-May	30-Sep	7
1995	14-Jul	8-Sep	5
1996			
1997	3-Jun	11-Sep	15
1998	22-May	16-Sep	22
1999	10-Jun	20-Sep	18
Avg.	29-May	6-Sep	15
Earliest	9-May	26-Jul	0
Latest	14-Jul	30-Sep	30

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS


Six Mile headgate


Six Mile flume

Diversion: **SIX MILE DITCH DIVERSION**

Date: 4 Oct. 2000

Diversion Description: Headgate consists of a single, 3.5 x 5.3-foot rectangular steel gate operated with a Waterman-type screw, mounted in a concrete headwall, adjacent to a rock dam.

Diversion Location: The Six Mile diversion is located on the main stem of Clear Creek between the confluences of Clear Creek and North Fork and Sand creeks.

Headgate:

Lat.	Long.
N 44° 19' 44.9"	W 106° 45' 15.3"

Flume:

Lat.	Long.
N 44° 19' 43.9"	W 106° 45' 13.9"

Conveyance Description: Open channel canal, approximately 6.5 miles long.

Direct Flow Water Rights:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	07-12-1884	I,S	800	11.53	11.53
1899E	11-02-1908	I	1160	16.57	28.1
4177E	01-15-1921	D,I	101.2	1.44	29.54

Associated Storage Rights: Irrigators on Six Mile Ditch have an exchange arranged, receiving stored water from Cloud Peak Reservoir in exchange for Rock Creek flow.

Irrigation Practices: See introduction to Clear Creek drainage

Agricultural Practices: See introduction to Clear Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	5	2	0

Losses: Approximately 15 percent by the end of the ditch

References: Dave Pelloux, Interview, State Engineer’s Office, 25 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Six Mile	July 12, 1884	800	11.53	CFS	OS	Adj	Clear Creek
Terr	D	Six Mile	July 12, 1884	800	11.53	CFS	OS	Adj	Clear Creek
1899	E	Enl. Six Mile	March 2, 1908	1160	16.57	CFS	OS	Adj	Clear Creek
14763	D	Six Mile	Aug. 10, 1917	55	0.78	CFS	OS	Adj	Gresser or Six Mile Creek
4177	E	Enl. Six Mile	Jan. 15, 1921	101.2	1.44	CFS	OS	Adj	Clear Creek
21703	D	Six Mile	Sep. 19, 1955	1934	27.63	CFS	OS	Una	Clear Creek
21703	D	Six Mile	Sep. 19, 1955	1934	910.25	CFS	OS	Adj	Clear Creek

Name	Six Mile Ditch Diversion
Source	Clear Creek
District	2
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								429.76	1164.52	854.74	0.00	0.00	2449.02
1975													
1976													
1977													
1978													
1979													
1980													
1981								796.17	740.06	805.01	630.58	263.52	3235.34
1982								0.00	832.23	846.71	761.55	371.52	2812.01
1983								327.20	807.47	701.61	0.00	0.00	1836.28
1984								22.31	729.16	824.88	763.64	294.66	2634.65
1985								0.00	195.47	752.91	639.25	322.17	1909.80
1986								534.10	1434.40	774.22	643.60	177.95	3564.27
1987								934.20	947.43	887.05	555.62	238.18	3562.48
1988								725.58	1435.18	828.19	179.53	157.98	3326.46
1989								597.47	1147.46	1119.53	892.26	336.77	4093.49
1990								730.99	1305.06	911.88	823.43	288.34	4059.70
1991								257.41	524.28	1121.65	624.30	115.49	2643.13
1992								767.62	724.02	610.33	874.12	636.91	3613.00
1993								178.57	820.27	935.36	938.53	420.55	3293.28
1994								424.79	946.84	854.06	561.70	0.00	2787.39
1995								102.86	1012.02	848.96	797.20	294.03	3055.07
1996								225.44	1056.77	885.34	487.27	222.69	2877.51
1997								426.53	979.52	884.49	134.23	0.00	2424.77
1998								385.50	1355.84	1226.26	812.65	535.28	4315.53
1999								0.00	774.76	1037.54	660.50	159.97	2632.77
Mean								393.33	946.64	885.54	589.00	241.80	3056.30
Max								934.20	1435.18	1226.26	938.53	636.91	4315.53
Min								0.00	195.47	610.33	0.00	0.00	1836.28

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Six Mile Ditch Diversion
Source	Clear Creek
District	2
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	16-May	28-Jul	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	1-May	15-Sep	19
1982	3-Jun	15-Sep	19
1983	17-May	28-Jul	13
1984	31-May	12-Sep	8
1985	25-Jun	18-Sep	4
1986	15-May	8-Sep	5
1987	14-May	10-Sep	5
1988	16-May	15-Sep	12
1989	15-May	15-Sep	6
1990	15-May	13-Sep	12
1991	15-May	14-Sep	8
1992	15-May	27-Sep	42
1993	26-May	30-Sep	16
1994	20-May	24-Aug	40
1995	26-May	18-Sep	17
1996	17-May	16-Sep	19
1997	19-May	11-Aug	19
1998	21-May	28-Sep	9
1999	3-Jun	8-Sep	11
Avg.	21-May	8-Sep	14
Earliest	1-May	28-Jul	0
Latest	25-Jun	30-Sep	42

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

PINEY CREEK

DUNLAP DITCH DIVERSION
LEITER DITCH DIVERSION
MEAD & COFFEEN DITCH DIVERSION
PINEY & CRUSE DITCH DIVERSION
PINEY DIVIDE DITCH DIVERSION & LITTLE PINEY DITCH DIVERSION
PRAIRIE DOG DITCH DIVERSION
PRATT & FERRIS NO. 1 DITCH DIVERSION
ROCK CREEK & SOUTH PINEY DITCH DIVERSION

PINEY CREEK DRAINAGE
INTRODUCTION

BACKGROUND

Piney Creek begins in the east face of the Big Horn Mountains, the northernmost drainage of the Powder River tributaries in Wyoming, between Little Goose and Rock Creek drainages. The South Fork of Piney Creek joins Kearney Creek, then the North Fork of Piney Creek to become Piney Creek downstream of Story, Wyoming. It picks up Little Piney Creek and Boxelder Creek before running through Ucross, Wyoming and joining Clear Creek, a tributary of the Powder River. The Powder River runs north to cross the Montana state line north of Spotted Horse, Wyoming.

High-elevation storage is provided on the South Fork of Piney Creek in Cloud Peak and Willow Park reservoirs and on Kearney Creek in Kearney Lake Reservoir. For lower-elevation storage, Piney Creek has Lake DeSmet, which has includes storage from the former Shell Creek, Piney Creek, Box Elder, High Dam, and Lower Clear Creek reservoirs.

CHARACTERISTICS

Upstream of the confluence of the South and North forks of Piney Creek, early settlers and irrigators tunneled for hundreds of feet to daylight their ditches on the north side of the ridge bordering the North Fork of Piney Creek. They cut three such tunnels, one each for the Mead & Coffeen, the Piney & Cruse, and Prairie Dog ditches, and cut crossover channels between the South and North forks through what is now Story to divert South Fork water into their ditches as well. Today, the tunnels are gone but the ditches are not. The tunnels are now deep canyons eroded into the ridge, and the three ditches divert more water than any other diversions in the Powder/Tongue or Northeast Wyoming River Basins. They also continue to head-cut, forming waterfalls, and maintenance challenges for their owners.

Because the town of Story is cut with so many crossover channels, ditches, and streams, residents tend to pump nearby channels to water yards and gardens. These losses have been ignored for some time, but water commissioners are attempting to clean up the losses by asking people to establish a storage right and exchange it with the ditch companies for use of their water.

Another crossover project allows water to run through the Piney Divide Ditch to Little Piney Creek, then through the Little Piney Crossover to Bear Creek, and through the Little Piney Divide crossover to Little Piney, which flows back to Piney Creek.

USAGE

Piney Creek's diversions are permitted primarily for irrigation, but they also find stock, industrial, power, and domestic uses. The creek has a 5-cfs stock appropriation.

Regulation

Water commissioners estimate that regulation is imposed on Piney Creek drainage diversions with the following timing:

Wet Year	Average Year	Dry Year
End of July	Second week of July	June

Agriculture

Irrigation and planting practices are detailed in the following diversion memoranda.

The typical irrigation season runs from May 1 (depending on whether the spring runoff is delayed by colder weather) to late Sep. (depending on when the first snows fall and the ground freezes). Piney Creek users do not typically practice post-season irrigation.

Double Appropriation

Irrigation water rights with priority dates of March 1, 1945 or earlier are entitled to an additional 1cfs per 70 acres under Wyoming's surplus water statutes. Whenever the supply in a stream exceeds to amount required to satisfy all existing appropriations established prior to March 1, 1985, the stream is said to be in an excess flow condition and water right holders with priorities between March 2, 1945 and March 1, 1985 may use an additional 1 cfs for each 70 acres irrigated.

In Piney Creek, this practice is limited primarily by the condition of ditches. Many of the ditches are not capable of carrying all of the water an irrigator could use.

% of appropriation	% of ditches in drainage capable of flow
200	10
150	10
100-150	90
0-100	90

Permitted Uses

Permits granted for water appropriation are granted for specific uses. The following pages contain tables of permits and their associated uses. The following table provides a key to those uses:

Code	Use
Chem	Chemical
Com	Commercial
Cul	Culinary
D	Domestic
Drl	Drilling
Eng	Steam Engines
Fire	Fire Protection
Fish	Fish Propogation
F.C.	Flood Control
I	Irrigation
Ind	Industrial
I.F.	Instream Flow
Mech	Mechanical
Mfg	Manufacturing
Mil	Milling

Code	Use
Min	Mining
Misc	Miscellaneous
Mun	Municipal
Oil	Oil Refining or Production
P.C.	Pollution Control
Power	Power Development
R.R.	Railroad
Rec	Recreational
Ref	Refining
Res. Supply	Supply Facility for a Reservoir
S	Stock
T	Transportation

Water rights:

Two water rights summary tables are provided for each diversion serving irrigation referenced here. The first, included in the body of the diversion synopsis, refers to the rights on record with the State Engineer's Office and is derived from that office's *Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two* (Oct. 1999).

Because this rights summary is pulled directly from the SEO *Tab,* the rights cited follow the SEO's priority order:

Hierarchy	Format of right	Example
1	Day, Month, Year	05-15-1884
2	Month and Year	05-00-1884
3	Specified Season and Year	Spring 1884
4	Year Only	1884
5	Before Year	Before 1884

Board orders or court orders may also establish a specific priority.

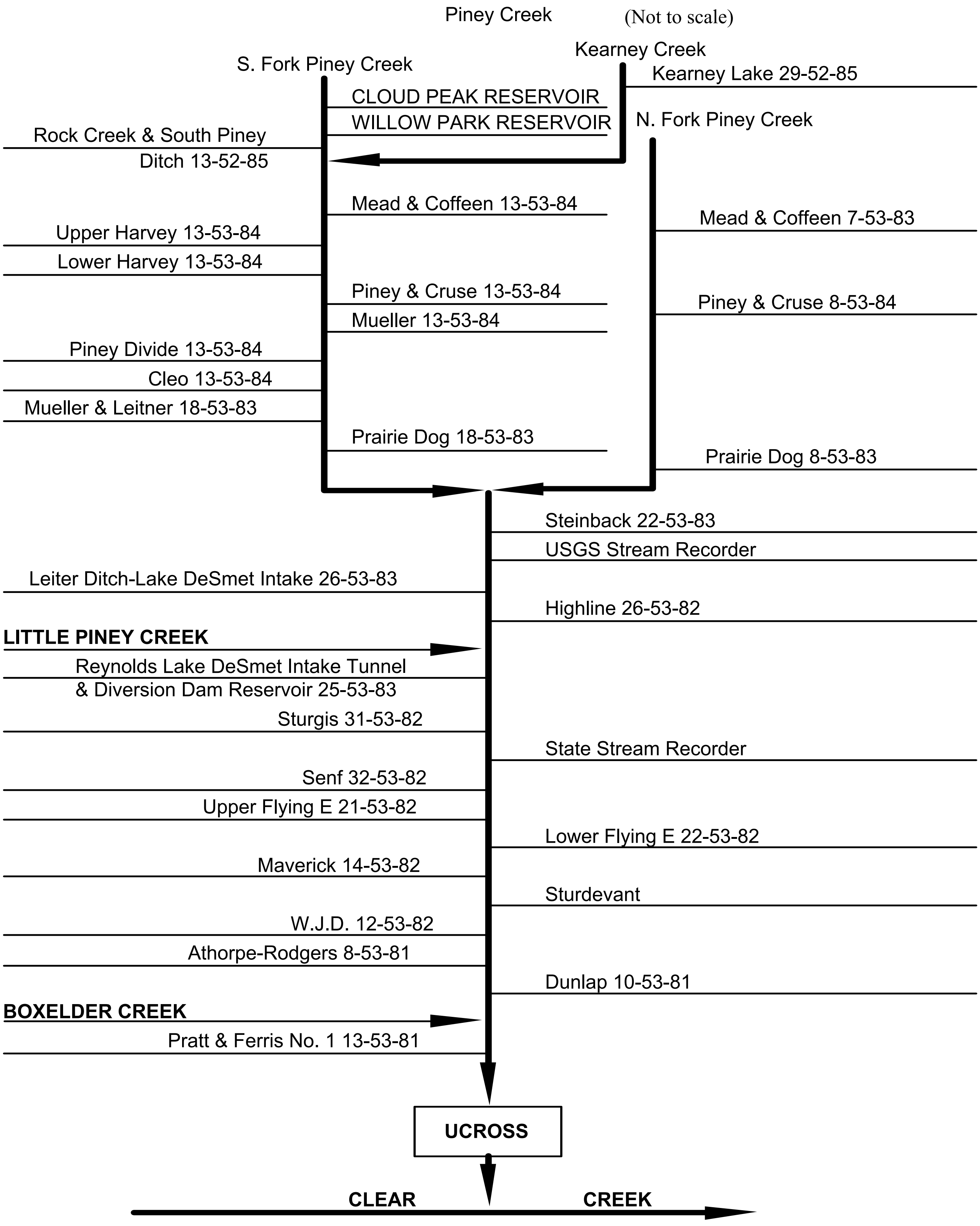
Irrigated Lands Water Rights Database

The second table, which follows the diversion synopsis, is taken from the irrigated lands water rights database developed for the basin plan. It can be used as a reference with the following caveats: It only lists water rights associated with the irrigated lands polygons mapped by HKM. The table does not include nonirrigation rights devoted to reservoir supply, municipal, fish propagation, etc. The rights on this table are associated only with those irrigated lands identified through the course of this study, both actively irrigated and currently idle.

Column Heading Key

PerNo	Permit Number	“Terr” denotes a territorial right.
PerSfx	Permit Suffix	D = direct flow E = enlargement R = reservoir
Facility Name		Parentheses denote the former means of conveyance for the water right.
Unit	Flow or volume	CFS = cubic feet per second AF = acre-feet GPM = gallons per minute
SupTyp	Supply Type	OS = original supply SS = supplement supply, for lands having an original supply from another source Sec = secondary supply, for water stored in a reservoir
Status	Status of adjudication	Adj = adjudicated Una = unadjudicated
Source	Source water	Parentheses denote the permit number of the related storage right.

Schematic diagram for Piney Creek drainage:



NOTE: HG locations by section-township-range

KEY DIVERSIONS

Diversion: **DUNLAP DITCH DIVERSION**

Date: 21 Sep. 2000

Diversion Description: Headgate consists of a single, 5 x 5-foot rectangular steel gate in steel slides operated with a Waterman-type screw, mounted in a concrete headwall. The structure diverts immediately through a 3-foot–diameter corrugated metal culvert.

Dunlap Ditch Headgate

Diversion Location: The Dunlap Ditch diversion is located on the main stem of Piney Creek just upstream from the confluence of Piney Creek and Boxelder Creek.

Dunlap Ditch Flume

Headgate:

Lat.	Long.
N 44° 34' 36.5"	W 106° 36' 23.0"

Flume:

Lat.	Long.
N 44° 34' 40.1"	W 106° 36' 11.9"

Conveyance Description: Open channel, approximately 3.5 miles long.

Direct Flow Water Rights: The direct-flow water rights are summarized below:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	06-00-1882	I	463.70	6.63	6.63
Terr.	06-00-1882	I	150.00	2.14	8.77
Terr.	-1893	I	56.20	0.81	9.58
6373E	07-31-1970	I	78.20	1.11	10.69

Associated Storage Rights: Irrigators on the Dunlap Ditch use water from Lake DeSmet.

Irrigation Practices: 80% sprinkler, 20% flood.

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Piney Creek	50	35	25

Losses: Approximately 10 percent by the end of the ditch.

References: Carmine LoGuidice, water commissioner, State Engineer's Office, interview, 12 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Dunlap	June 30, 1882	613.71	8.77	CFS	OS	Adj	Piney Creek
Terr	D	Dunlap, 2nd Appropriation	Dec. 31, 1893	56.18	0.81	CFS	OS	Adj	Piney Creek
401	E	Enl. Athorpe (Dunlap)	Jan. 21, 1899	32.63	0.47	CFS	OS	Adj	Piney Creek
6373	E	Enl. Dunlap	July 31, 1970	78.2	1.11	CFS	OS	Adj	Piney Creek

Name	Dunlap Ditch Diversion
Source	Piney Creek
District	9
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								0.00	471.39	812.27	749.91	0.00	2033.57
1975													
1976													
1977													
1978													
1979													
1980													
1981								669.37	892.81	846.54	1015.34	499.34	3923.40
1982								406.69	1094.96	611.40	752.66	139.24	3004.95
1983								531.14	1188.23	1131.77	849.12	821.06	4521.32
1984								0.00	430.15	726.22	729.32	67.82	1953.51
1985								360.20	529.59	750.94	467.21	219.97	2327.91
1986								30.50	583.59	652.40	515.77	39.22	1821.48
1987								131.80	303.96	430.20	331.77	0.00	1197.73
1988								0.00	194.74	685.26	601.41	123.68	1605.09
1989								309.02	547.93	619.34	655.14	205.39	2336.82
1990								0.00	582.05	630.00	651.77	0.00	1863.82
1991								0.00	0.00	406.02	709.04	287.85	1402.91
1992								271.44	379.54	537.92	442.51	162.05	1793.46
1993								188.93	496.76	317.49	331.40	482.38	1816.96
1994								175.30	538.88	589.37	482.79	182.96	1969.30
1995								0.00	55.28	336.17	548.55	354.47	1294.47
1996								0.74	308.77	448.41	340.51	312.47	1410.90
1997								0.00	154.35	524.05	367.99	32.00	1078.39
1998								147.30	580.19	538.36	607.23	79.47	1952.55
1999								0.00	106.56	392.78	575.58	331.76	1406.68
Mean								161.12	471.99	599.35	586.25	217.06	2035.76
Max								669.37	1188.23	1131.77	1015.34	821.06	4521.32
Min								0.00	0.00	317.49	331.40	0.00	1078.39

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement
3. June & July 1974 data includes interpolated data using WRDS records.

Name	Dunlap Ditch Diversion
Source	Piney Creek
District	9
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	17-Jun	31-Aug	1
1975			
1976			
1977			
1978			
1979			
1980			
1981	10-May	28-Sep	36
1982	21-May	11-Sep	18
1983	21-May	30-Sep	9
1984	1-Jun	4-Sep	13
1985	16-May	13-Sep	15
1986	29-May	5-Sep	12
1987	15-May	21-Aug	45
1988	21-Jun	8-Sep	13
1989	15-May	15-Sep	21
1990	4-Jun	31-Aug	11
1991	12-Jul	13-Sep	4
1992	15-May	18-Sep	11
1993	17-May	29-Sep	7
1994	23-May	16-Sep	7
1995	19-Jun	27-Sep	5
1996	28-May	20-Sep	20
1997	3-Jun	11-Sep	29
1998	22-May	16-Sep	22
1999	10-Jun	20-Sep	18
Avg.	29-May	13-Sep	16
Earliest	10-May	21-Aug	1
Latest	12-Jul	30-Sep	45

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **LEITER DITCH DIVERSION**
AKA: Leiter at Upper Weir, Upper Leiter

Leiter Ditch Headgate

Date: 21 Sep. 2000

Note: The Leiter Ditch serves to charge Lake DeSmet with Leiter Creek or Cadiz Draw water. It has essentially been replaced through Texaco's rights to ranches it has purchased over the past few decades on lower Piney Creek above DeSmet. Texaco now charges DeSmet with the rights for Leiter Ditch as a matter of convenience through its large diversion structure, the Reynolds Lake DeSmet intake tunnel and diversion dam reservoir. The Leiter Ditch is now only used occasionally.

Diversion Description: Headgate consists of two, 5 x 5-foot rectangular steel gates in steel slides operated with Waterman-type screws, mounted in a concrete headwall. One of the screws is bent.

Diversion Location: The Leiter Ditch diversion is located on the main stem of Piney Creek between the confluence of the North and South forks and the confluence of Little Piney Creek and Piney Creek.

Headgate:

Lat.	Long.
N 44° 32' 5.6"	W 106° 49' 8.9"

Flume:

Lat.	Long.
N 44° 32' 2.4"	W 106° 49' 6.9"

Leiter Ditch Flume

Conveyance Description: Open channel canal, approximately 3 miles long.

Direct Flow Water Rights: None.

Associated Storage Rights: The summary for storage rights associated with the Leiter Ditch follows:

Reservoir	Permit	Permitted Use	Priority Date	Volume (a-f)
Leiter Res.	5956R	I	09-15-1952	52.7

This reservoir is well downstream from Lake DeSmet in 33-55-78 (S-R-T).

Irrigation Practices: None.

Return Flows: None.

Losses: 0 to 5%

References: Warren Gilbert, water commissioner, State Engineer's Office, interview, 21 Sept. 2000

Irrigated Lands Water Rights Database
No rights in database.

Name	Leiter Ditch Diversion
Source	Piney Creek
District	11
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974													
1975													
1976													
1977													
1978													
1979													
1980				0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00		100.00
1981				353.00	573.00	950.00	0.00	0.00	0.00	0.00	0.00		1876.00
1982				0.00	0.00	0.00	0.00	0.00	2740.00	450.00	0.00		3190.00
1983				0.00	0.00	0.00	0.00	3450.00	7780.00	0.00	0.00		11230.00
1984				0.00	0.00	0.00	0.00	2755.00	4282.00	0.00	0.00		7037.00
1985													
1986				0.00	0.00	0.00	1817.00	44.00	0.00	0.00	0.00		1861.00
1987				0.00	0.00	0.00	0.00	2803.00	3378.00	0.00	0.00		6181.00
1988				0.00	0.00	0.00	0.00	4224.90	0.00	0.00	0.00		4224.90
1989				0.00	0.00	0.00	0.00	1607.00	0.00	0.00	0.00		1607.00
1990				0.00	0.00	0.00	0.00	0.00	2525.39	357.03	0.00		2882.42
1991				0.00	0.00	0.00	0.00	42.10	2375.00	0.00	0.00		2417.10
1992				0.00	0.00	0.00	0.00	0.00	642.30	791.40	0.00		1433.70
1993													
1994													
1995				0.00	0.00	0.00	0.00	1540.90	1953.30	0.00	0.00		3494.20
1996													
1997													
1998				0.00	0.00	0.00	0.00	0.00	1037.40	357.00	0.00		1394.40
1999													
Mean				25.21	40.93	67.86	129.79	1176.21	1915.24	139.67	0.00	#DIV/0!	3494.91
Max				353.00	573.00	950.00	1817.00	4224.90	7780.00	791.40	0.00	0.00	11230.00
Min				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

Notes:
1. Monthly data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Leiter Ditch Diversion
Source	Piney Creek
District	11
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974			
1975			
1976			
1977			
1978			
1979			
1980	13-Jun	16-Jun	0
1981	20-Jan	1-Apr	0
1982	16-Jun	4-Jul	0
1983	17-May	21-Jun	0
1984	18-May	13-Jun	0
1985			
1986	10-Apr	1-May	0
1987	29-Apr	26-Jun	0
1988	13-May	27-May	0
1989	2-May	22-May	0
1990	14-Jun	7-Jul	0
1991	31-May	10-Jun	0
1992	26-Jun	6-Jul	0
1993			
1994			
1995	16-May	19-Jun	0
1996			
1997			
1998	20-Jun	3-Jul	0
1999			
Avg.	15-May	10-Jun	0
Earliest	20-Jan	1-Apr	0
Latest	26-Jun	7-Jul	0

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **MEAD & COFFEEN DITCH DIVERSION**

Date: 21 Sep. 2000

Note: Directly adjacent to the crossover diversion described below is a sink that delivers water to seeps to the north. When the head is raised too high on the crossover diversion, losses increase dramatically.

Because Mead & Coffeen Ditch runs through a channel cut through the hills separating the North Fork of Piney Creek from Mead & Coffeen Ditch, then runs well into the Little Goose drainage, the diversion represents a transbasin diversion, from Powder River to Tongue River drainage.


Mead & Coffeen crossover diversion structure (left) next to fish hatchery diversion (right)

Diversion Description: For the primary diversion, the headgate consists of two, 3.5 x 4.5-foot rectangular wooden gates in a concrete headwall operated with Waterman-type screws on a section of concrete channel. The structure is mounted in a concrete channel to separate it from the North Fork of Piney Creek and is adjacent to a concrete dam. Only one of the gates is operational.


Mead & Coffeen primary diversion

The Mead & Coffeen Ditch also has a crossover channel to move water from the South Fork of Piney Creek into the North Fork, where it can be diverted through the primary diversion above. The crossover channel has its own headgate, a single 5 x 6-foot rectangular wooden gate in steel slides operated with a Waterman-type screw, mounted in a concrete headwall. This structure is adjacent to the diversion for the fish hatchery in Story, a newer structure in excellent condition.

Diversion Location: The Mead & Cofffeen Ditch diversion consists of two diversions, the first a crossover diversion from the South Fork of Piney Creek to the North Fork, the second a diversion from the North Fork of Piney Creek. These diversions are located in the Story community area.

Primary Diversion Headgate:

Lat.	Long.
N 44° 34' 47.1"	W 106° 53' 36.1"

Crossover Diversion Headgate:

Lat.	Long.
N 44° 33' 26.7"	W 106° 56' 3.2"

Conveyance Description: Open channel canal. The crossover is approximately 2.2 miles long. The primary channel is approximately 13.6 miles long.

Direct Flow Water Rights: The summary for direct flow rights follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	05-07-1884	I	61.5	0.88	0.88
Terr.	05-07-1884	D,I	318.5	4.55	5.43
Terr.	05-07-1884	I	25.0	0.36	5.79
Terr.	05-07-1884	I	42.5	0.6	6.39
Terr.	05-07-1884	I	140.0	2	8.39
Terr.	05-07-1884	I	140.0	2	10.39
Terr.	05-07-1884	I	42.5	0.6	10.99
Terr.	05-07-1884	I	80.0	1.14	12.13
Terr.	05-07-1884	I	750.0	10.71	22.84
Terr.	05-07-1884	D,I	20.0	0.28	23.12
234E	11-30-1896	I	160.0	2.28	25.4
234E	11-30-1896	I	450.0	6.42	31.82
298E	12-27-1897	I	55.0	0.78	32.6
328E	03-28-1898	I	70.0	1	33.6
3098E	12-15-1914	I	119	1.7	35.3
5358E	05-02-1942	I	567.0	8.1	43.4

Associated Storage Rights: Irrigators on the Mead & Coffeen Ditch use water stored in Willow Park and Kearney reservoirs.

Irrigation Practices: Irrigators tend to irrigate 30 percent alfalfa and 70 percent grass. They use a variety of irrigation practices: 50% flood, 30% sprinkler, 20% gated pipe.

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Little Goose	50	35	25

Losses: Approximately 15 percent by the end of the ditch.

References: Warren Gilbert, water commissioner, State Engineer's Office, interview, 21 Sept. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Mead Creek or Coffeen (Piney & Cruse, Snell Pumps No. 2 and No. 3)	May 17, 1884	1620	23.12	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
Terr	D	Piney & Cruse, 2nd App. (Mead Creek or Coffeen)	Dec. 31, 1891	3111	44.38	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
234	E	Enl. Mead Creek or Coffeen	Nov. 30, 1896	610	8.7	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
298	E	Enl. Mead Creek or Coffeen	Dec. 27, 1897	55	0.79	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
328	E	Enl. Mead Creek or Coffeen	March 28, 1898	70	1	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
891	E	Enl. Mead Creek or Coffeen	Aug. 2, 1902	100	1.42	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
3098	E	Enl. Mead Creek or Coffeen	Dec. 5, 1914	119	1.7	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
5358	E	Enl. Mead Creek or Coffeen	May 2, 1942	567	8.1	CFS	OS	Adj	Piney Creek
5358	E	Enl. Mead Creek or Coffeen	May 2, 1942	135	0		SS	Adj	Piney Creek

Name	Mead & Coffeen Ditch Diversion
Source	North & South Piney Creeks
District	11
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971								82.16	1353.20	1503.07	1583.21	944.93	5466.57
1972								396.69	1629.22	1592.92	1394.38	1259.70	6272.91
1973								0.00	1130.58	1613.55	1634.97	858.39	5237.49
1974								430.41	1728.59	1591.93	1711.14	982.39	6444.46
1975								0.00	1281.58	1440.71	1585.09	1363.42	5670.80
1976								104.09	1375.38	1166.97	1059.17	594.45	4300.06
1977								665.26	1312.38	990.11	1147.10	690.13	4804.98
1978								0.00	15.27	1142.60	698.70	373.09	2229.66
1979													
1980								512.00	1207.00	1265.00	1776.00	1013.00	5773.00
1981								1050.00	951.00	1308.00	1197.00	286.00	4792.00
1982								0.00	510.00	910.00	1350.00	660.00	3430.00
1983								0.00	642.00	1160.00	1460.00	1130.00	4392.00
1984								0.00	319.00	1120.00	1080.00	500.00	3019.00
1985								419.00	959.00	1425.00	983.00	496.00	4282.00
1986								224.00	961.00	1199.00	1291.00	510.00	4185.00
1987								457.00	703.00	1578.00	838.00	261.00	3837.00
1988								184.20	1053.30	1278.00	706.00	523.70	3745.20
1989								281.90	1079.30	1131.30	1260.20	708.20	4460.90
1990								45.94	504.42	1038.34	1198.45	698.05	3485.20
1991								0.00	256.00	858.00	973.50	696.40	2783.90
1992								400.50	818.40	600.30	650.10	325.70	2795.00
1993								68.60	298.30	497.50	453.40	358.90	1676.70
1994								148.90	621.60	899.80	941.40	431.10	3042.80
1995								0.00	153.10	534.40	928.10	862.00	2477.60
1996								0.00	268.20	664.40	753.20	760.20	2446.00
1997								0.00	409.90	501.20	581.90	443.20	1936.20
1998								316.60	1008.00	846.30	847.30	590.10	3608.30
1999								46.60	466.70	837.30	1033.40	733.80	3117.80
Mean								208.35	821.98	1096.20	1111.28	680.49	3918.30
Max								1050.00	1728.59	1613.55	1776.00	1363.42	6444.46
Min								0.00	15.27	497.50	453.40	261.00	1676.70

Notes:
1. Monthly data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement
3. May & June 1971 data contains interpolated data using the WRDS records.

Name	Mead & Coffeen Ditch Diversion
Source	North & South Piney Creeks
District	11
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971	25-May	20-Sep	2
1972	22-May	30-Sep	0
1973	5-Jun	25-Sep	0
1974	24-May	30-Sep	0
1975	1-Jun	30-Sep	0
1976	27-May	30-Sep	0
1977	9-May	30-Sep	0
1978	29-Jun	30-Sep	0
1979			
1980	6-May	22-Sep	0
1981	1-May	30-Sep	0
1982	1-Jun	30-Sep	0
1983	1-Jun	30-Sep	0
1984	1-Jun	30-Sep	0
1985	10-May	30-Sep	0
1986	19-May	30-Sep	0
1987	8-May	24-Sep	0
1988	17-May	30-Sep	0
1989	16-May	30-Sep	0
1990	26-May	30-Sep	0
1991	11-Jun	30-Sep	0
1992	11-May	30-Sep	0
1993	22-May	30-Sep	0
1994	14-May	30-Sep	0
1995	21-Jun	30-Sep	0
1996	1-Jun	30-Sep	0
1997	3-Jun	30-Sep	0
1998	17-May	30-Sep	0
1999	29-May	30-Sep	0
Avg.	24-May	28-Sep	0
Earliest	1-May	20-Sep	0
Latest	29-Jun	30-Sep	2

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **PINEY & CRUSE DITCH DIVERSION**

Date: 21 Sep. 2000

Note: Because Piney & Cruse Ditch runs through a channel cut through the hills separating the North Fork of Piney Creek from Piney & Cruse Ditch, then runs well into the Little Goose drainage, the diversion represents a transbasin diversion, from Powder River to Tongue River drainage.


Piney & Cruse primary headgate

Diversion Description: For the primary diversion, the headgate consists of two, 4.5 x 4.7-foot rectangular steel gates on steel slides in a concrete headwall operated with Waterman-type screws on a section of concrete channel. The gates are in good condition.


Piney & Cruse crossover headgate to N. Piney

The Piney & Cruse Ditch also has a crossover channel to move water from the South Fork of Piney Creek into the North Fork, where it can be diverted through the primary diversion above. The crossover channel has its own headgate, a single 6.2 x 4.7-foot rectangular steel gate in steel slides operated with a Waterman-type screw, mounted in a river rock headwall. This diversion appears to be in good condition.


Piney & Cruse flume and recorder for crossover

Diversion Location: The Piney & Cruse Ditch diversion consists of two diversions, the first a crossover diversion from the South Fork of Piney Creek to the North Fork, the second a diversion from the North Fork of Piney Creek. These diversions are located in the Story community area.


Piney & Cruse flume, recorder, primary diversion, North Fork of Piney Creek

Primary Diversion Headgate:

Lat.	Long.
N 44° 34' 43.0"	W 106° 53' 11.8"

Flume:

Lat.	Long.
N 44° 34' 42.5"	W 106° 53' 10.8"

Crossover Diversion Headgate:

Lat.	Long.
N 44° 33' 32.6"	W 106° 55' 31.0"

Flume:

Lat.	Long.
N 44° 34' 48.3"	W 106° 53' 31.7"

Conveyance Description: Open channel canal. The crossover ditch is approximately 2.4 miles long. The primary ditch is approximately 4.6 miles long.

Direct Flow Water Rights: The summary of direct flow rights follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	07-20-1885	I	1	0.01	0.01
Terr.	07-20-1885	I	10	0.14	0.15
Terr.	07-20-1885	D,I,S	20	0.29	0.44
Terr.	07-20-1885	I	25	0.36	0.8
Terr.	07-20-1885	I	37	0.53	1.33
Terr.	07-20-1885	I	40	0.57	1.9
Terr.	07-20-1885	I	40	0.57	2.47
Terr.	07-20-1885	I	40	0.57	3.04
Terr.	07-20-1885	I	40	0.57	3.61
Terr.	07-20-1885	I	42	0.6	4.21
Terr.	07-20-1885	I	45	0.64	4.85
Terr.	07-20-1885	I	50	0.71	5.56
Terr.	07-20-1885	I	60	0.86	6.42
Terr.	07-20-1885	I	60	0.86	7.28
Terr.	07-20-1885	I	70	1	8.28
Terr.	07-20-1885	I	70	1	9.28
Terr.	07-20-1885	I	90	1.29	10.57
Terr.	07-20-1885	I	100	1.43	12
Terr.	-1891	I	5	0.04	12.04
Terr.	-1891	I	10	0.14	12.18
Terr.	-1891	I	26	0.37	12.55
Terr.	-1891	I	30	0.43	12.98
Terr.	-1891	I	33	0.47	13.45
Terr.	-1891	I	40	0.58	14.03
Terr.	-1891	I	40	0.58	14.61
Terr.	-1891	I	50	0.71	15.32
Terr.	-1891	I	50	0.71	16.03
Terr.	-1891	I	60	0.86	16.89
Terr.	-1891	I	65	0.93	17.82
Terr.	-1891	I	70	1	18.82
Terr.	-1891	I	70	1	19.82
Terr.	-1891	I	75	1.07	20.89
Terr.	-1891	I	80	1.14	22.03
Terr.	-1891	I	80	1.14	23.17
Terr.	-1891	I	80	1.14	24.31
Terr.	-1891	I	80	1.14	25.45
Terr.	-1891	I	80	1.14	26.59
Terr.	-1891	I	80	1.14	27.73
Terr.	-1891	I	80	1.14	28.87

Direct Flow Rights cont'd.

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	-1891	I	80	1.14	30.01
Terr.	-1891	D,I	85	1.21	31.22
Terr.	-1891	I	88	1.26	32.48
Terr.	-1891	I	95	1.34	33.82
Terr.	-1891	I	100	1.43	35.25
Terr.	-1891	I	110	1.57	36.82
Terr.	-1891	I	120	1.71	38.53
Terr.	-1891	I	125	1.79	40.32
Terr.	-1891	I	139	1.99	42.31
Terr.	-1891	I	140	2	44.31
Terr.	-1891	I	155	2.21	46.52
Terr.	-1891	I	160	2.29	48.81
Terr.	-1891	I	220	3.14	51.95
Terr.	-1891	I	310	4.43	56.38
1242	05-27-1896	I	40	0.57	56.95
235E	01-08-1897	I	20	0.28	57.23
359E	08-12-1898	I	96	1.37	58.6
1086E	12-12-1902	I	35	0.5	59.1
991E	2-16-1903	I	73	1.04	60.14
1113E	8-7-1903	I	132	1.88	62.02
1434E	6-24-1905	I	37	0.52	62.54
3927E	6-10-1918	I	80	1.14	63.68

Associated Storage Rights: Irrigators on the Piney & Cruse Ditch use water stored in Willow Park and Kearney reservoirs.

Irrigation Practices: Irrigators tend to plant 30 percent alfalfa and 70 percent grass. They use a variety of irrigation practices: 60% flood, 20% sprinkler, 20% gated.

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Little Goose	50	35	25

Losses: Approximately 15 percent by the end of the ditch.

References: Warren Gilbert, water commissioner, State Engineer's Office, interview, 21 Sept. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Prairie Dog Water Supply Co., 1st App. (Piney & Cruse)	Oct. 1, 1880	163	2.32	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
Terr	D	Prairie Dog Water Supply Co, 2nd App. (Piney & Cruse, Red Butte, Rose No.1)	May 1, 1884	3170.1	45.31	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
Terr	D	Mead Creek or Coffeen (Piney & Cruse, Snell Pumps No. 2 and No. 3)	May 7, 1884	1620	23.12	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
Terr	D	Piney & Cruse, 1st App.	July 20, 1885	840	12	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)

Irrigated Lands Water Rights Database cont'd.

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Prairie Dog Water Supply Co., 3rd App. (Piney & Cruse, Red Butte, Rose #1)	Aug. 3, 1885	5027.5	71.81	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
Terr	D	Piney & Cruse, 2nd App. (Mead Creek or Coffeen)	Dec. 31, 1891	3111	44.38	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
359	E	Enl. Piney & Cruse	Aug. 12, 1898	96	1.37	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
1086	E	Enl. Piney & Cruse	Dec. 12, 1902	35	0.5	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
991	E	Enl. Piney & Cruse	Feb. 16, 1903	73	1.04	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
1113	E	Enl. Piney & Cruse	Aug. 7, 1903	132	1.88	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
1434	E	Enl. Piney & Cruse Creek	June 24, 1905	37	0.52	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
3927	E	Enl. Piney & Cruse/Robinson-Zullig	June 10, 1918	80	1.14	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
21032	D	Piney & Cruse Creek	Sep. 2, 1952	599.6			Sec	Adj	South Piney Creek (973R)

Name	Piney & Cruse Ditch Diversion
Source	North & South Piney Creeks
District	11
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971							0.00	14.96	722.24	1203.37	989.65	326.52	3256.74
1972							0.00	303.51	1783.93	1259.90	1541.55	778.47	5667.36
1973							0.00	0.00	516.50	1629.02	1543.34	255.07	3943.93
1974							0.00	133.09	1814.88	1547.30	1510.81	365.55	5371.63
1975							0.00	0.00	724.18	1130.16	1209.88	444.75	3508.97
1976							0.00	272.57	789.82	1003.30	1082.95	537.14	3685.78
1977							0.00	487.18	1156.05	728.63	786.88	748.60	3907.34
1978							0.00	0.00	62.06	757.01	691.36	568.60	2079.03
1979													
1980							0.00	196.00	908.00	1429.00	889.00	517.00	3939.00
1981							0.00	778.00	742.00	1131.00	596.00	587.00	3834.00
1982							0.00	0.00	240.00	1110.00	1070.00	560.00	2980.00
1983							0.00	0.00	815.00	1640.00	1310.00	518.00	4283.00
1984							0.00	0.00	0.00	1180.00	1025.00	659.00	2864.00
1985							0.00	701.00	990.00	885.00	512.00	599.00	3687.00
1986							0.00	132.00	1437.00	1402.00	1246.00	521.00	4738.00
1987							0.00	792.00	1148.00	1180.00	1148.00	575.00	4843.00
1988							0.00	101.90	1289.50	1215.00	684.80	213.20	3504.40
1989							0.00	293.40	1007.50	1184.10	1267.80	924.80	4677.60
1990							0.00	43.66	446.07	1190.83	1202.16	803.67	3686.39
1991							0.00	0.00	394.30	1026.80	1031.20	923.50	3375.80
1992							48.40	775.80	990.30	854.30	898.80	660.10	4227.70
1993							0.00	102.90	288.40	318.30	652.80	662.50	2024.90
1994							0.00	292.20	866.20	670.00	791.20	567.90	3187.50
1995							0.00	0.00	51.40	485.50	1009.70	614.00	2160.60
1996							0.00	0.00	218.80	894.00	883.70	704.80	2701.30
1997							0.00	0.00	152.70	350.30	375.10	509.10	1387.20
1998							0.00	354.60	1006.40	822.00	925.30	785.20	3893.50
1999							0.00	0.00	384.70	564.50	761.00	590.60	2300.80
Mean							1.73	206.24	748.07	1028.26	987.00	590.00	3561.30
Max							48.40	792.00	1814.88	1640.00	1543.34	924.80	5667.36
Min							0.00	0.00	0.00	318.30	375.10	213.20	1387.20

Notes:
1. Monthly data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Piney & Cruse Ditch Diversion
Source	North & South Piney Creeks
District	11
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971	28-May	26-Sep	0
1972	19-May	30-Sep	0
1973	21-Jun	25-Sep	0
1974	27-May	12-Sep	0
1975	1-Jun	30-Sep	0
1976	4-May	30-Sep	0
1977	11-May	30-Sep	0
1978	26-Jun	30-Sep	0
1979			
1980	23-May	30-Sep	0
1981	1-May	30-Sep	0
1982	1-Jun	30-Sep	0
1983	6-Jun	30-Sep	0
1984	1-Jul	30-Sep	0
1985	10-May	30-Sep	0
1986	28-May	30-Sep	0
1987	13-May	30-Sep	0
1988	20-May	30-Sep	0
1989	15-May	30-Sep	0
1990	24-May	30-Sep	0
1991	13-Jun	30-Sep	0
1992	24-Apr	30-Sep	0
1993	21-May	30-Sep	0
1994	17-May	30-Sep	0
1995	13-Jun	30-Sep	0
1996	11-Jun	30-Sep	0
1997	3-Jun	30-Sep	0
1998	15-May	30-Sep	0
1999	5-Jun	30-Sep	0
Avg.	26-May	29-Sep	0
Earliest	24-Apr	12-Sep	0
Latest	1-Jul	30-Sep	0

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **PINEY DIVIDE DITCH DIVERSION and**
LITTLE PINEY DITCH DIVERSION
AKA: Little Piney Divide

Date: 21 Sep. 2000

Note: The Piney Divide Ditch represents the first segment of a diversion that takes water from the South Fork of Piney Creek to Bear Creek. It is routed through the Piney Divide diversion to Little Piney, then through the Little Piney Divide crossover to Bear Creek, and from Bear Creek through the downstream Little Piney Divide crossover to Little Piney Creek (which runs into Piney Creek).

Piney to Little Piney headgate

Diversion Description: Headgate consists of two, 4 x 3.4-foot rectangular wood-and-steel gates in steel slides operated with Waterman-type screws, mounted in a concrete headwall.

Piney Divide flume and recorder

Diversion Location: The Piney Divide Ditch diversion is located on the South Fork of Piney Creek between the confluence of the South Fork with Kearney Creek and its confluence with the North Fork of Piney Creek.

Piney Divide Headgate (South Fork Piney to Little Piney Creek):

Lat.	Long.
N 44° 33' 38.3"	W 106° 54' 46.2"

Flume:

Lat.	Long.
N 44° 33' 38.0"	W 106° 54' 44.6"

Little Piney Divide Headgate (Little Piney Creek to Bear Creek):

Lat.	Long.
N 44° 32' 33.3"	W 106° 52' 4.6"

Little Piney Divide Headgate (Bear Creek to Little Piney):

Lat.	Long.
N 44° 32' 12.3"	W 106° 52' 1.9"

Flume:

Lat.	Long.
N 44° 32' 14.1"	W 106° 51' 59.0"

Conveyance Description: Open channel canal, approximately 2 miles long.

Direct Flow Water Rights: The summary for direct flow rights for Piney Divide and Little Piney Divide follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	05-01-1886	I	60.00	0.86	0.86
Terr.	05-01-1886	I	12.00	0.17	1.03
Terr.	05-01-1886	I	17.00	0.24	1.27
Terr.	05-01-1886	I	40.00	0.57	1.84
Terr.	12-31-1887	I	28.00	0.40	2.24
Terr.	12-31-1887	I	100.00	1.43	3.67
Terr.	12-31-1887	I	41.00	0.59	4.26
Terr.	12-31-1887	I	130.00	1.86	6.12
Terr.	12-31-1887	I	35.00	0.50	6.62
Terr.	12-31-1887	I	110.00	1.57	8.19
Terr.	12-31-1887	I	70.00	1.00	9.19
Terr.	12-31-1887	I	75.00	1.07	10.26
Terr.	12-31-1887	I	10.00	0.14	10.40
Terr.	12-31-1887	I	113.00	1.61	12.01
Terr.	12-31-1887	I	165.00	2.35	14.36
Terr.	12-31-1887	I	105.00	1.50	15.86
Terr.	12-31-1887	I	40.00	0.58	16.44
Terr.	12-31-1887	I	160.00	2.29	18.73
Terr.	12-31-1887	I	60.00	0.86	19.59
Terr.	12-31-1887	I	250.00	3.57	23.16
169E	12-05-1895	I	330.00	4.71	27.87
170E	12-05-1895	I	127.00	1.81	29.68
174E	12-23-1895	I	141.00	2.02	31.70
248E	10-06-1896	I	91.50	1.30	33.00
2616E	08-14-1911	I	102.00	1.46	34.46
3230E	07-03-1915	I	113.00	1.61	36.07
5795E	01-07-1955	I	133.00	1.90	37.97
6802E	12-20-1979	Fish		5.96	43.93

Note: Permit No. 3230E is drawn from Little Piney Creek and South Piney Creek. Permit No. 6802E is satisfied from Little Piney Creek; all others are satisfied from South Piney Creek. Permit No. 6802E applies Sept. 15 – Nov. 15.

Associated Storage Rights: Irrigators on the Piney Divide Ditch use water stored in Cloud Peak and Willow Park reservoirs.

Permit	Priority Date	Permitted Use	Acres	Volume (af)	Cumulative (af)
20616	10-10-1950	I,S	320	100	100
21080	08-02-1951	I	100	50	150
5616E	03-31-1952	I	320	50	200
21606	05-13-1955	I	485	50	250

Note: All of the permits listed in the table above denote rights for secondary supply. They are satisfied from natural flow of South Piney Creek in exchange for water stored in Lake DeSmet Reservoir and released to supply prior rights below DeSmet at a rate of 1.0 cfs for each 50 acre-feet of water stored.

Irrigation Practices: Irrigators tend to irrigate pasture, approximately 95 percent grass, five percent alfalfa. They use ditch-flood irrigation only.

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Piney Creek	50	35	25

Losses: Approximately 10 percent by the end of the ditch.

References: Warren Gilbert, water commissioner, State Engineer's Office, interview, 21 Sept. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
169	E	Enl. Little Piney Divide	Dec. 5, 1895	330	4.71	CFS	OS	Adj	South Piney Creek
174	E	Enl. Little Piney Divide (Lower Harvey, Big Piney)	Dec. 23, 1895	141	2.02	CFS	OS	Adj	South Piney Creek
22649	D	Little Piney Divide or Piney Divide	July 26, 1961	330	0		Sec	Una	South Piney Creek Exchange (973R, 5829R)

Name	Piney Divide Ditch Diversion
Source	South Piney Creek
District	11
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971								288.73	1040.15	1667.90	956.23	892.56	4845.57
1972								79.74	1520.59	1423.34	1829.16	738.05	5590.88
1973								0.00	800.89	1488.99	927.11	712.46	3929.45
1974								194.42	1688.15	1446.82	1219.60	534.17	5083.16
1975								0.00	463.24	1284.67	933.06	1268.09	3949.06
1976								13.75	1213.78	1084.42	797.55	1216.86	4326.36
1977													
1978								0.00	269.63	757.21	1135.58	886.02	3048.44
1979													
1980								769.00	1136.00	1249.00	766.00	686.00	4606.00
1981								546.00	1330.00	1234.00	1021.00	471.00	4602.00
1982								0.00	370.00	1110.00	1160.00	810.00	3450.00
1983								0.00	485.00	1180.00	1390.00	749.00	3804.00
1984								0.00	449.00	1155.00	1264.00	952.00	3820.00
1985								401.00	1131.00	1186.00	837.00	646.00	4201.00
1986								249.00	1528.00	1253.00	1346.00	588.00	4964.00
1987								898.00	1073.00	886.00	1394.00	1065.00	5316.00
1988								455.60	1421.50	1153.20	1033.00	638.00	4701.30
1989								201.90	1182.50	1506.00	1359.50	925.70	5175.60
1990								519.26	1385.24	1400.77	1689.82	1047.21	6042.30
1991								147.70	1279.00	1680.90	1330.20	1200.00	5637.80
1992								391.70	1503.70	1174.00	1281.90	918.30	5269.60
1993								430.40	679.00	853.70	910.90	730.70	3604.70
1994								484.60	939.30	1324.80	1283.40	948.60	4980.70
1995								178.70	585.40	926.30	1015.80	688.50	3394.70
1996								228.00	838.30	1054.70	923.40	970.70	4015.10
1997								218.40	529.70	728.00	948.10	859.90	3284.10
1998								262.30	1423.10	1317.50	1525.10	958.90	5486.90
1999								157.50	643.80	900.20	1086.30	1163.90	3951.70
Mean								263.54	996.63	1200.98	1161.62	861.69	4484.46
Max								898.00	1688.15	1680.90	1829.16	1268.09	6042.30
Min								0.00	269.63	728.00	766.00	471.00	3048.44

Notes:
1. Monthly data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement
3. Aug 1972 data contains interpolated data using the WRDS records.

Name	Piney Divide Ditch Diversion
Source	South Piney Creek
District	11
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971	19-May	30-Sep	0
1972	24-May	15-Sep	1
1973	1-Jun	24-Sep	0
1974	28-May	30-Sep	0
1975	1-Jun	30-Sep	0
1976	28-May	30-Sep	0
1977			
1978	19-Jun	30-Sep	0
1979			
1980	1-May	30-Sep	0
1981	1-May	30-Sep	0
1982	15-Jun	30-Sep	0
1983	4-Jun	30-Sep	0
1984	11-Jun	30-Sep	0
1985	21-May	30-Sep	0
1986	19-May	25-Sep	0
1987	1-May	30-Sep	0
1988	17-May	30-Sep	0
1989	15-May	30-Sep	0
1990	16-May	30-Sep	0
1991	19-May	30-Sep	0
1992	15-May	30-Sep	0
1993	9-May	30-Sep	0
1994	10-May	30-Sep	0
1995	5-May	30-Sep	0
1996	2-May	30-Sep	0
1997	16-May	30-Sep	0
1998	13-May	30-Sep	0
1999	21-May	30-Sep	0
Avg.	19-May	29-Sep	0
Earliest	1-May	15-Sep	0
Latest	19-Jun	30-Sep	1

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

Name	Little Piney Ditch Diversion
Source	Little Piney Creek
District	11
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974													
1975													
1976													
1977													
1978													
1979													
1980													
1981								312.00	702.00	689.00	445.00	288.00	2436.00
1982								0.00	243.18	255.17	396.50	95.01	989.86
1983								0.00	193.98	470.74	650.06	133.81	1448.59
1984								0.00	213.13	403.52	455.98	0.00	1072.63
1985								354.97	287.23	512.27	285.48	0.00	1439.95
1986								247.83	437.45	565.43	285.67	0.00	1536.38
1987													
1988								77.36	0.00	0.00	0.00	0.00	77.36
1989													
1990								0.00	672.33	1073.37	1145.69	305.36	3196.75
1991													
1992								251.31	480.20	266.08	409.44	293.16	1700.19
1993								57.12	571.54	143.60	313.09	293.95	1379.30
1994								456.08	595.47	395.96	461.20	280.24	2188.95
1995								0.00	0.00	92.85	361.58	174.08	628.51
1996								81.96	316.01	148.06	263.75	251.97	1061.75
1997								81.25	210.23	271.31	212.85	107.16	882.80
1998								151.55	170.66	148.32	382.21	253.10	1105.84
1999								27.41	83.31	197.21	410.02	276.36	994.31
Mean								131.18	323.55	352.06	404.91	172.01	1383.70
Max								456.08	702.00	1073.37	1145.69	305.36	3196.75
Min								0.00	0.00	0.00	0.00	0.00	77.36

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement
3. Monthly data for 1981 is derived from published AF values in the Hydrographers Annual Reports.

Name	Little Piney Ditch Diversion
Source	Little Piney Creek
District	11
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974			
1975			
1976			
1977			
1978			
1979			
1980			
1981	1-May	30-Sep	0
1982	8-Jun	8-Sep	27
1983	14-Jun	15-Sep	12
1984	6-Jun	31-Aug	16
1985	2-May	14-Aug	48
1986	17-May	14-Aug	17
1987			
1988	25-May	26-May	0
1989			
1990	19-Jun	14-Sep	28
1991			
1992	15-May	28-Sep	11
1993	28-May	29-Sep	9
1994	2-May	30-Sep	10
1995	17-Jul	27-Sep	5
1996	1-May	30-Sep	16
1997	12-May	13-Sep	25
1998	15-May	17-Sep	8
1999	22-May	29-Sep	14
Avg.	24-May	8-Sep	15
Earliest	1-May	26-May	0
Latest	17-Jul	30-Sep	48

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **PRAIRIE DOG DITCH DIVERSION**

Date: 21 Sep. 2000

Diversion Description:

For the primary diversion, the headgate consists of two, 5 x 4.5-foot rectangular steel gates in steel slides operated with Waterman-type screws, mounted in a concrete headwall on a section of concrete channel.

Prairie Dog Ditch also has a crossover channel to move water from the South Fork of Piney Creek into the North Fork, where it can be diverted through the primary diversion above. The crossover channel has its own headgate, two 4.2 x 4.8-foot rectangular steel gates in steel slides operated with Waterman-type screws, mounted in a concrete headwall.

Prairie Dog , Primary Diversion headgate

Prairie Dog flume

Prairie Dog crossover, S. Piney to N. Piney headgate

Diversion Location:

The Prairie Dog Ditch diversion consists of two diversions, the first a crossover diversion from the South Fork of Piney Creek to the North Fork, the second a diversion from the North Fork of Piney Creek. These diversions are located in the Story community area. Because Piney Creek is a tributary to the Powder River, these diversions fall under the control of the Yellowstone River Compact.

Primary Diversion Headgate:

Lat.	Long.
N 44° 34' 40.1"	W 106° 52' 56.6"

Flume:

Lat.	Long.
N 44° 34' 41.0"	W 106° 52' 54.2"

Crossover Diversion Headgate:

Lat.	Long.
N 44° 34' 11.9"	W 106° 53' 44.9"

Conveyance Description:

Open channel canal, approximately 1 mile total, open ditch crossover flow south to North Fork of Piney (includes 20 miles of natural conveyance).

Direct Flow Water Rights: The summary for direct flow rights follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	10-01-1880	I	3	0.04	0.04
Terr.	10-01-1880	D,I	30	0.43	0.47
Terr.	10-01-1880	D,I	50	0.71	1.18
Terr.	10-01-1880	I	80	1.14	2.32
Terr.	05-01-1884	I	4	0.06	2.38
Terr.	05-01-1884	I	5	0.07	2.45
Terr.	05-01-1884	D,I	5	0.07	2.52
Terr.	05-01-1884	I	15	0.21	2.73
Terr.	05-01-1884	D,I	20	0.29	3.02
Terr.	05-01-1884	I	20	0.29	3.31
Terr.	05-01-1884	D,I	20	0.29	3.60
Terr.	05-01-1884	I	25	0.36	3.96
Terr.	05-01-1884	I	25	0.36	4.32
Terr.	05-01-1884	I	25	0.36	4.68
Terr.	05-01-1884	I	25	0.36	5.04
Terr.	05-01-1884	I	30	0.43	5.47
Terr.	05-01-1884	I	30	0.43	5.90
Terr.	05-01-1884	I	30	0.43	6.33
Terr.	05-01-1884	I	35	0.50	6.83
Terr.	05-01-1884	I	35	0.50	7.33
Terr.	05-01-1884	I	40	0.57	7.90
Terr.	05-01-1884	I	45	0.64	8.54
Terr.	05-01-1884	D,I	50	0.71	9.25
Terr.	05-01-1884	I	60	0.86	10.11
Terr.	05-01-1884	I	70	1.00	11.11
Terr.	05-01-1884	I	70	1.00	12.11
Terr.	05-01-1884	I	80	1.14	13.25
Terr.	05-01-1884	I	83	1.19	14.44
Terr.	05-01-1884	D,I	89	1.27	15.71
Terr.	05-01-1884	I	90	1.29	17.00
Terr.	05-01-1884	I	100	1.43	18.43
Terr.	05-01-1884	I	100	1.43	19.86
Terr.	05-01-1884	I	100.6	1.43	21.29
Terr.	05-01-1884	I	125	1.79	23.08
Terr.	05-01-1884	I	136.4	1.95	25.03
Terr.	05-01-1884	D,I	150	2.14	27.17
Terr.	05-01-1884	I	156.3	2.23	29.40
Terr.	05-01-1884	I	175	2.50	31.90
Terr.	05-01-1884	I	200	2.86	34.76
Terr.	05-01-1884	I	200	2.86	37.62
Terr.	05-01-1884	I	203.7	2.91	40.53
Terr.	05-01-1884	I	226.4	3.24	43.77
Terr.	05-01-1884	I	270.7	3.86	47.63
Terr.	08-03-1885	I	25	0.36	47.99
Terr.	08-03-1885	I	25	0.36	48.35
Terr.	08-03-1885	I	26	0.37	48.72
Terr.	08-03-1885	I	27.2	0.39	49.11
Terr.	08-03-1885	I	32.7	0.47	49.58
Terr.	08-03-1885	I	45	0.64	50.22

Direct Flow Rights cont'd:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	08-03-1885	I	45	0.64	50.86
Terr.	08-03-1885	I	50	0.71	51.57
Terr.	08-03-1885	I	54.4	0.78	52.35
Terr.	08-03-1885	I	55	0.79	53.14
Terr.	08-03-1885	I	66	0.94	54.08
Terr.	08-03-1885	D,I,S	73.3	1.05	55.13
Terr.	08-03-1885	I	75	1.07	56.20
Terr.	08-03-1885	I	85.2	1.21	57.41
Terr.	08-03-1885	D,I	88.4	1.26	58.67
Terr.	08-03-1885	I	89	1.27	59.94
Terr.	08-03-1885	I	90	1.29	61.23
Terr.	08-03-1885	I	90	1.29	62.52
Terr.	08-03-1885	I	90.2	1.29	63.81
Terr.	08-03-1885	I	91	1.30	65.11
Terr.	08-03-1885	I	97.3	1.39	66.50
Terr.	08-03-1885	I	105	1.50	68.00
Terr.	08-03-1885	D,I,S	36.2	1.51	69.51
Terr.	08-03-1885	D,I	110	1.57	71.08
Terr.	08-03-1885	I	115.4	1.65	72.73
Terr.	08-03-1885	I	124	1.77	74.50
Terr.	08-03-1885	I	125	1.79	76.29
Terr.	08-03-1885	I	127	1.81	78.10
Terr.	08-03-1885	I	130	1.86	79.96
Terr.	08-03-1885	I	130	1.86	81.82
Terr.	08-03-1885	I	130	1.86	83.68
Terr.	08-03-1885	I	135	1.93	85.61
Terr.	08-03-1885	I	145.9	2.08	87.69
Terr.	08-03-1885	I	157.1	2.24	89.93
Terr.	08-03-1885	I	175	2.50	92.43
Terr.	08-03-1885	I	180	2.57	95.00
Terr.	08-03-1885	I	238	3.40	98.40
Terr.	08-03-1885	I	275	3.93	102.33
Terr.	08-03-1885	I	292.2	4.17	106.50
Terr.	08-03-1885	I	339	4.84	111.34
Terr.	08-03-1885	I	637	9.10	120.44
Terr.	-1894	I	70	1.00	121.44
Terr.	-1894	I	80	1.14	122.58
264E	04-27-1897	I	55	0.78	123.36
282E	10-18-1897	I	25	0.35	123.71
346E	06-13-1898	I	150	2.14	125.85
1064E	01-02-1903	I	84	1.20	127.05
1370E	01-24-1905	I	77	1.10	128.15
4225E	07-30-1921	D	0	0.46	128.61
4224E	07-30-1921	Power	0	9.60	138.21
16791	05-15-1922	I	1.5	0.02	138.23
16791	05-15-1922	I	4	0.06	138.29
16791	05-15-1922	I	5	0.07	138.36
16791	05-15-1922	I	6.8	0.10	138.46
16791	05-15-1922	I	7.5	0.10	138.56
16791	05-15-1922	I	8	0.11	138.67

Direct Flow Rights cont'd:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
16791	05-15-1922	I	8.2	0.11	138.78
16791	05-15-1922	I	10	0.14	138.92
16791	05-15-1922	I	12.5	0.18	139.10
16791	05-15-1922	I	13.2	0.19	139.29
16791	05-15-1922	I	20.7	0.29	139.58
16791	05-15-1922	I	22.6	0.32	139.90
16791	05-15-1922	I	47	0.67	140.57
16791	05-15-1922	I	88.4	1.26	141.83

Associated Storage Rights: Irrigators on Prairie Dog Ditch use water stored in Kearney and Willow reservoirs.

Irrigation Practices: Irrigators tend to irrigate 50 percent alfalfa and 50 percent grass. They use a variety of irrigation practices: 60% flood, 20% sprinkler, 20% gated pipe.

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Prairie Dog Creek	50	35	25

Losses: Approximately 10 percent by the end of the ditch.

References: Warren Gilbert, water commissioner, State Engineer's Office, interview, 21 Sept. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Prairie Dog Water Supply Co., 1st App. (Piney & Cruse)	Oct. 1, 1880	163	2.32	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
Terr	D	Prairie Dog Water Supply Co, 2nd App. (Piney & Cruse, Red Butte, Rose No.1)	May 1, 1884	3170.1	45.31	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
Terr	D	Prairie Dog Water Supply Co., 3rd App. (Piney & Cruse, Red Butte, Rose #1)	Aug. 3, 1885	5027.5	71.81	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
Terr	D	Prairie Dog Water Supply Co., 3rd App. (Piney & Cruse, Red Butte, Rose #1)	Aug. 3, 1885	145.9	2.08	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
Terr	D	Prairie Dog Water Supply Co., 4th App.	Dec. 31, 1894	150	2.14	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
264	E	Enl. Prairie Dog Water Supply Co.	April 12, 1897	55	0.78	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
346	E	Enl. Prairie Dog Water Supply Co. & Nine Mile	June 13, 1898	150	2.14	CFS	OS	Adj	Piney Creek (N. Piney & S. Piney)
10658	D	Willey & Harden Lateral Prairie Dog Water Supply C	April 20, 1911	155	0		SS	Adj	Mead Creek
16765	D	Prairie Dog Water Supply Companys	Dec. 6, 1920	5240	0		SS	Una	South Fork Piney Creek
16790	D	Prairie Dog Water Supply Co.	May 15, 1922	4	0		SS	Adj	North Piney Creek
16790	D	Prairie Dog Water Supply Co.	May 15, 1922	5	0		SS	Adj	North Piney Creek

Irrigated Lands Water Rights Database cont'd.

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
16790	D	Prairie Dog Water Supply Co.	May 15, 1922	7.5	0		SS	Adj	North Piney Creek
16790	D	Prairie Dog Water Supply Co.	May 15, 1922	12.5	0		SS	Adj	North Piney Creek
16790	D	Prairie Dog Water Supply Co.	May 15, 1922	20.7	0		SS	Adj	North Piney Creek
16790	D	Prairie Dog Water Supply Co.	May 15, 1922	47	0		SS	Adj	North Piney Creek
16790	D	Prairie Dog Water Supply Co.	May 15, 1922	119.4	0		SS	Adj	North Piney Creek
16790	D	Prairie Dog Water Supply Ditch Co.	May 15, 1922	286.4	0		SS	Adj	North Piney Creek
16790	D	Prairie Dog Water Supply Co.	May 15, 1922	450.4	0		SS	Una	North Piney Creek
16791	D	Prairie Dog Water Supply Co.	May 15, 1922	4	0.06	CFS	OS	Adj	South Piney Creek
16791	D	Prairie Dog Water Supply Co.	May 15, 1922	5	0.07	CFS	OS	Adj	South Piney Creek
16791	D	Prairie Dog Water Supply Co.	May 15, 1922	7.5	0.1	CFS	OS	Adj	South Piney Creek
16791	D	Prairie Dog Water Supply Co.	May 15, 1922	12.5	0.18	CFS	OS	Adj	South Piney Creek
16791	D	Prairie Dog Water Supply Co.	May 15, 1922	18	0		SS	Adj	South Piney Creek
16791	D	Prairie Dog Water Supply Co.	May 15, 1922	20.7	0.29	CFS	OS	Adj	South Piney Creek
16791	D	Prairie Dog Water Supply Co.	May 15, 1922	47	0.67	CFS	SS	Adj	South Piney Creek
16791	D	Prairie Dog Water Supply Co.	May 15, 1922	88.4	1.26	CFS	OS	Adj	South Piney Creek
16791	D	Prairie Dog Water Supply Ditch Co.	May 15, 1922	255.4	3.62	CFS	OS	Adj	South Piney Creek
5401	E	Enl. Prairie Dog Water Supply No. 13	Dec. 10, 1945	97	1.39	CFS	OS	Adj	Prairie Dog Creek
20615	D	Prairie Dog Water Supply Co.	Aug. 17, 1950	138.5	0		SEC	Adj	South Piney Creek (973R)
22280	D	Prairie Dog Water Supply	Oct. 17, 1955	301	0		SEC	Adj	South Piney Creek (973R)

Name	Prairie Dog Ditch Diversion
Source	North & South Piney Creeks
District	11
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971							0.00	654.58	2075.23	3981.02	3459.57	1510.81	11681.21
1972							0.00	794.18	2408.53	2817.72	3043.63	2286.35	11350.41
1973							0.00	0.00	3508.56	3172.16	3194.97	2102.08	11977.77
1974							0.00	977.85	3296.53	3626.38	3463.54	1718.28	13082.58
1975							0.00	0.00	2357.85	3059.42	3543.91	1418.58	10379.76
1976							0.00	885.86	3017.63	3530.50	3596.37	3479.11	14509.47
1977							0.00	0.00	0.00	0.00	3323.13	2518.73	5841.86
1978							0.00	0.00	148.92	2252.17	3313.64	2020.96	7735.69
1979													
1980							0.00	2153.00	2628.00	3293.00	3050.00	1824.00	12948.00
1981							0.00	1914.00	1852.00	2751.00	2952.00	1605.00	11074.00
1982							0.00	1850.00	1750.00	2540.00	3240.00	1490.00	10870.00
1983							0.00	0.00	3730.00	3450.00	3540.00	2070.00	12790.00
1984							0.00	0.00	2370.00	3890.00	4550.00	2055.00	12865.00
1985							0.00	2979.00	3512.00	4019.00	3491.00	1687.00	15688.00
1986							0.00	2505.00	2555.00	3256.00	3162.00	2025.00	13503.00
1987							0.00	3370.00	2997.00	3745.00	2887.00	1954.00	14953.00
1988							0.00	1068.30	4064.80	3625.20	3712.40	1922.90	14393.60
1989							0.00	816.00	3314.20	3577.90	3363.30	1810.80	12882.20
1990							0.00	969.67	2833.15	3615.27	3364.31	1069.09	11851.49
1991							0.00	571.40	2098.30	4026.20	3771.50	1649.50	12116.90
1992							271.90	2696.00	3011.30	3014.70	3542.30	1119.90	13656.10
1993							0.00	533.70	1158.50	1578.70	1834.10	1337.30	6442.30
1994							0.00	438.80	3406.50	4094.10	3997.60	1277.80	13214.80
1995							294.60	202.90	848.20	2919.70	4157.80	2240.70	10663.90
1996							0.00	654.70	2240.70	4105.80	3838.10	2640.00	13479.30
1997							0.00	1036.00	2239.00	2732.70	2763.90	1009.30	9780.90
1998							0.00	1863.30	4283.40	3796.50	4008.70	2332.20	16284.10
1999							0.00	419.00	1845.50	3078.30	3974.20	2638.70	11955.70
Mean							20.23	1048.33	2483.96	3198.16	3433.53	1886.18	12070.39
Max							294.60	3370.00	4283.40	4105.80	4550.00	3479.11	16284.10
Min							0.00	0.00	0.00	0.00	1834.10	1009.30	5841.86

Notes:
1. Monthly data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Prairie Dog Ditch Diversion
Source	North & South Piney Creeks
District	11
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971	22-May	27-Sep	0
1972	19-May	30-Sep	0
1973	1-Jun	25-Sep	0
1974	15-May	30-Sep	0
1975	1-Jun	30-Sep	0
1976	11-May	30-Sep	0
1977	1-Aug	30-Sep	0
1978	27-Jun	30-Sep	0
1979			
1980	1-May	30-Sep	0
1981	1-May	30-Sep	0
1982	1-May	30-Sep	0
1983	1-Jun	30-Sep	0
1984	1-Jun	30-Sep	0
1985	6-May	30-Sep	0
1986	1-May	30-Sep	0
1987	1-May	30-Sep	0
1988	18-May	30-Sep	0
1989	16-May	30-Sep	0
1990	22-May	30-Sep	0
1991	22-May	30-Sep	0
1992	24-Apr	15-Sep	0
1993	6-May	30-Sep	0
1994	26-May	15-Sep	0
1995	18-Apr	30-Sep	0
1996	2-May	30-Sep	0
1997	15-May	30-Sep	0
1998	15-May	30-Sep	0
1999	21-May	30-Sep	0
Avg.	17-May	28-Sep	0
Earliest	18-Apr	15-Sep	0
Latest	1-Aug	30-Sep	0

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Pratt & Ferris
No. 1 Headgate

Diversion: **PRATT & FERRIS NO. 1 DITCH DIVERSION**
AKA: P&F No. 1

Date: 21 Sep. 2000

Diversion Description: Headgate consists of a single, 4.5 x 4.5-foot rectangular steel gate in steel slides operated with a Waterman-type screw, mounted in a concrete headwall. The structure adjoins a concrete dam.

Diversion Location: The Pratt & Ferris No. 1 Ditch diversion is located on the main stem of Piney Creek just upstream from Ucross.

Headgate:

Lat.	Long.
N 44° 34' 1.1"	W 106° 33' 27.1"

Flume:

Lat.	Long.
N 44° 33' 55.9"	W 106° 33' 23.4"

Pratt & Ferris No. 1 Flume

Conveyance Description: Open channel, approximately 6 miles long.

Direct Flow Water Rights: The direct-flow water rights are summarized below:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	07-00-1884	I	900.00	12.86	12.86
1039E	05-09-1903	I	288.10	4.12	16.98
5516E	03-20-1950	I	33.40	0.48	17.46
5606E	03-06-1952	I	47.55	0.68	18.14

Associated Storage Rights: Irrigators on the Pratt & Ferris No. 1 use water stored in Lake DeSmet.

Irrigation Practices: 90% flood, 10% sprinkler

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Powder River	50	35	25

Losses: Approximately 10 percent by the end of the ditch.

References: Carmine LoGuidice, water commissioner, State Engineer's Office, interview, 12 Oct. 2000.

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
1039	E	Enl. Pratt & Ferris No. 1	May 9, 1903	288.1	4.12	CFS	OS	Adj	Piney Creek
5438	E	Enl. Pratt & Ferris No. 1	April 18, 1947	180	0		SS	Adj	Piney Creek
5516	E	Enl. Pratt & Ferris No. 1	March 20, 1950	33.4	0.48	CFS	OS	Adj	Piney Creek
5606	E	Enl. Pratt & Ferris No. 1	March 6, 1952	47.55	0.68	CFS	OS	Adj	Piney Creek

Name	Pratt & Ferris No. 1 Ditch Diversion
Source	Piney Creek
District	9
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								0.00	774.35	1864.82	780.46	0.00	3419.63
1975													
1976													
1977													
1978													
1979													
1980													
1981								1009.51	1250.95	1807.87	697.94	380.63	5146.90
1982								211.28	1791.99	1793.55	1090.61	229.22	5116.65
1983								302.83	1789.64	1774.08	1030.31	458.97	5355.83
1984								0.00	1449.27	1171.58	1608.73	0.00	4229.58
1985								848.97	1299.07	1370.59	868.65	320.83	4708.11
1986								126.52	1267.76	1869.92	1564.61	166.26	4995.07
1987								817.42	1171.15	1678.36	1020.50	0.00	4687.43
1988								0.00	362.51	1356.66	1476.46	172.01	3367.64
1989								523.64	1451.11	1738.71	1800.40	488.43	6002.29
1990								105.92	1871.01	1639.73	1194.45	195.97	5007.08
1991								166.41	343.80	1516.37	1650.94	592.36	4269.88
1992								680.63	950.58	1715.30	1075.24	299.40	4721.15
1993								616.96	1085.35	1263.57	1190.18	926.58	5082.64
1994								444.06	1483.76	1489.03	1164.45	576.46	5157.76
1995								0.00	340.88	1379.56	1392.39	1265.01	4377.84
1996								243.05	772.34	1355.58	1122.72	527.30	4020.99
1997								0.00	1234.52	1407.37	528.17	404.15	3574.21
1998								159.16	752.48	1169.81	1222.61	248.09	3552.15
1999								0.00	52.76	959.66	1593.73	460.09	3066.24
Mean								312.82	1074.76	1516.11	1203.68	385.59	4492.95
Max								1009.51	1871.01	1869.92	1800.40	1265.01	6002.29
Min								0.00	52.76	959.66	528.17	0.00	3066.24

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement
3. July 1974 data includes interpolated data using WRDS records.

Name	Pratt & Ferris No. 1 Ditch Diversion
Source	Piney Creek
District	9
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	17-Jun	31-Aug	1
1975			
1976			
1977			
1978			
1979			
1980			
1981	14-May	28-Sep	15
1982	26-May	20-Sep	18
1983	25-May	30-Sep	8
1984	1-Jun	30-Aug	10
1985	14-May	13-Sep	13
1986	29-May	5-Sep	11
1987	12-May	21-Aug	31
1988	21-Jun	8-Sep	13
1989	15-May	15-Sep	5
1990	28-May	14-Sep	11
1991	15-May	13-Sep	17
1992	15-May	25-Sep	7
1993	14-May	29-Sep	7
1994	23-May	30-Sep	5
1995	5-Jun	27-Sep	5
1996	7-May	20-Sep	21
1997	3-Jun	11-Sep	15
1998	22-May	16-Sep	22
1999	10-Jun	20-Sep	18
Avg.	25-May	15-Sep	13
Earliest	7-May	21-Aug	1
Latest	21-Jun	30-Sep	31

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **ROCK CREEK & SOUTH PINEY DITCH DIVERSION**
AKA: Rock Creek & Piney Ditch Co.

Date: 12 Oct. 2000

Diversion Description: Headgate consists of two, 3.5 x 5-foot rectangular wood-and-steel gates in steel slides operated with Waterman-type screws, mounted in a concrete headwall.

Rock Creek & South Piney headgate

Diversion Location: The Rock Creek & South Piney Ditch diversion is located on the South Fork of Piney Creek and is the first diversion downstream of Cloud Peak and Willow Park reservoirs.

Headgate:

Lat.	Long.
N 44° 28' 21.0"	W 107° 1' 52.2"

Flume:

Lat.	Long.
N 44° 28' 23.4"	W 107° 1' 48.0"

Rock Creek & South Piney flume and gage

Conveyance Description: Open channel canal, approximately 1.8 miles long.

Direct Flow Water Rights: The summary for direct flow rights follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
1330	09-08-1896	I	134.0	1.91	1.91
1334	09-28-1896	I	73.3	1.04	2.95
1334	09-28-1896	I	98.7	1.41	4.36
1323	10-01-1896	I	26.0	0.37	4.73
1323	10-01-1896	I	30.0	0.43	5.16
1323	10-01-1896	I	95.0	1.35	6.51
1323	10-01-1896	I	254.2	3.62	10.13
1323	10-01-1896	I	271.6	3.88	14.01
1323	10-01-1896	I	316.4	4.51	18.52
1323	10-01-1896	I	1325.1	18.93	37.45
1643E	09-24-1906	I	69.0	0.98	38.43

Associated Storage Rights: Irrigators on the Rock Creek & South Piney Ditch use water stored in Willow and Cloud Peak reservoirs.

Irrigation Practices: Irrigators tend to irrigate pasture, approximately 95 percent grass, 5 percent alfalfa. They use ditch-flood irrigation only.

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
South Fork Piney Creek	50	35	25

Losses: Approximately 25 percent by the end of the ditch.

References: Carmine LoGuidice, water commissioner, State Engineer's Office, interview, 12 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
1330	D	Rock Creek & Piney Reservoir & Ditch Co.'s Canal	Sep. 8, 1896	134	1.91	CFS	OS	Adj	South Piney Creek
1323	D	Rock Creek & Piney Reservoir & Ditch Co.'s Canal	Oct. 1, 1896	2318	33.09	CFS	OS	Adj	South Piney Creek
1323	D	Rock Creek & Piney Reservoir & Ditch Co.'s Canal	Oct. 1, 1896	3888			SS	Adj	South Piney Creek
1643	E	Enl. Rock Creek & Piney Ditch Co./Barkey Lateral	Sep. 24, 1906	69	0.98	CFS	OS	Adj	South Piney Creek

Name	Rock Creek & South Piney Ditch Diversion
Source	South Piney Creek
District	11
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971								0.00	412.52	2193.72	2856.00	1318.41	6780.65
1972													
1973								0.00	91.83	1891.00	1912.86	466.51	4362.20
1974													
1975													
1976													
1977								0.00	228.97	2321.61	1543.50	143.29	4237.37
1978								0.00	0.00	700.09	2582.46	1322.28	4604.83
1979													
1980								0.00	525.00	2269.00	2396.00	596.00	5786.00
1981								0.00	1118.00	1868.00	1939.00	986.00	5911.00
1982								0.00	420.00	850.00	1840.00	2470.00	5580.00
1983								0.00	0.00	1120.00	2400.00	1690.00	5210.00
1984								0.00	0.00	1020.00	2180.00	954.00	4154.00
1985								397.00	1504.00	2508.00	2292.00	582.00	7283.00
1986								0.00	288.00	1578.00	2090.00	1714.00	5670.00
1987								617.00	1048.00	792.00	1595.00	1009.00	5061.00
1988								0.00	1295.00	2585.30	1235.70	706.50	5822.50
1989								110.60	1170.60	1717.40	1523.40	1349.30	5871.30
1990								0.00	303.36	1419.53	2086.54	1183.04	4992.47
1991								0.00	0.00	1169.90	2196.60	866.70	4233.20
1992								45.70	1385.20	1576.80	1471.20	1050.60	5529.50
1993								0.00	244.00	1300.40	1869.50	917.10	4331.00
1994								143.50	1399.50	2249.90	1256.00	399.80	5448.70
1995								0.00	39.80	704.70	1735.60	1039.80	3519.90
1996								0.00	436.90	1093.40	1642.40	1126.30	4299.00
1997								0.00	272.20	524.60	1233.90	1183.80	3214.50
1998								0.00	0.00	1390.10	2404.00	1480.20	5274.30
1999								0.00	227.00	1331.10	2770.00	1524.10	5852.20
Mean								54.74	517.08	1507.27	1960.49	1086.61	5126.19
Max								617.00	1504.00	2585.30	2856.00	2470.00	7283.00
Min								0.00	0.00	524.60	1233.90	143.29	3214.50

Notes:
1. Monthly data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement
3. Jun 1971 data includes interpolated data using the WRDS records.

Name	Rock Creek & South Piney Ditch Diversion
Source	South Piney Creek
District	11
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971	17-Jun	30-Sep	2
1972			
1973	30-Jun	10-Sep	0
1974			
1975			
1976			
1977	14-Jun	30-Sep	0
1978	6-Jul	30-Sep	0
1979			
1980	10-Jun	28-Sep	0
1981	1-Jun	30-Sep	0
1982	17-Jun	30-Sep	0
1983	1-Jul	30-Sep	0
1984	1-Jul	28-Sep	0
1985	21-May	26-Sep	0
1986	1-Jun	27-Sep	0
1987	14-May	14-Sep	0
1988	7-Jun	29-Sep	0
1989	26-May	30-Sep	0
1990	14-Jun	29-Sep	0
1991	8-Jul	20-Sep	0
1992	29-May	19-Sep	0
1993	10-Jun	30-Sep	0
1994	28-May	30-Sep	0
1995	27-Jun	25-Sep	0
1996	12-Jun	30-Sep	0
1997	1-Jun	30-Sep	0
1998	1-Jul	30-Sep	0
1999	11-Jun	30-Sep	0
Avg.	12-Jun	26-Sep	0
Earliest	14-May	10-Sep	0
Latest	8-Jul	30-Sep	2

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

ROCK CREEK

HALLIE DITCH DIVERSION
LAKE DESMET (M&M) DITCH DIVERSION
MOWRY BASIN DITCH DIVERSION
PRINCE ALBERT DITCH DIVERSION

ROCK CREEK DRAINAGE
INTRODUCTION

BACKGROUND

Rock Creek flows out of the east slope of the Bighorn Mountains, beginning on hydrographers' maps as the north and south forks of Rock Creek. Three other, smaller tributaries (Sayles, Johnson, and Sand creeks) join it before it terminates in Clear Creek, which in turn flows into the Powder River. The Powder River crosses the Montana state line north of Spotted Horse, Wyoming.

CHARACTERISTICS

Rock Creek travels steep slopes in its course, much of which are characterized by mountainous seams and the subsurface ducts. As a result, water commissioners estimate that losses (or "shrinkage") to releases from Willow Park and Cloud Peak reservoirs at 60 percent in a dry year to 40 percent in a wet year. (This reservoir water, used extensively in Rock Creek, is transferred to the North Fork of Rock Creek through the Rock Creek & Piney Ditch Co. Canal.)

USAGE

Rock Creek's diversions are entirely devoted to agricultural irrigation.

Regulation

Water commissioners estimate that regulation is imposed on Rock Creek drainage diversions with the following timing:

Wet Year	Average Year	Dry Year
mid-August	mid-July	mid-June

Even under regulation, Johnson Creek flows 1-2 cfs.

Agriculture

Growers in the Rock Creek drainage tend to devote approximately 60 percent of their lands to alfalfa, 40 percent to grass hay. They have the following irrigation practices:

Percentage of lands served by irrigation type:

Flood	Gated Pipe	Sprinklers
25	60	15

The typical irrigation season runs from April 15-May 1 (depending on whether the spring runoff is delayed by colder weather) to early/mid October (depending on when the first snows fall and the ground freezes). Approximately 10 percent of the irrigators using Rock Creek water (the biggest users) practice post-season irrigation, though they usually do not use their entire right to do so.

Double Appropriation

Irrigation water rights with priority dates of March 1, 1945 or earlier are entitled to an additional 1cfs per 70 acres under Wyoming's surplus water statutes. Whenever the supply in a stream exceeds to amount required to satisfy all existing appropriations established prior to March 1, 1985, the stream is said to be in an excess flow condition and water right holders with priorities between March 2, 1945 and March 1, 1985 may use an additional 1 cfs for each 70 acres irrigated.

In Rock Creek, this practice is limited primarily by the condition of ditches. Many of the ditches are not capable of carrying all of the water an irrigator could use.

% of appropriation	% of ditches in drainage capable of flow
200	20
150	60
100-150	90
0-100	90

Permitted Uses

Permits granted for water appropriation are granted for specific uses. The following pages contain tables of permits and their associated uses. The following table provides a key to those uses:

Code	Use
Chem	Chemical
Com	Commercial
Cul	Culinary
D	Domestic
Drl	Drilling
Eng	Steam Engines
Fire	Fire Protection
Fish	Fish Propogation
F.C.	Flood Control
I	Irrigation
Ind	Industrial
I.F.	Instream Flow
Mech	Mechanical
Mfg	Manufacturing
Mil	Milling

Code	Use
Min	Mining
Misc	Miscellaneous
Mun	Municipal
Oil	Oil Refining or Production
P.C.	Pollution Control
Power	Power Development
R.R.	Railroad
Rec	Recreational
Ref	Refining
Res. Supply	Supply Facility for a Reservoir
S	Stock
T	Transportation

WATER RIGHTS

Two water rights summary tables are provided for each diversion serving irrigation referenced here. The first, included in the body of the diversion synopsis, refers to the rights on record with the State Engineer's Office and is derived from that office's *Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two* (Oct. 1999).

Because this rights summary is pulled directly from the SEO *Tab,* the rights cited follow the SEO's priority order:

Hierarchy	Format of right	Example
1	Day, Month, Year	05-15-1884
2	Month and Year	05-00-1884
3	Specified Season and Year	Spring 1884
4	Year Only	1884
5	Before Year	Before 1884

Board orders or court orders may also establish a specific priority.

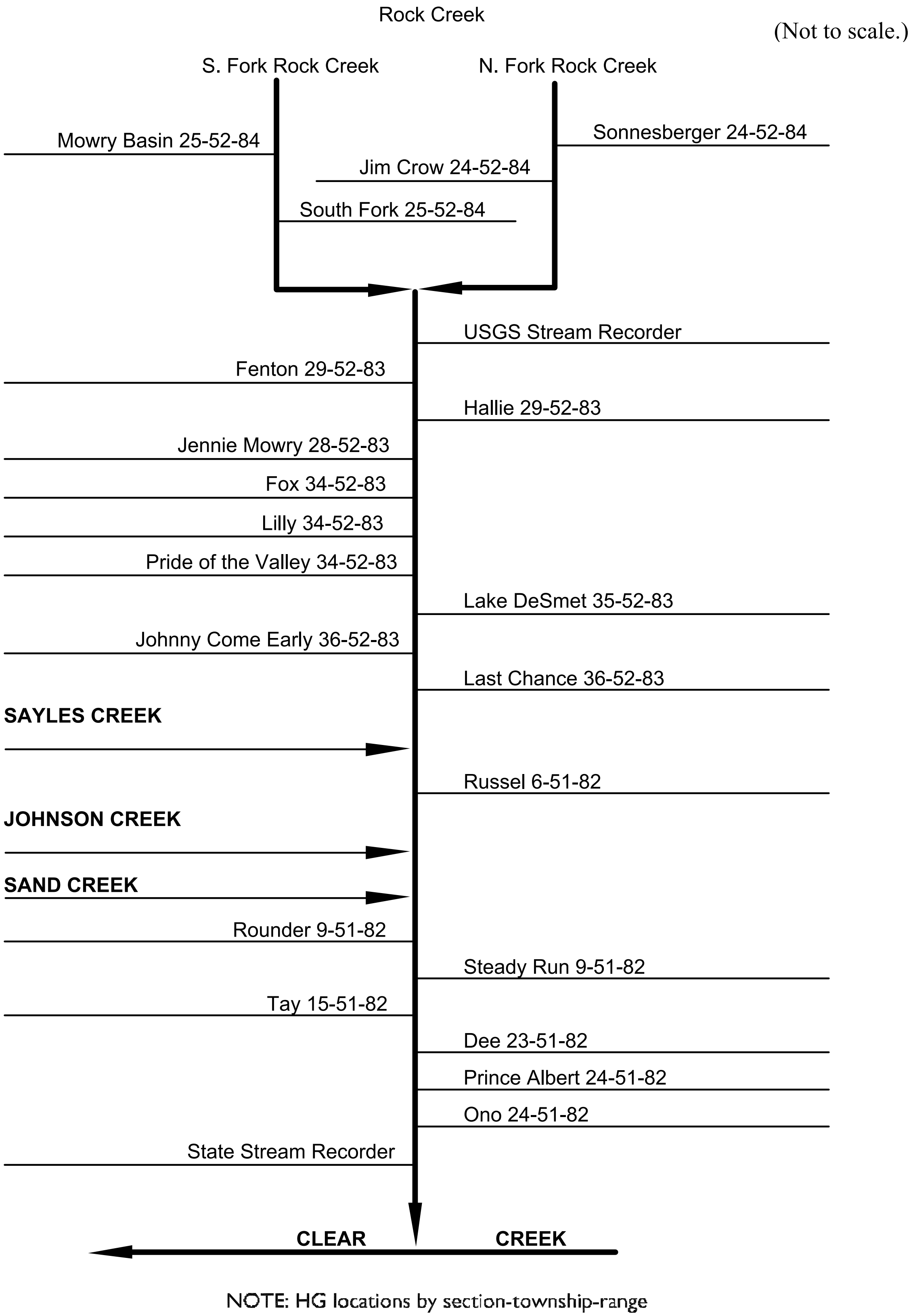
Irrigated Lands Water Rights Database

The second table, which follows the diversion synopsis, is taken from the irrigated lands water rights database developed for the basin plan. It can be used as a reference with the following caveats: It only lists water rights associated with the irrigated lands polygons mapped by HKM. The table does not include nonirrigation rights devoted to reservoir supply, municipal, fish propagation, etc. The rights on this table are associated only with those irrigated lands identified through the course of this study, both actively irrigated and currently idle.

Column Heading Key

PerNo	Permit Number	“Terr” denotes a territorial right.
PerSfx	Permit Suffix	D = direct flow E = enlargement R = reservoir
Facility Name		Parentheses denote the former means of conveyance for the water right.
Unit	Flow or volume	CFS = cubic feet per second AF = acre-feet GPM = gallons per minute
SupTyp	Supply Type	OS = original supply SS = supplement supply, for lands having an original supply from another source Sec = secondary supply, for water stored in a reservoir
Status	Status of adjudication	Adj = adjudicated Una = unadjudicated
Source	Source water	Parentheses denote the permit number of the related storage right.

Schematic of Rock Creek stream and diversions:



KEY DIVERSIONS

Diversion: **HALLIE DITCH DIVERSION**

Hallie Ditch headgate

Date: 18 Oct. 2000

Diversion Description: Headgate consists of a single, 4.5 x 4.8-foot steel gate in steel slides operated with a Waterman-type screw, mounted in a concrete headwall. The headgate is in good condition.

Diversion Location: The Hallie Ditch diversion is located on the main stem of Rock Creek, between the confluences of the South and North forks and the of Rock and Sayles creeks.

Headgate:

Lat.	Long.
N 44° 27' 16.0"	W 106° 52' 11.3"

Flume:

Lat.	Long.
N 44° 27' 16.0"	W 106° 52' 9.4"

Hallie Ditch flume

Conveyance Description: Open channel canal, approximately 6.1 mi. long.

Direct Flow Water Rights: The summary for direct flow rights follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	04-10-1886	I	5.00	0.07	0.07
Terr.	04-10-1886	I	160.00	2.28	2.35
Terr.	04-10-1886	I	160.00	2.28	4.63
Terr.	04-10-1886	I	175.30	2.50	7.13
Terr.	04-10-1886	I	820.00	11.71	18.84
659E	05-04-1901	D,I,S	320.00	4.57	23.41
1116E	05-21-1903	I	159.00	2.27	25.68

Irrigators on the Hallie Ditch take advantage of the Double Appropriation Doctrine.

Associated Storage Rights: Irrigators on Hallie Ditch use stored water from Willow and Cloud Peak reservoirs.

Irrigation Practices: See introduction to Rock Creek drainage above.

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Shell Creek	5	2	0

Losses: 25 percent by the end of the ditch

References: Carmine LoGuidice, water commissioner, State Engineer's Office, interview, 18 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Hallie	April 10, 1886	1320.3	18.84	CFS	OS	Adj	Rock Creek
659	E	Enl. Hallie	May 4, 1901	320	4.57	CFS	OS	Adj	Rock Creek
2531	E	Enl. Kempton (Hallie)	Aug. 21, 1911	24	0.34	CFS	OS	Adj	Rock Creek

Name	Hallie Ditch Diversion
Source	Rock Creek
District	3
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971							0.00	228.69	799.02	562.95	547.54	388.40	2526.60
1972							0.00	261.64	1104.34	642.94	615.55	635.90	3260.37
1973							0.00	258.39	1324.16	421.47	737.04	487.34	3228.40
1974							20.89	924.14	1143.71	611.48	407.03	237.26	3344.51
1975							0.00	0.00	0.00	422.24	436.76	448.54	1307.54
1976													
1977							0.00	604.40	1026.85	532.26	0.00	0.00	2163.51
1978							0.00	0.00	0.00	511.14	498.15	439.62	1448.91
1979													
1980							0.00	193.00	633.00	255.00	552.00	0.00	1633.00
1981							0.00	333.00	720.00	372.00	349.00	232.00	2006.00
1982							0.00	34.40	750.00	810.00	260.00	400.00	2254.40
1983							0.00	0.00	846.00	567.00	507.00	225.00	2145.00
1984							0.00	0.00	400.00	846.00	248.00	401.00	1895.00
1985							0.00	287.00	821.00	345.00	404.00	351.00	2208.00
1986							122.00	689.00	803.00	800.00	246.00	414.00	3074.00
1987							0.00	541.47	611.48	473.86	473.00	542.00	2641.81
1988							0.00	0.00	541.50	240.60	159.60	114.70	1056.40
1989							0.00	683.10	612.40	492.90	528.80	238.20	2555.40
1990							0.00	32.91	951.25	531.74	335.03	253.83	2104.76
1991							0.00	55.70	605.70	563.90	355.70	192.50	1773.50
1992							0.00	597.80	787.90	467.90	422.00	266.50	2542.10
1993							0.00	0.00	246.90	289.00	444.70	455.60	1436.20
1994							3.80	365.40	538.90	378.50	320.70	163.40	1770.70
1995							48.20	86.30	433.00	436.30	299.40	311.60	1614.80
1996							0.00	312.80	926.90	475.10	287.30	418.00	2420.10
1997							0.00	464.90	422.80	130.00	77.70	49.30	1144.70
1998							0.00	437.30	959.90	712.50	739.00	390.90	3239.60
1999							0.00	34.10	268.10	398.90	466.70	372.20	1540.00
Mean							7.22	275.02	676.96	492.25	396.95	312.18	2160.57
Max							122.00	924.14	1324.16	846.00	739.00	635.90	3344.51
Min							0.00	0.00	0.00	130.00	0.00	0.00	1056.40

Notes:
1. Monthly data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 198
2. Zero flow is assumed prior to the first and after the last measuremen
3. Monthly data for May-July 1987 is derived from spot measurements in the Hydrographers' Annual Reports
4. June & July 1974 data includes interpolated data using WRDS records.

Name	Hallie Ditch Diversion
Source	Rock Creek
District	3
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971	24-May	30-Sep	0
1972	10-May	30-Sep	0
1973	22-May	30-Sep	0
1974	28-Apr	30-Sep	0
1975	7-Jul	30-Sep	0
1976			
1977	17-May	31-Jul	27
1978	11-Jul	30-Sep	0
1979			
1980	11-May	29-Aug	0
1981	1-May	30-Sep	0
1982	24-May	30-Sep	0
1983	1-Jun	30-Sep	0
1984	11-Jun	30-Sep	0
1985	23-May	30-Sep	0
1986	9-Apr	25-Sep	0
1987	14-May	30-Sep	44
1988	6-Jun	30-Sep	0
1989	10-May	30-Sep	0
1990	31-May	30-Sep	0
1991	29-May	30-Sep	0
1992	5-May	30-Sep	0
1993	14-Jun	30-Sep	0
1994	30-Apr	30-Sep	0
1995	19-Apr	30-Sep	0
1996	1-May	30-Sep	0
1997	16-May	30-Sep	0
1998	5-May	30-Sep	0
1999	26-May	30-Sep	0
Avg.	19-May	26-Sep	3
Earliest	9-Apr	31-Jul	0
Latest	11-Jul	30-Sep	44

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **LAKE DESMET (M&M) DITCH DIVERSION**

Date: 18 Oct. 2000

Diversion Description: Headgate consists of two, 5.5 x 4.5-foot steel gates in steel slides operated with Waterman-type screws, mounted in a concrete headwall. The structure adjoins a rock dam. The diversion is in excellent condition.

Lake DeSmet Ditch headgate

Diversion Location: The Lake DeSmet Ditch diversion is located on the main stem of Rock Creek, between the confluence of the South and North forks and the confluence of Rock and Sayles creeks.

Headgate:

Lat.	Long.
N 44° 26' 6.8"	W 106° 48' 55.2"

Flume:

Lat.	Long.
N 44° 26' 5.3"	W 106° 48' 49.2"

Lake DeSmet Ditch flume

Conveyance Description: Open channel canal, approximately 9.2 mi. long, with approximately 400 feet in a siphon.

Direct Flow Water Rights: The summary for direct flow rights follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	10-31-1884	I	25.00	0.36	0.36
Terr.	10-31-1884	I	70.00	1.00	1.36
Terr.	10-31-1884	I	100.00	1.43	2.79
Terr.	10-31-1884	I	300.00	4.28	7.07
Terr.	10-31-1884	I	520.00	7.43	14.50
Terr.	10-31-1884	I	523.00	7.47	21.97
Terr.	10-31-1884	I	3500.70	50.01	71.98
658E	04-22-1901	I	373.00	5.32	77.30
815E	04-19-1902	I	359.00	5.12	82.42
6800E	12-20-1979	Fish	0.00	10.00	92.42

Much of the water carried by this ditch is actually from South Piney Creek.

The maximum appropriation carried by the Lake DeSmet Ditch is approximately 58 percent (54 cfs). The condition of the ditch precludes larger flows.

Associated Storage Rights: Irrigators on Lake DeSmet Ditch use stored water from Willow and Cloud Peak reservoirs.

Irrigation Practices: See introduction to Rock Creek drainage above.

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Rock Creek	0	0	0

Losses: Approximately 5 percent by the end of the ditch

References: Carmine LoGuidice, water commissioner, State Engineer's Office, interview, 18 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Lake DeSmet	Oct. 31, 1884	5038.7	71.98	CFS	OS	Adj	Rock Creek
815	E	Enl. Lake DeSmet	April 19, 1902	359	5.12	CFS	OS	Adj	Rock Creek

Name	Lake DeSmet (M&M) Ditch Diversion
Source	Rock Creek
District	3
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971							475.40	2287.73	2162.78	1372.36	1423.34	841.31	8562.92
1972							113.36	1385.51	2269.09	1630.61	1426.91	286.04	7111.52
1973							418.67	1583.48	2742.94	1591.73	1186.31	676.94	8200.07
1974							117.46	1975.81	2162.78	1619.70	1414.21	571.04	7861.00
1975							0.00	0.00	0.00	2280.73	1878.74	0.00	4159.47
1976													
1977							0.00	1496.03	1556.43	1357.43	957.04	180.04	5546.97
1978							238.31	661.65	1123.04	1257.62	1640.27	568.66	5489.55
1979													
1980							266.00	1680.00	1665.00	1230.00	1051.00	366.00	6258.00
1981							116.00	984.00	1662.00	1413.00	1032.00	505.00	5712.00
1982							190.00	700.00	1880.00	1510.00	1120.00	670.00	6070.00
1983							433.00	701.00	1760.00	1120.00	990.00	940.00	5944.00
1984							0.00	725.00	969.00	1033.00	1570.00	764.00	5061.00
1985							0.00	0.00	1451.00	1073.00	1308.00	348.00	4180.00
1986							0.00	1877.00	2001.00	1160.00	1078.00	1365.00	7481.00
1987							277.00	1992.00	1430.00	973.00	901.00	964.00	6537.00
1988							287.40	1353.70	1942.60	1401.30	633.50	120.00	5738.50
1989							160.60	424.40	1709.90	1398.10	691.90	397.30	4782.20
1990							286.60	1505.44	1692.62	1276.36	1313.49	530.39	6604.90
1991							237.90	965.70	1577.50	1020.90	954.80	406.60	5163.40
1992							210.60	1317.60	1001.40	744.00	620.30	746.70	4640.60
1993							53.50	1405.10	1209.40	526.80	601.40	393.20	4189.40
1994							80.10	1034.40	1368.30	819.40	432.80	27.70	3762.70
1995							0.00	102.70	1138.80	562.00	676.30	366.90	2846.70
1996							0.00	1188.90	1935.90	666.40	488.10	380.10	4659.40
1997							0.00	792.10	957.20	507.70	375.20	435.20	3067.40
1998							0.00	1225.60	2186.90	823.80	929.30	305.20	5470.80
1999							0.00	317.80	1333.00	614.70	982.20	466.00	3713.70
Mean							146.74	1099.36	1588.47	1147.54	1025.04	504.49	5511.64
Max							475.40	2287.73	2742.94	2280.73	1878.74	1365.00	8562.92
Min							0.00	0.00	0.00	507.70	375.20	0.00	2846.70

Notes:
1. Monthly data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Lake DeSmet (M&M) Ditch Diversion
Source	Rock Creek
District	3
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971	4-Apr	30-Sep	0
1972	19-Apr	16-Sep	0
1973	10-Apr	30-Sep	0
1974	27-Apr	30-Sep	0
1975	1-Jul	31-Aug	0
1976			
1977	1-May	30-Sep	0
1978	18-Apr	30-Sep	0
1979			
1980	1-Apr	30-Sep	0
1981	1-Apr	30-Sep	0
1982	14-Apr	30-Sep	0
1983	1-Apr	30-Sep	0
1984	18-May	30-Sep	0
1985	6-Jun	30-Sep	0
1986	1-May	30-Sep	0
1987	10-Apr	30-Sep	0
1988	12-Apr	30-Sep	0
1989	11-Apr	30-Sep	0
1990	5-Apr	30-Sep	0
1991	2-Apr	30-Sep	0
1992	1-Apr	30-Sep	0
1993	16-Apr	30-Sep	0
1994	20-Apr	15-Sep	0
1995	19-May	30-Sep	0
1996	14-May	30-Sep	0
1997	13-May	30-Sep	0
1998	6-May	24-Sep	0
1999	7-May	30-Sep	0
Avg.	24-Apr	27-Sep	0
Earliest	1-Apr	31-Aug	0
Latest	1-Jul	30-Sep	0

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **MOWRY BASIN DITCH DIVERSION**

Date: 18 Oct. 2000

Mowry Basin headgate

Diversion Description: Headgate consists of a single, 3.5 x 1.2-foot steel gate in steel slides operated with a Waterman-type screw, mounted in a concrete headwall.

Diversion Location: The Mowry Basin Ditch diversion is located on the South Fork of Rock Creek.

Headgate:

Lat.	Long.
N 44° 26' 46.4"	W 106° 54' 30.7"

Flume:

Lat.	Long.
N 44° 26' 43.8"	W 106° 54' 20.0"

Mowry Basin flume

Conveyance Description: Canal, approximately 2.4 mi. long, with approximately 450 ft. of length in pipe.

Direct Flow Water Rights: The summary for direct flow rights follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	10-20-1884	I	10.00	0.14	0.14
Terr.	10-20-1884	I	70.00	1.00	1.14
Terr.	-1887	I	177.00	2.53	3.67
Terr.	-1887	I	60.00	0.86	4.53
Terr.	-1887	I	40.00	0.57	5.10
Terr.	-1887	I	35.00	0.50	5.60
2390E	07-25-1910	I	382.70	5.46	11.06
2460E	04-20-1911	I	111.60	1.59	12.65

Associated Storage Rights: Irrigators on Mowry Basin Ditch have arranged an exchange for water stored in Cloud Peak Reservoir.

Irrigation Practices: See Rock Creek summary above.

Return Flows:	Wet Yr.	Avg. Yr.	Dry Yr.
Rock Creek	10	5	2

Losses: Approximately 5 percent by the end of the ditch

References: Carmine LoGuidice, water commissioner, State Engineer's Office, interview, 18 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Mowry Basin (Fenton)	Oct. 20, 1884	80	1.14	CFS	OS	Adj	South Fork Rock Creek
Terr	D	Mowry Basin, 2nd App.	Dec. 31, 1887	312	4.46	CFS	OS	Adj	South Fork Rock Creek
Terr	D	Mowry Basin	Dec. 31, 1887	40	0.57	CFS	OS	Adj	South Fork Rock Creek
1900	E	Enl. Fenton (Mowry Basin)	June 1, 1908	120	1.71	CFS	OS	Adj	Rock Creek
2390	E	Enl. Mowry Basin	July 25, 1910	382.7	5.46	CFS	OS	Adj	South Fork Rock Creek
2460	E	Enl. Mowry Basin	April 20, 1911	111.6	1.59	CFS	OS	Adj	South Fork Rock Creek
4015	E	Enl. Mowry Basin	June 30, 1919	456	0		Sec	Adj	Mowry Basin (1355R)
303201	D	Love Enl. Mowry Basin	Nov. 9, 2000	0	0		OS	Una	South Fork Rock Creek

Name	Mowry Basin Ditch Diversion
Source	Rock Creek
District	3
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974													
1975													
1976													
1977													
1978													
1979													
1980													
1981								521.86	406.12	293.08	292.67	82.57	1596.30
1982								50.34	503.40	432.71	249.02	88.36	1323.83
1983								117.46	503.40	450.97	289.61	149.56	1511.00
1984								0.00	238.02	678.51	339.94	80.33	1336.80
1985													
1986								0.00	733.96	482.17	265.01	128.23	1609.37
1987								0.00	344.07	244.40	0.00	0.00	588.47
1988								0.00	48.10	221.53	175.85	73.75	519.23
1989													
1990								280.88	434.55	527.44	441.78	11.66	1696.31
1991								79.46	301.01	354.53	374.01	15.53	1124.54
1992								0.00	0.00	33.02	368.40	82.36	483.78
1993								317.42	85.51	198.81	354.18	33.80	989.72
1994								237.38	327.30	247.52	196.06	0.00	1008.26
1995								155.34	361.68	139.60	285.53	92.81	1034.96
1996								20.45	230.91	251.44	245.95	82.81	831.56
1997								128.08	214.91	149.95	155.29	0.00	648.23
1998								570.85	621.95	230.62	152.85	224.68	1800.95
1999								0.00	198.33	444.40	240.91	10.71	894.35
Mean								145.85	326.66	316.51	260.42	68.07	1117.51
Max								570.85	733.96	678.51	441.78	224.68	1800.95
Min								0.00	0.00	33.02	0.00	0.00	483.78

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Mowry Basin Ditch Diversion
Source	Rock Creek
District	3
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974			
1975			
1976			
1977			
1978			
1979			
1980			
1981	1-May	11-Sep	26
1982	29-May	11-Sep	6
1983	25-May	22-Sep	10
1984	21-Jun	12-Sep	8
1985			
1986	2-Jun	15-Sep	10
1987	12-Jun	16-Jul	4
1988	24-Jun	13-Sep	5
1989			
1990	15-May	4-Sep	16
1991	27-May	6-Sep	25
1992	27-Jul	9-Sep	7
1993	4-May	7-Sep	45
1994	16-May	30-Aug	40
1995	10-May	19-Sep	28
1996	20-May	17-Sep	32
1997	21-May	15-Aug	21
1998	17-May	22-Sep	36
1999	10-Jun	1-Sep	20
Avg.	29-May	6-Sep	20
Earliest	1-May	16-Jul	4
Latest	27-Jul	22-Sep	45

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **PRINCE ALBERT DITCH DIVERSION**

Date: 18 Oct. 2000

Diversion Description: Headgate consistsof a single 4 x 3.5-foot steel gate in steel slides operated with Waterman-type screws, mounted in a concrete headwall penetrated by 18 ft of three-foot-diameter corrugated metal pipe.

Diversion Location: The Prince Albert Ditch diversion is located on the main stem of Rock Creek, just upstream of the confluence Rock and Clear creeks.

Prince Albert Ditch headgate

Headgate:

Lat.	Long.
N 44° 22’ 16”	W 106° 40’ 25”

Flume:

Lat.	Long.
N 44° 22’ 13”	W 106° 40’ 20”

Conveyance Description: Open channel canal, approximately 2.5 mi. long.

Direct Flow Water Rights: The summary for direct flow rights follows:

Prince Albert Ditch flume

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	06-10-1883	I	8.00	0.11	0.11
Terr.	06-10-1883	I	520.00	7.43	7.54
Terr.	06-00-1885	I	180.00	2.57	10.11

The Prince Albert Ditch typically carries 200 percent of its allocation during the early season as per the Wyoming Double Appropriation Doctrine.

Associated Storage Rights: None

Irrigation Practices: See introduction to Rock Creek drainage above.

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
Clear Creek	10	5	2

Losses: Approximately 15 percent by the end of the ditch

References: Carmine LoGuidice, water commissioner, State Engineer’s Office, interview, 18 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
Terr	D	Prince Albert	June 10, 1883	528	7.54	CFS	OS	Adj	Rock Creek

Name	Prince Albert Ditch Diversion
Source	Rock Creek
District	3
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								232.76	240.87	200.65	98.24	0.00	772.52
1975													
1976													
1977													
1978													
1979													
1980													
1981								523.05	338.85	330.58	11.23	0.00	1203.71
1982								202.25	417.33	375.94	462.94	115.36	1573.82
1983								94.61	567.67	468.43	307.27	0.00	1437.98
1984								0.00	0.00	480.29	333.89	0.00	814.18
1985													
1986								300.50	465.72	238.79	400.68	139.37	1545.06
1987								335.36	446.46	147.97	0.00	0.00	929.79
1988								0.00	88.99	248.50	0.00	0.00	337.49
1989													
1990								0.00	13.39	48.20	12.10	0.00	73.69
1991								0.00	14.99	308.07	284.27	107.52	714.85
1992								0.00	0.00	26.83	249.55	180.91	457.29
1993								220.09	185.66	169.40	190.80	121.37	887.32
1994								90.86	394.60	277.71	59.31	0.00	822.48
1995								79.23	191.32	430.23	190.08	94.81	985.67
1996								23.60	262.06	299.78	280.76	158.17	1024.37
1997								107.61	110.70	367.85	4.72	0.00	590.88
1998								97.75	49.87	364.40	252.29	127.57	891.88
1999								0.00	10.06	350.34	349.88	0.00	710.28
Mean								128.20	211.03	285.22	193.78	58.06	876.29
Max								523.05	567.67	480.29	462.94	180.91	1573.82
Min								0.00	0.00	26.83	0.00	0.00	73.69

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Prince Albert Ditch Diversion
Source	Rock Creek
District	3
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	17-May	13-Aug	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	1-May	1-Aug	16
1982	21-May	8-Sep	26
1983	27-May	24-Aug	10
1984	7-Jul	30-Aug	8
1985			
1986	16-May	13-Sep	10
1987	14-May	16-Jul	24
1988	24-Jun	24-Jul	4
1989			
1990	26-Jun	7-Aug	15
1991	21-Jun	13-Sep	13
1992	27-Jul	25-Sep	9
1993	18-May	28-Sep	14
1994	23-May	30-Aug	40
1995	10-May	19-Sep	15
1996	20-May	17-Sep	32
1997	21-May	14-Aug	23
1998	21-May	16-Sep	31
1999	3-Jun	31-Aug	26
Avg.	31-May	28-Aug	18
Earliest	1-May	16-Jul	0
Latest	27-Jul	28-Sep	40

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

FRENCH CREEK

HOPKINS DITCH DIVERSION
PENROSE DITCH DIVERSION & PENROSE-JOHNSON DITCH DIVERSION

FRENCH CREEK DRAINAGE
INTRODUCTION

BACKGROUND

French Creek flows out of the east slope of the Bighorn Mountains between the tributaries of Rock and Clear creeks before becoming a tributary of Clear Creek. Clear Creek eventually joins the Powder River, which runs north to cross the Montana state line north of Spotted Horse, Wyoming. French Creek is fed in part by the Four Lakes & French Creek Ditch, which routes water from the North Fork of Clear Creek into upper French Creek. In turn, the Penrose Ditch diverts a supplementary supply from French Creek into Rock Creek to be used there.

CHARACTERISTICS

Compared to most of the other tributaries of Clear Creek and other east-slope drainages, French Creek has relatively small diversions. Because it goes through such steep descents in its passage, even the broken geology it crosses doesn't cause it to have the magnitude of losses found in streams meandering in the Powder River Basin. Water commissioners estimate French Creek's instream losses to be approximately 10 percent at the maximum.

French Creek does not play a significant part in returning flow to Clear Creek. Water commissioners and irrigators are careful to divert the entirety of the stream upstream of its confluence with Clear Creek.

USAGE

French Creek's diversions are entirely devoted to agricultural irrigation.

Regulation

Water commissioners estimate that regulation is imposed on French Creek drainage diversions with the following timing:

Wet Year	Average Year	Dry Year
None or last of August	2nd week of July	2nd week of June

Agriculture

Growers in the French Creek drainage tend to devote approximately 60 percent of their lands to alfalfa and 40 percent to grass hay. To deliver water from their diversions, they have the following irrigation practices:

Percentage of land served by irrigation practices

Flood	Gated Pipe	Sprinklers
45	40	15

The typical irrigation season runs from April 15-May 1 (depending on whether the spring runoff is delayed by colder weather) to mid/early October (depending on when the first snows fall and the ground freezes). Approximately 10 percent of the irrigators using French Creek water (the biggest users) practice post-season irrigation, though they usually do not use their entire right to do so.

Shrinkage

Irrigators on Johnson Creek who receive water from the Four Lakes ditch via French Creek and Penrose Ditch are charged "shrinkage" (instream loss) on the reservoir water they use based on the following:

Type of water year	Shrinkage (% of flow or volume)
Wet	10
Average	30
Dry	50

Double Appropriation

Irrigation water rights with priority dates of March 1, 1945 or earlier are entitled to an additional 1cfs per 70 acres under Wyoming's surplus water statutes. Whenever the supply in a stream exceeds the amount required to satisfy all existing appropriations established prior to March 1, 1985, the stream is said to be in an excess flow condition and water right holders with priorities between March 2, 1945 and March 1, 1985 may use an additional 1 cfs for each 70 acres irrigated.

In French Creek, this practice is limited primarily by the condition of ditches that follow the diversions from the creek. Many of the ditches are not capable of carrying all of the water an irrigator could use.

% of appropriation	% of ditches in drainage capable of flow
200	20
150	60
100-150	90
0-100	90

Permitted Uses

Permits granted for water appropriation are granted for specific uses. The following pages contain tables of permits and their associated uses. The following table provides a key to those uses:

Code	Use
Chem	Chemical
Com	Commercial
Cul	Culinary
D	Domestic
Drl	Drilling
Eng	Steam Engines
Fire	Fire Protection
Fish	Fish Propogation
F.C.	Flood Control
I	Irrigation
Ind	Industrial
I.F.	Instream Flow
Mech	Mechanical
Mfg	Manufacturing
Mil	Milling

Code	Use
Min	Mining
Misc	Miscellaneous
Mun	Municipal
Oil	Oil Refining or Production
P.C.	Pollution Control
Power	Power Development
R.R.	Railroad
Rec	Recreational
Ref	Refining
Res. Supply	Supply Facility for a Reservoir
S	Stock
T	Transportation

WATER RIGHTS

Two water rights summary tables are provided for each diversion serving irrigation referenced here. The first, included in the body of the diversion synopsis, refers to the rights on record with the State Engineer's Office and is derived from that office's *Tabulation of Adjudicated Surface Water Rights of the State of Wyoming, Water Division Number Two* (Oct. 1999).

Because this rights summary is pulled directly from the SEO *Tab,* the rights cited follow the SEO's priority order:

Hierarchy	Format of right	Example
1	Day, Month, Year	05-15-1884
2	Month and Year	05-00-1884
3	Specified Season and Year	Spring 1884
4	Year Only	1884
5	Before Year	Before 1884

Board orders or court orders may also establish a specific priority.

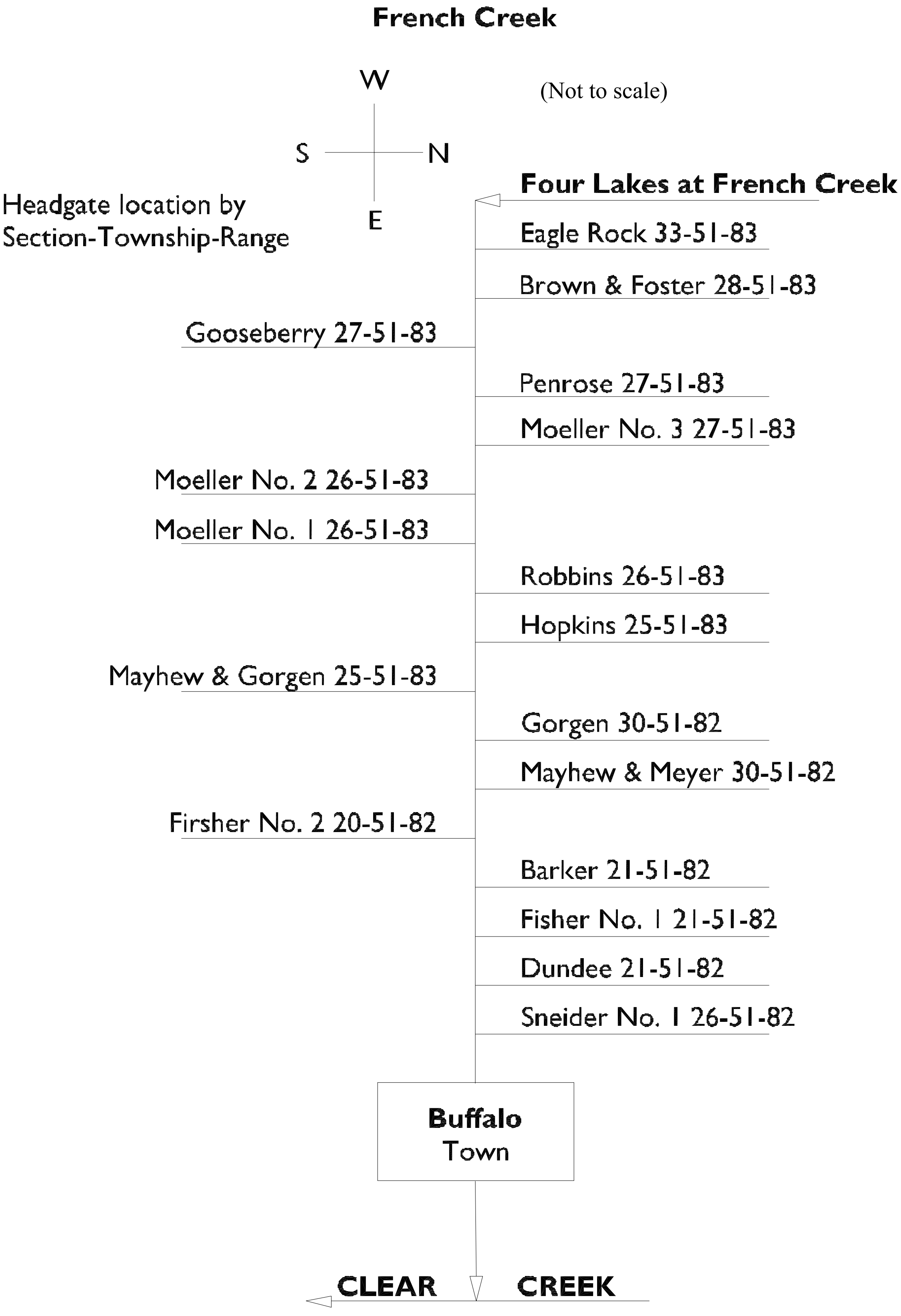
Irrigated Lands Water Rights Database

The second table, which follows the diversion synopsis, is taken from the irrigated lands water rights database developed for the basin plan. It can be used as a reference with the following caveats: It only lists water rights associated with the irrigated lands polygons mapped by HKM. The table does not include nonirrigation rights devoted to reservoir supply, municipal, fish propagation, etc. The rights on this table are associated only with those irrigated lands identified through the course of this study, both actively irrigated and currently idle.

Column Heading Key

PerNo	Permit Number	"Terr" denotes a territorial right.
PerSfx	Permit Suffix	D = direct flow E = enlargement R = reservoir
Facility Name		Parentheses denote the former means of conveyance for the water right.
Unit	Flow or volume	CFS = cubic feet per second AF = acre-feet GPM = gallons per minute
SupTyp	Supply Type	OS = original supply SS = supplement supply, for lands having an original supply from another source Sec = secondary supply, for water stored in a reservoir
Status	Status of adjudication	Adj = adjudicated Una = unadjudicated
Source	Source water	Parentheses denote the permit number of the related storage right.

Schematic of French Creek stream and diversions:



KEY DIVERSIONS

Diversion: **HOPKINS DITCH DIVERSION**
AKA: Hopkins (on French Creek)

Date: 18 Oct. 2000

Diversion Description: The Hopkins Ditch headgate consists of a single, 5 x 3.5-foot rectangular steel gate in steel slider, raised/lowered by a Waterman-type screw mounted in a concrete headwall penetrated with 12 feet of five-foot-wide oval corrugated metal pipe.

Hopkins Ditch headgate

Diversion Location: The Hopkins Ditch diversion on French Creek is located on the main stem of French Creek.

Headgate:

Lat.	Long.
N 44° 21’ 59”	W 106° 47’ 14”

Flume:

Lat.	Long.
N 44° 21’ 59”	W 107° 47’ 12”

Hopkins Ditch flume

Conveyance Description: Open channel canal, approximately 2.5 mi. long.

Direct Flow Water Rights: A summary of the direct-flow rights is shown below:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
Terr.	06-01-1884	I	1101.2	15.73	15.73
5283E	01-05-1931	I	19.1	0.27	16.0

Note:

- *“Terr.” permits date from before Wyoming became a state and before a numerical system for the permits had been established.*
- *The Territorial permit cited here is diverted from the North Fork of Clear Creek through the Four Lakes-French Creek Ditch. Original right is for a total of 15.73 cfs, but subsequent subdivision has reduced the diversion the State Engineer’s Office allows to 10.43 cfs.*

Associated Storage Rights: None

Irrigation Practices: See introduction to French Creek drainage

Agricultural Practices: See introduction to French Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
French Creek	2.5	2.5	0

Losses: Typical (10 percent) by the end of the ditch

References: Dave Pelloux, water commissioner, State Engineer's Office, interview, 18 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
5306	E	Enl. Hopkins	Jan. 2, 1931	3	0.04	CFS	OS	Una	French Creek
5283	E	Enl. Hopkins	Jan. 5, 1931	19.1	0.27	CFS	OS	Adj	French Creek
5283	E	Enl. Hopkins	Jan. 5, 1931	622.1	0		SS	Adj	French Creek
5284	E	Enl. Hopkins	April 24, 1935	104.67	0		SS	Adj	French Creek

Name	Hopkins Ditch Diversion
Source	French Creek
District	3
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								161.41	721.11	465.04	0.00	0.00	1347.56
1975													
1976													
1977													
1978													
1979													
1980													
1981								369.95	686.70	451.63	315.72	37.27	1861.27
1982								185.70	741.75	783.87	567.64	64.50	2343.46
1983								80.93	743.90	751.95	562.58	256.04	2395.40
1984								0.00	774.68	845.79	557.81	88.40	2266.68
1985													
1986								0.00	909.70	683.51	232.88	0.00	1826.09
1987								0.00	839.94	819.74	468.71	104.43	2232.82
1988								68.17	735.79	257.78	0.00	0.00	1061.74
1989								220.43	363.72	0.00	0.00	0.00	584.15
1990								207.73	710.68	809.48	524.93	102.23	2355.05
1991								266.31	994.56	602.05	157.42	0.00	2020.34
1992								0.00	0.00	58.81	421.23	323.05	803.09
1993								164.78	659.51	665.43	409.48	229.55	2128.75
1994								291.50	628.38	503.38	286.58	0.00	1709.84
1995								57.67	642.07	360.38	286.77	0.00	1346.89
1996								25.31	1033.24	541.06	130.63	139.03	1869.27
1997								180.15	951.11	613.89	68.59	0.00	1813.74
1998								0.00	793.89	763.97	634.48	324.41	2516.75
1999								0.00	805.39	676.23	305.29	42.64	1829.55
Mean								120.00	722.95	560.74	312.14	90.08	1805.92
Max								369.95	1033.24	845.79	634.48	324.41	2516.75
Min								0.00	0.00	0.00	0.00	0.00	584.15

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Hopkins Ditch
Source	French Creek
District	3
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	10-May	28-Jul	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	15-May	6-Sep	34
1982	14-May	6-Sep	13
1983	28-May	23-Sep	26
1984	4-Jun	7-Sep	11
1985			
1986	3-Jun	27-Aug	9
1987	4-Jun	13-Sep	6
1988	28-May	19-Jul	4
1989	15-May	16-Jun	9
1990	23-May	10-Sep	14
1991	21-May	19-Aug	8
1992	29-Jul	29-Sep	13
1993	25-May	29-Sep	16
1994	19-May	30-Aug	49
1995	23-May	23-Aug	17
1996	31-May	18-Sep	31
1997	23-May	19-Aug	22
1998	2-Jun	24-Sep	15
1999	8-Jun	10-Sep	11
Avg.	28-May	30-Aug	16
Earliest	10-May	16-Jun	0
Latest	29-Jul	29-Sep	49

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

KEY DIVERSIONS

Diversion: **PENROSE DITCH DIVERSION and PENROSE-JOHNSON DITCH DIVERSION**
AKA: Penrose (on Johnson Creek)

Date: 18 Oct. 2000

Note: Two headgates divert for this ditch. The first diverts from French Creek to bring water to Johnson Creek, where the majority of the water is used. The second diverts water out of Johnson Creek.

Diversion Description: The French Creek headgate consists of a single, 3.4 x 1.8-foot round steel gate in steel slider raised/lowered by a Waterman-type screw mounted in a concrete headwall, all in good condition.

The Johnson Creek headgate consists of a single, 3.5-foot round steel gate in steel slider raised/lowered by a Waterman-type screw mounted in a concrete wall, all in good condition.

Penrose Ditch at French Creek headgate

Diversion Location: The Penrose Ditch diversion on French Creek is located on the main stem of French Creek and diverts Four Lakes Ditch water to Johnson Creek (a tributary of Rock Creek), where it is diverted by the second headgate.

Penrose Ditch at Johnson Creek headgate

French Creek Headgate:

Lat.	Long.
N 44° 21' 27.9"	W 106° 50' 6.4"

Flume:

Lat.	Long.
N 44° 21' 30.5"	W 106° 50' 2.4"

Penrose Ditch at French Creek flume

Johnson Creek Headgate:

Lat.	Long.
N 44° 22' 38.4"	W 106° 49' 26.4"

Flume:

Lat.	Long.
N 44° 22' 38.4"	W 106° 49' 26.6"

Penrose Ditch at Johnson Creek flume

Conveyance Description: Open channel canal, approximately 4.7 mi. long.

Direct Flow Water Rights: Because the Penrose is a means of conveyance for North Fork of Clear Creek water to get to irrigators on Johnson Creek for original and supplemental supplies, the direct-flow rights in Penrose are officially 0 cfs. But because Johnson Creek's direct flow is notoriously poor, this supplemental supply is put to use for most of the season. As a result, the flow for Penrose can reasonably be calculated using the Wyoming State Engineer's Office baseline allocation:

1 cfs/70 acres * 633.93 acres = 9.06 cfs

Note that this figure is subject to the shrinkage factors cited in the *Storage* section of the French Creek summary above. As a result, an average-year flow would be reduced by 30 percent to 6.34 cfs.

The direct-flow rights summary follows:

Permit	Priority Date	Permitted Use	Acres	Flow (cfs)	Cumulative (cfs)
17927	01-31-1931	I	134	0 (SS)	0
17927	01-31-1931	I	165.47	0 (SS)	0
17927	01-31-1931	I	334.46	0 (SS)	0

Note: Permit No. 17927 is designated supplemental supply only.

Associated Storage Rights: None

Irrigation Practices: See introduction to French Creek drainage

Agricultural Practices: See introduction to French Creek drainage

Return Flows: Estimated percentage of total diversion developing into return flows:

Destination	Wet Yr.	Avg. Yr.	Dry Yr.
French Creek	5	2.5	2.5

Losses: Typical (10 percent) by the end of the ditch

References: Dave Pelloux, water commissioner, State Engineer's Office, interview, 18 Oct. 2000

Irrigated Lands Water Rights Database

PerNo	PerSfx	Facility Name	Priority	Acres	Amount	Unit	SupTyp	Status	Source
17927	D	Penrose	Jan. 31, 1931	633.93	0		SS	Adj	French Creek

Name	Penrose Ditch Diversion
Source	French Creek
District	3
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974								379.06	780.99	507.83	0.00	0.00	1667.88
1975													
1976													
1977													
1978													
1979													
1980													
1981								410.48	725.95	675.17	496.89	57.39	2365.88
1982								139.14	1048.52	1211.31	884.48	290.08	3573.53
1983								0.00	1032.99	1097.85	935.95	482.12	3548.91
1984								0.00	1020.72	1224.29	997.35	128.75	3371.11
1985													
1986								600.99	1201.98	976.79	485.36	113.06	3378.18
1987								0.00	863.07	819.06	630.01	156.00	2468.14
1988								104.07	845.09	238.52	0.00	0.00	1187.68
1989								283.11	439.74	0.00	0.00	0.00	722.85
1990								171.24	955.86	1049.42	596.50	106.60	2879.62
1991								0.00	440.53	536.95	245.04	0.00	1222.52
1992								0.00	0.00	53.83	598.44	255.63	907.90
1993								0.00	509.77	252.19	482.65	189.90	1434.51
1994								326.87	897.61	784.47	370.66	0.00	2379.61
1995								38.08	707.57	901.54	314.77	189.57	2151.53
1996								80.61	148.45	535.32	124.52	0.00	888.90
1997								274.69	476.19	363.77	202.78	0.00	1317.43
1998								0.00	721.56	920.86	633.13	278.07	2553.62
1999								0.00	444.89	617.12	536.07	186.45	1784.53
Mean								147.81	697.97	671.91	449.19	128.09	2094.96
Max								600.99	1201.98	1224.29	997.35	482.12	3573.53
Min								0.00	0.00	0.00	0.00	0.00	722.85

Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Penrose Ditch Diversion
Source	French Creek
District	3
Data	First & Last Dates, Max. Days

Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974	6-May	28-Jul	0
1975			
1976			
1977			
1978			
1979			
1980			
1981	15-May	6-Sep	34
1982	27-May	13-Sep	7
1983	3-Jun	23-Sep	26
1984	4-Jun	7-Sep	11
1985			
1986	17-May	16-Sep	11
1987	4-Jun	13-Sep	6
1988	24-May	19-Jul	5
1989	15-May	16-Jun	9
1990	14-May	10-Sep	14
1991	5-Jun	19-Aug	8
1992	30-Jul	29-Sep	13
1993	10-Jun	29-Sep	13
1994	19-May	30-Aug	49
1995	23-May	20-Sep	30
1996	24-May	13-Aug	24
1997	23-May	18-Aug	19
1998	2-Jun	24-Sep	15
1999	8-Jun	10-Sep	11
Avg.	29-May	31-Aug	16
Earliest	6-May	16-Jun	0
Latest	30-Jul	29-Sep	49

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

Name	Penrose-Johnson Ditch Diversion
Source	Johnson Creek
District	3
Data	Total monthly flow in AF

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1970													
1971													
1972													
1973													
1974													
1975													
1976													
1977													
1978													
1979													
1980													
1981								341.92	606.94	549.16	403.26	58.35	1959.63
1982								126.94	810.39	886.83	659.40	244.96	2728.52
1983								0.00	888.59	983.80	746.97	390.37	3009.73
1984								0.00	704.23	808.56	749.67	95.40	2357.86
1985													
1986								512.63	1025.26	810.91	328.94	96.00	2773.74
1987								0.00	662.99	603.28	472.75	119.54	1858.56
1988								0.00	790.19	290.30	0.00	0.00	1080.49
1989								225.29	296.20	0.00	0.00	0.00	521.49
1990								201.96	651.79	701.50	707.55	133.15	2395.95
1991								0.00	427.72	458.55	210.80	0.00	1097.07
1992								0.00	0.00	0.00	475.81	159.33	635.14
1993								0.00	506.68	246.59	515.09	239.70	1508.06
1994								314.30				0.00	
1995								36.51	672.08	686.16	371.17	193.69	1959.61
1996								149.70	343.34	404.91	159.91	0.00	1057.86
1997								269.33	480.85	437.96	236.46	0.00	1424.60
1998								0.00	880.88	764.03	648.02	230.48	2523.41
1999								0.00	355.83	443.34	497.91	109.09	1406.17
Mean								121.03	594.35	533.88	422.57	115.00	1782.23
Max								512.63	1025.26	983.80	749.67	390.37	3009.73
Min								0.00	0.00	0.00	0.00	0.00	521.49

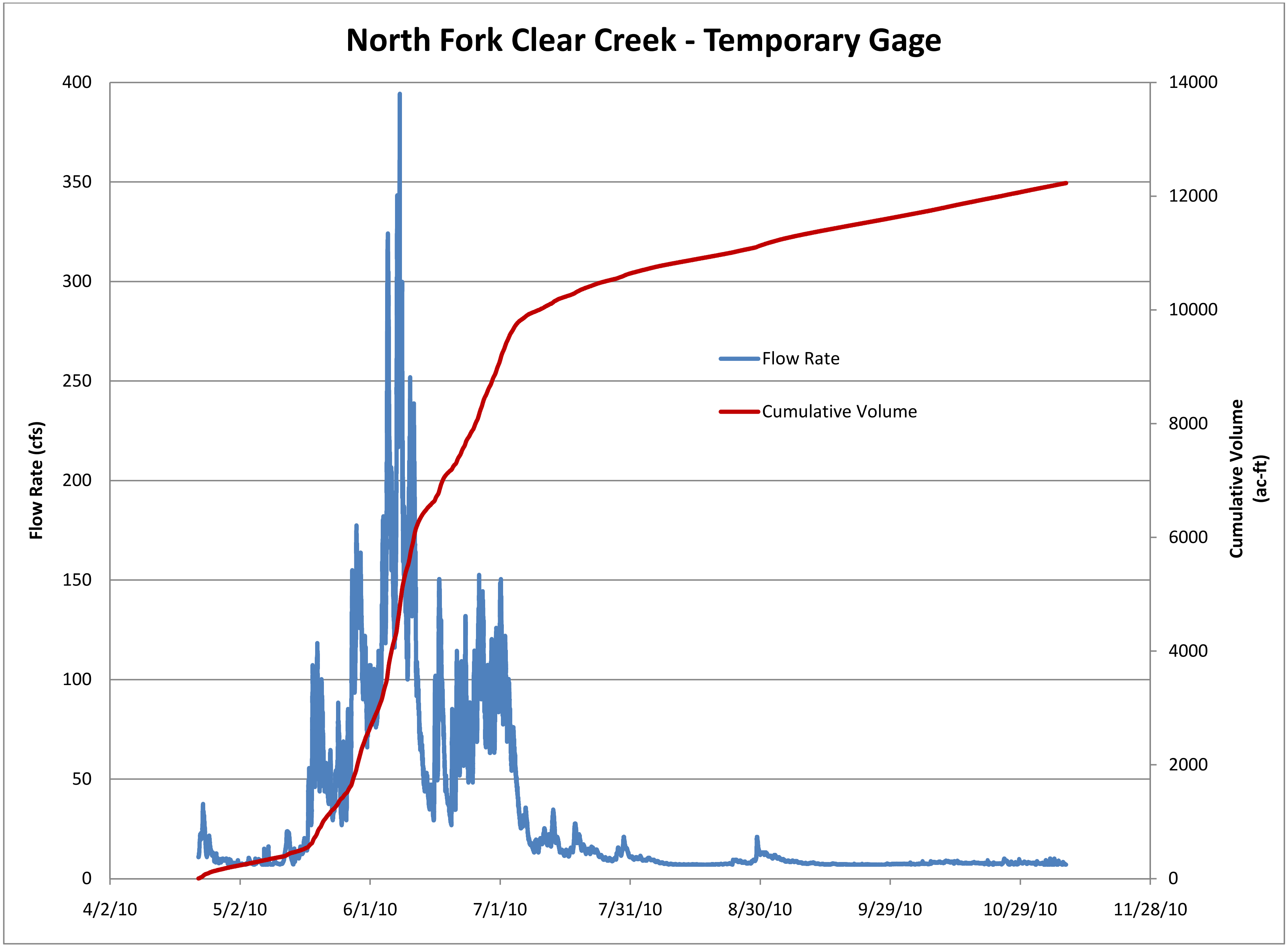
Notes:
1. Monthly data is derived from spot measurements in the Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980
2. Zero flow is assumed prior to the first and after the last measurement

Name	Penrose-Johnson Ditch Diversion
Source	Johnson Creek
District	3
Data	First & Last Dates, Max. Days

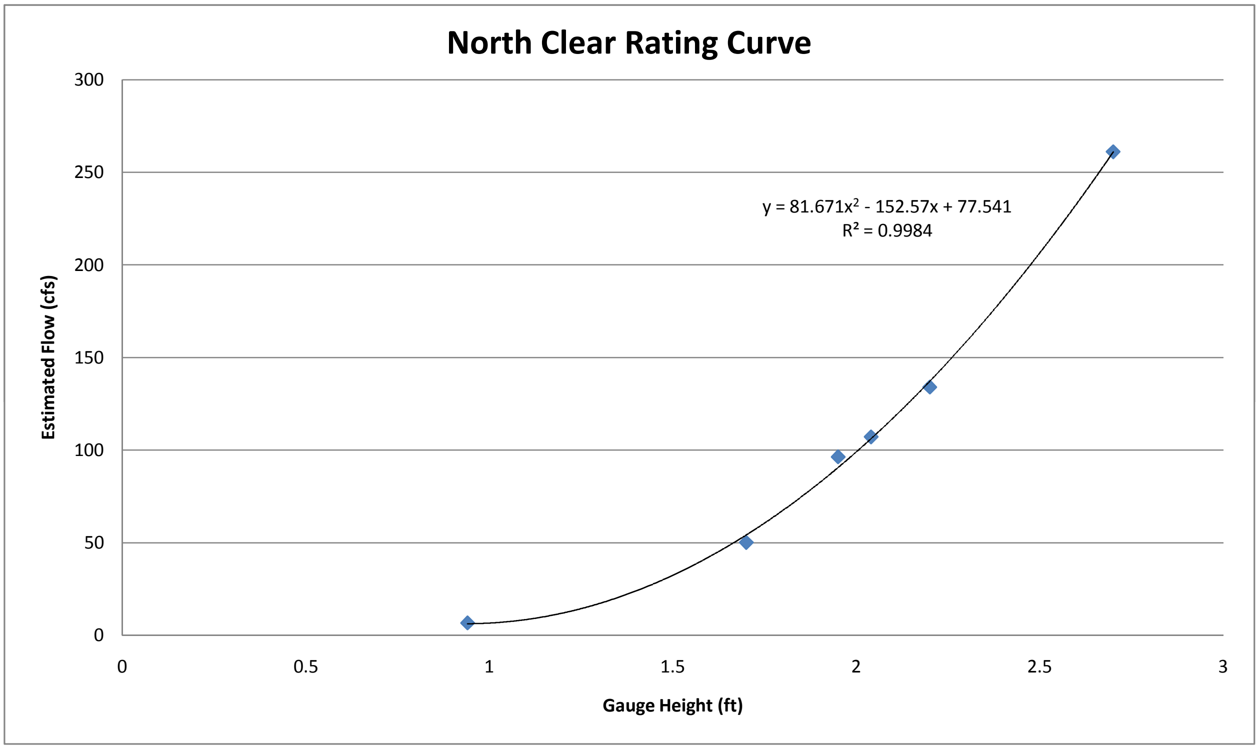
Water Year	First Date of Measurement	Last Date of Measurement	Maximum Days Missing
1970			
1971			
1972			
1973			
1974			
1975			
1976			
1977			
1978			
1979			
1980			
1981	15-May	7-Sep	34
1982	27-May	13-Sep	7
1983	3-Jun	23-Sep	26
1984	4-Jun	7-Sep	11
1985			
1986	17-May	16-Sep	11
1987	4-Jun	13-Sep	6
1988	1-Jun	19-Jul	4
1989	15-May	16-Jun	9
1990	14-May	10-Sep	21
1991	5-Jun	19-Aug	8
1992	4-Aug	11-Sep	16
1993	10-Jun	29-Sep	13
1994	19-May	30-Aug	63
1995	23-May	20-Sep	30
1996	24-May	21-Aug	31
1997	23-May	15-Aug	19
1998	2-Jun	24-Sep	15
1999	8-Jun	10-Sep	11
Avg.	31-May	1-Sep	19
Earliest	14-May	16-Jun	4
Latest	4-Aug	29-Sep	63

Notes: 1. Data is from Hydrographers' Annual Reports for years 1980 and later, and from WRDS for years prior to 1980.

Appendix 3J
Temporary Stream Gauging


North Fork Clear Creek - Temporary Gage
Flow Rate (cfs)
400
350
300
250
200
150
100
50
0
Cumulative Volume (ac-ft)
14000
12000
10000
8000
6000
4000
2000
0
4/2/10
5/2/10
6/1/10
7/1/10
7/31/10
8/30/10
9/29/10
10/29/10
11/28/10
Flow Rate
Cumulative Volume

	Gauge Height (ft.)	Est. Flow (cfs)
9/17/2009	0.94	6.68
5/19/2010	1.7	50.12
5/20/2010	1.95	96.35
6/2/2010	2.04	107.19
6/3/2010	2.2	134.03
6/8/2010	2.7	261.08



North Clear Creek 9/17/09										**GH = 0.94**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
28.3	0	0	0	0	0				0.01	0.00
28	0.2	0	0	0	0	0.00	0.03	0.00	0.06	0.00
27	0	0	0	0.00	0	0.00	0.10	0.00	0.08	0.00
26	0.1	6	30	0.20	0.22	0.11	0.05	0.01	0.15	0.03
25	0.4	3	30	0.10	0.13	0.17	0.25	0.04	0.34	0.04
24	0.45	28	60	0.47	0.48	0.30	0.43	0.13	0.46	0.22
23	0.55	39	60	0.65	0.66	0.57	0.50	0.29	0.54	0.36
22	0.6	20	60	0.33	0.35	0.51	0.58	0.29	0.61	0.22
21	0.7	37	60	0.62	0.63	0.49	0.65	0.32	0.70	0.44
20	0.8	60	60	1.00	1.01	0.82	0.75	0.61	0.79	0.79
19	0.85	48	60	0.80	0.81	0.91	0.83	0.75	0.88	0.71
18	1	48	60	0.80	0.81	0.81	0.93	0.75	0.86	0.70
17	0.6	31	60	0.52	0.53	0.67	0.80	0.54	0.75	0.40
16	0.8	58	60	0.97	0.97	0.75	0.70	0.53	0.70	0.68
15	0.6	24	60	0.40	0.42	0.70	0.70	0.49	0.65	0.27
14	0.6	1	30	0.03	0.06	0.24	0.60	0.14	0.64	0.04
13	0.75	2	30	0.07	0.09	0.08	0.68	0.05	0.70	0.07
12	0.7	23	60	0.38	0.40	0.25	0.73	0.18	0.69	0.28
11	0.6	20	60	0.33	0.35	0.38	0.65	0.25	0.68	0.24
10	0.8	33	60	0.55	0.57	0.46	0.70	0.32	0.79	0.45
9	0.95	7	30	0.23	0.26	0.41	0.88	0.36	0.93	0.24
8	1	12	60	0.20	0.22	0.24	0.98	0.23	0.96	0.22
7	0.9	14	60	0.23	0.26	0.24	0.95	0.23	0.91	0.23
6	0.85	2	30	0.07	0.09	0.17	0.88	0.15	0.75	0.07
5	0.4	0	0	0.00	0	0.05	0.63	0.03	0.52	0.00
3.5	0	0	0	0.00	0	0.00	0.30	0.00	0.08	0.00
							Total	**6.684**		**6.684**

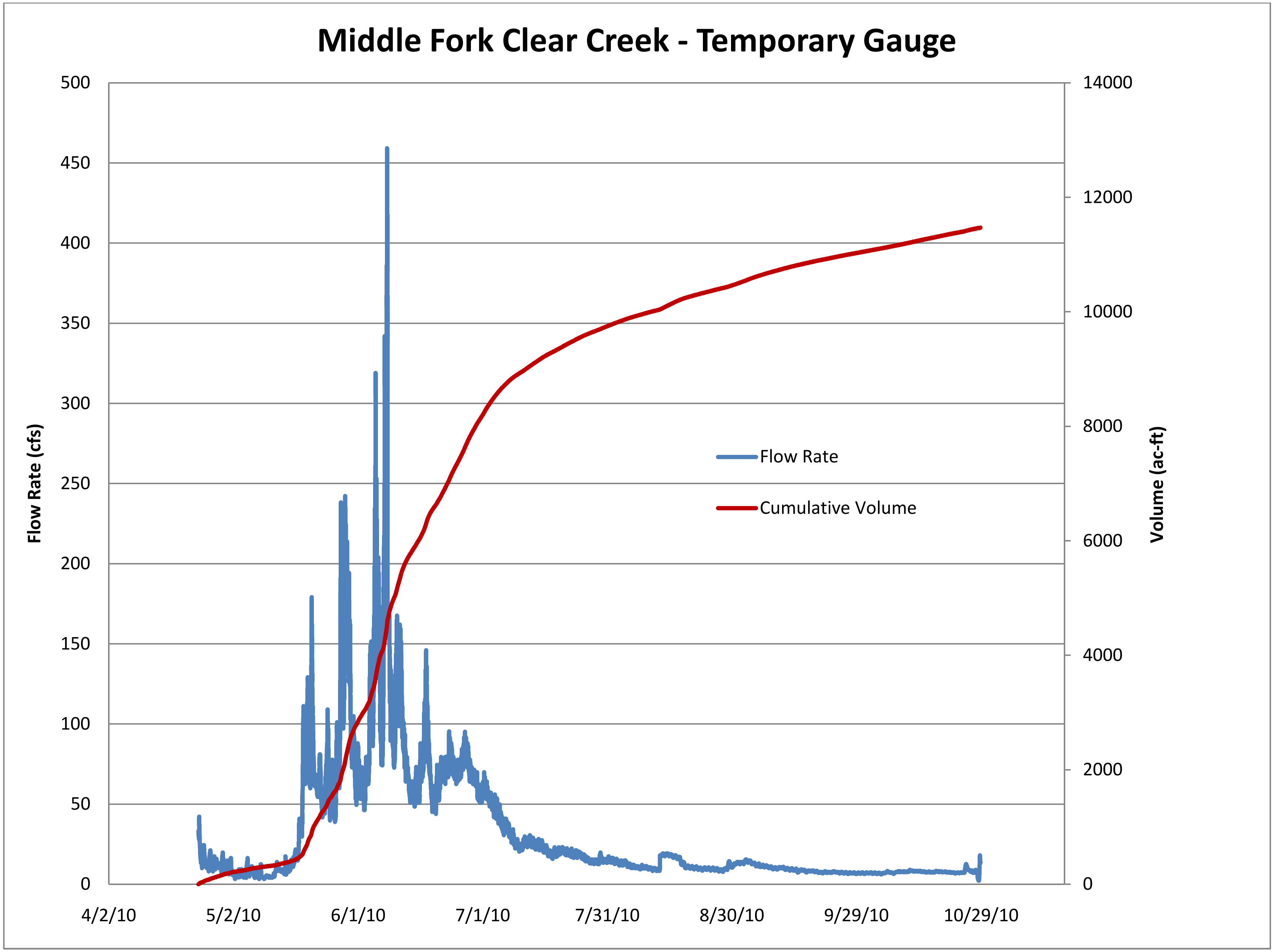
North Clear Creek 5/19/10										**GH = 1.7**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
31.2	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
27.5	1	55	60	0.92	0.92	0.46	1.85	0.85	1.76	1.62
26	0.7	82	60	1.37	1.36	1.14	1.28	1.46	1.09	1.49
25	1.1	62	60	1.03	1.04	1.20	0.90	1.08	1.03	1.06
24	1.2	90	60	1.50	1.49	1.27	1.15	1.46	1.20	1.79
23	1.3	119	60	1.98	1.97	1.73	1.25	2.16	1.28	2.51
22	1.3	151	60	2.52	2.49	2.23	1.30	2.89	1.25	3.11
21	1.1	149	60	2.48	2.45	2.47	1.20	2.96	1.23	3.01
20	1.4	153	60	2.55	2.52	2.49	1.25	3.11	1.40	3.53
19	1.7	115	60	1.92	1.90	2.21	1.55	3.43	1.53	2.90
18	1.3	142	60	2.37	2.34	2.12	1.50	3.18	1.33	3.10
17	1	147	60	2.45	2.42	2.38	1.15	2.74	1.15	2.78
16	1.3	153	60	2.55	2.52	2.47	1.15	2.84	1.23	3.09
15	1.3	125	60	2.08	2.06	2.29	1.30	2.98	1.35	2.79
14	1.5	126	60	2.10	2.08	2.07	1.40	2.90	1.48	3.07
13	1.6	140	60	2.33	2.31	2.19	1.55	3.40	1.55	3.58
12	1.5	100	60	1.67	1.66	1.98	1.55	3.07	1.43	2.36
11	1.1	86	60	1.43	1.43	1.54	1.30	2.01	1.25	1.79
10	1.3	74	60	1.23	1.23	1.33	1.20	1.60	1.35	1.66
9	1.7	68	60	1.13	1.14	1.18	1.50	1.78	1.60	1.82
8	1.7	68	60	1.13	1.14	1.14	1.70	1.93	1.68	1.90
7	1.6	63	60	1.05	1.05	1.09	1.65	1.81	1.60	1.69
6	1.5	45	60	0.75	0.76	0.91	1.55	1.41	1.50	1.14
5	1.4	45	60	0.75	0.76	0.76	1.45	1.10	1.13	0.86
3.9	0	0	0	0.00	0	0.38	0.77	0.29	0.88	0.00
							Total	**50.118**		**52.630**

North Clear Creek 5/20/10										**GH = 1.95**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
32.8	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
29	0.5	8	60	0.13	0.16	0.08	0.95	0.08	1.26	0.20
28	1.1	41	60	0.68	0.70	0.35	0.80	0.28	1.00	0.70
27	1.3	77	60	1.28	1.28	0.99	1.20	1.19	1.20	1.54
26	1.1	87	60	1.45	1.44	1.36	1.20	1.64	1.25	1.81
25	1.5	81	60	1.35	1.35	1.40	1.30	1.81	1.40	1.89
24	1.5	122	60	2.03	2.01	1.68	1.50	2.52	1.50	3.02
23	1.5	167	60	2.78	2.75	2.38	1.50	3.57	1.53	4.19
22	1.6	208	60	3.47	3.41	3.08	1.55	4.78	1.50	5.12
21	1.3	237	60	3.95	3.89	3.65	1.45	5.29	1.48	5.73
20	1.7	248	60	4.13	4.07	3.98	1.50	5.97	1.60	6.51
19	1.7	223	60	3.72	3.66	3.86	1.70	6.57	1.73	6.31
18	1.8	257	60	4.28	4.21	3.94	1.75	6.89	1.73	7.27
17	1.6	280	60	4.67	4.59	4.40	1.70	7.48	1.63	7.45
16	1.5	220	60	3.67	3.61	4.10	1.55	6.35	1.60	5.78
15	1.8	129	60	2.15	2.13	2.87	1.65	4.73	1.70	3.62
14	1.7	151	60	2.52	2.49	2.31	1.75	4.04	1.75	4.35
13	1.8	185	60	3.08	3.04	2.76	1.75	4.84	1.75	5.32
12	1.7	171	60	2.85	2.81	2.93	1.75	5.12	1.68	4.71
11	1.5	104	60	1.73	1.72	2.27	1.60	3.63	1.55	2.67
10	1.5	108	60	1.80	1.79	1.75	1.50	2.63	1.63	2.90
9	2	137	60	2.28	2.26	2.02	1.75	3.54	1.81	4.09
8	1.75	144	60	2.40	2.37	2.32	1.88	4.34	1.85	4.39
7	1.9	110	60	1.83	1.82	2.10	1.83	3.83	1.84	3.34
6	1.8	76	60	1.27	1.27	1.54	1.85	2.85	1.80	2.28
5	1.7	63	60	1.05	1.05	1.16	1.75	2.03	1.30	1.37
4	0	0	0	0.00	0	0.53	0.85	0.45	1.06	0.00
							Total	**96.357**		**96.556**

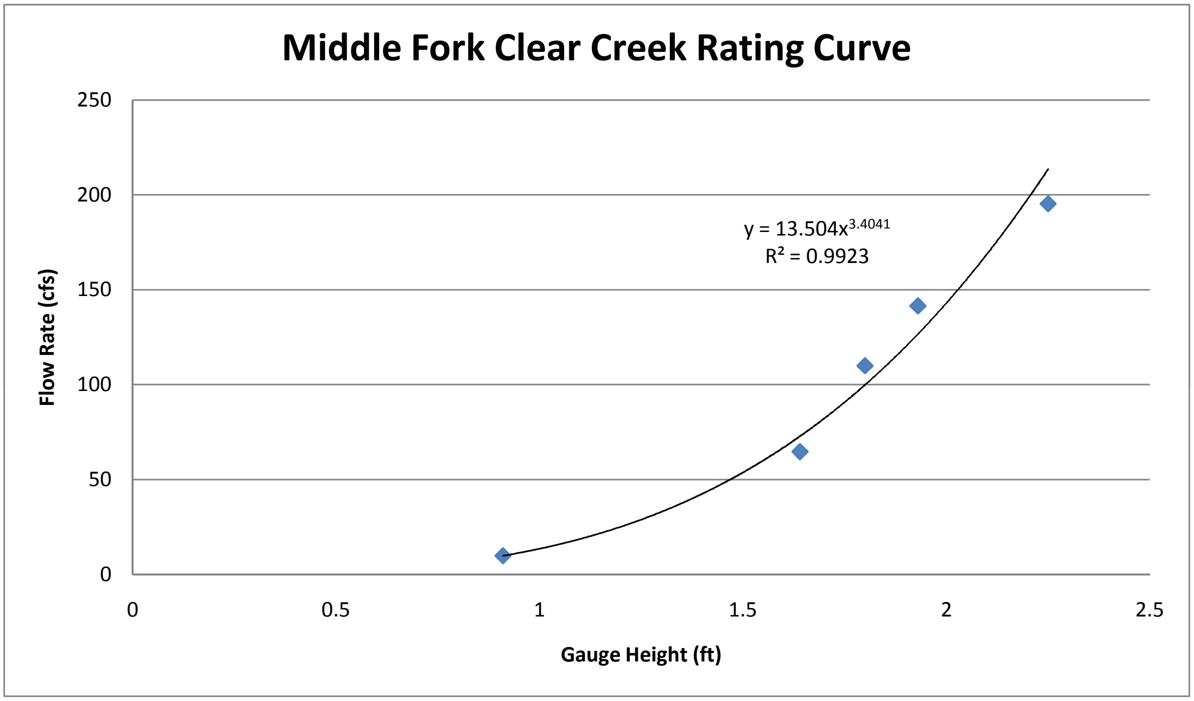
North Clear Creek 6/2/10										**GH = 2.04**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
33.9	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
30	0.5	6	60	0.10	0.13	0.06	0.98	0.06	0.97	0.12
28.7	0.5	6	60	0.10	0.13	0.06	0.65	0.04	0.70	0.09
28	1.3	57	60	0.95	0.96	0.54	0.63	0.34	0.87	0.83
27	1	84	60	1.40	1.40	1.18	1.15	1.35	1.11	1.55
26	1.15	111	60	1.85	1.84	1.62	1.08	1.74	1.20	2.20
25	1.5	108	60	1.80	1.79	1.81	1.33	2.40	1.43	2.55
24	1.55	147	60	2.45	2.42	2.10	1.53	3.21	1.49	3.60
23	1.35	190	60	3.17	3.12	2.77	1.45	4.02	1.41	4.41
22	1.4	230	60	3.83	3.77	3.45	1.38	4.74	1.41	5.33
21	1.5	269	60	4.48	4.41	4.09	1.45	5.93	1.54	6.78
20	1.75	246	60	4.10	4.03	4.22	1.63	6.86	1.74	7.01
19	1.95	220	60	3.67	3.61	3.82	1.85	7.07	1.91	6.90
18	2	248	60	4.13	4.07	3.84	1.98	7.58	1.95	7.93
17	1.85	312	60	5.20	5.11	4.59	1.93	8.83	1.93	9.83
16	2	172	60	2.87	2.83	3.97	1.93	7.64	1.91	5.41
15	1.8	130	60	2.17	2.14	2.49	1.90	4.72	1.85	3.97
14	1.8	170	60	2.83	2.80	2.47	1.80	4.45	1.83	5.10
13	1.9	212	60	3.53	3.48	3.14	1.85	5.81	1.83	6.35
12	1.7	153	60	2.55	2.52	3.00	1.80	5.40	1.73	4.35
11	1.6	92	60	1.53	1.53	2.02	1.65	3.34	1.68	2.56
10	1.8	122	60	2.03	2.01	1.77	1.70	3.01	1.83	3.68
9	2.1	144	60	2.40	2.37	2.19	1.95	4.28	1.96	4.66
8	1.85	140	60	2.33	2.31	2.34	1.98	4.62	1.93	4.44
7	1.9	98	60	1.63	1.62	1.97	1.88	3.69	1.89	3.06
6	1.9	66	60	1.10	1.10	1.36	1.90	2.59	1.59	1.76
5.3	1.8	58	60	0.97	0.97	1.04	1.30	1.34	1.29	1.26
4.5	1.4	49	60	0.82	0.83	0.90	1.28	1.15	0.75	0.62
4	0	0	0	0.00	0	0.55	1.90	1.05	0.79	0.00
							Total	**107.192**		**106.347**

North Clear Creek 6/3/10										**GH = 2.2**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
33.9	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
31	0.5	14	60	0.23	0.26	0.13	0.73	0.09	0.73	0.19
30	0.5	14	60	0.23	0.26	0.13	0.50	0.06	0.55	0.14
29	0.7	18	60	0.30	0.32	0.29	0.60	0.17	0.83	0.26
28	1.4	61	60	1.02	1.02	0.67	1.05	0.70	1.18	1.20
27	1.2	94	60	1.57	1.56	1.29	1.30	1.68	1.25	1.95
26	1.2	109	60	1.82	1.80	1.68	1.20	2.02	1.33	2.39
25	1.7	107	60	1.78	1.77	1.79	1.45	2.59	1.58	2.79
24	1.7	148	60	2.47	2.44	2.10	1.70	3.58	1.70	4.14
23	1.7	188	60	3.13	3.09	2.76	1.70	4.70	1.68	5.17
22	1.6	227	60	3.78	3.72	3.41	1.65	5.62	1.63	6.05
21	1.6	286	60	4.77	4.69	4.20	1.60	6.73	1.64	7.67
20	1.75	285	60	4.75	4.67	4.68	1.68	7.83	1.73	8.05
19	1.8	256	60	4.27	4.20	4.43	1.78	7.87	1.85	7.76
18	2.05	290	60	4.83	4.75	4.47	1.93	8.61	1.96	9.32
17	1.95	277	60	4.62	4.54	4.64	2.00	9.29	1.91	8.68
16	1.7	274	60	4.57	4.49	4.51	1.83	8.24	1.76	7.91
15	1.7	227	60	3.78	3.72	4.11	1.70	6.98	1.70	6.33
14	1.7	267	60	4.45	4.38	4.05	1.70	6.88	1.79	7.82
13	2.05	256	60	4.27	4.20	4.29	1.88	8.04	1.95	8.18
12	2	190	60	3.17	3.12	3.66	2.03	7.41	1.99	6.20
11	1.9	144	60	2.40	2.37	2.75	1.95	5.36	1.91	4.54
10	1.85	215	60	3.58	3.53	2.95	1.88	5.53	1.95	6.88
9	2.2	185	60	3.08	3.04	3.28	2.03	6.65	2.11	6.42
8	2.2	150	60	2.50	2.47	2.76	2.20	6.06	2.18	5.37
7	2.1	111	60	1.85	1.84	2.15	2.15	4.63	2.13	3.90
6	2.1	74	60	1.23	1.23	1.53	2.10	3.22	2.05	2.53
5	1.9	68	60	1.13	1.14	1.18	2.00	2.37	1.63	1.84
4	0.6	35	60	0.58	0.60	0.87	1.25	1.08	0.93	0.56
2.6	0	0	0	0.00	0	0.30	0.42	0.13	0.30	0.00
					2.51					
							Total	**134.034**		**134.278**

North Clear Creek 6/8/10										**GH = 2.7**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
36.9	End									
32.9	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
30.9	1	11	30	0.37	0.39	0.19	1.00	0.19	1.70	0.66
28.9	1.4	30	30	1.00	1.01	0.50	2.40	1.21	2.10	2.11
27.9	1.8	49	30	1.63	1.62	1.31	1.60	2.10	1.75	2.84
26.9	2	65	30	2.17	2.14	1.88	1.90	3.58	1.98	4.24
25.9	2.1	87	30	2.90	2.86	2.50	2.05	5.13	2.10	6.01
24.9	2.2	74	30	2.47	2.44	2.65	2.15	5.70	2.20	5.36
23.9	2.3	113	30	3.77	3.71	3.07	2.25	6.91	2.28	8.44
22.9	2.3	120	30	4.00	3.94	3.82	2.30	8.79	2.28	8.95
21.9	2.2	180	30	6.00	5.89	4.91	2.25	11.05	2.23	13.11
20.9	2.2	210	30	7.00	6.87	6.38	2.20	14.03	2.25	15.45
19.9	2.4	140	30	4.67	4.59	5.73	2.30	13.17	10.74	49.25
12	2.65	163	30	5.43	5.34	4.96	19.95	98.98	12.38	66.04
10	2.3	208	30	6.93	6.80	6.07	4.95	30.04	3.58	24.36
9	2.3	150	30	5.00	4.91	5.86	2.30	13.47	2.38	11.67
8	2.6	139	30	4.63	4.55	4.73	2.45	11.60	2.49	11.33
7	2.45	130	30	4.33	4.26	4.41	2.53	11.13	2.58	10.97
6	2.8	102	30	3.40	3.35	3.81	2.63	9.99	2.69	9.00
5	2.7	68	30	2.27	2.24	2.80	2.75	7.69	2.35	5.27
4	1.2	42	30	1.40	1.40	1.82	1.95	3.55	1.78	2.48
3	2	25	30	0.83	0.84	1.12	1.60	1.79	2.15	1.81
0.7	0	-	0	0.00	0	0.42	2.30	0.97	0.75	0.00
							Total	**261.080**		**259.336**


Middle Fork Clear Creek - Temporary Gauge
Flow Rate (cfs)
500
450
400
350
300
250
200
150
100
50
0
Volume (ac-ft)
14000
12000
10000
8000
6000
4000
2000
0
4/2/10
5/2/10
6/1/10
7/1/10
7/31/10
8/30/10
9/29/10
10/29/10
Flow Rate
Cumulative Volume

	Gauge Height (ft)	Est. Flow (cfs)
9/17/2009	0.91	9.78
5/19/2010	1.64	64.7
5/28/2010	1.8	109.95
6/3/2010	1.93	141.5
6/7/2010	2.25	195.4



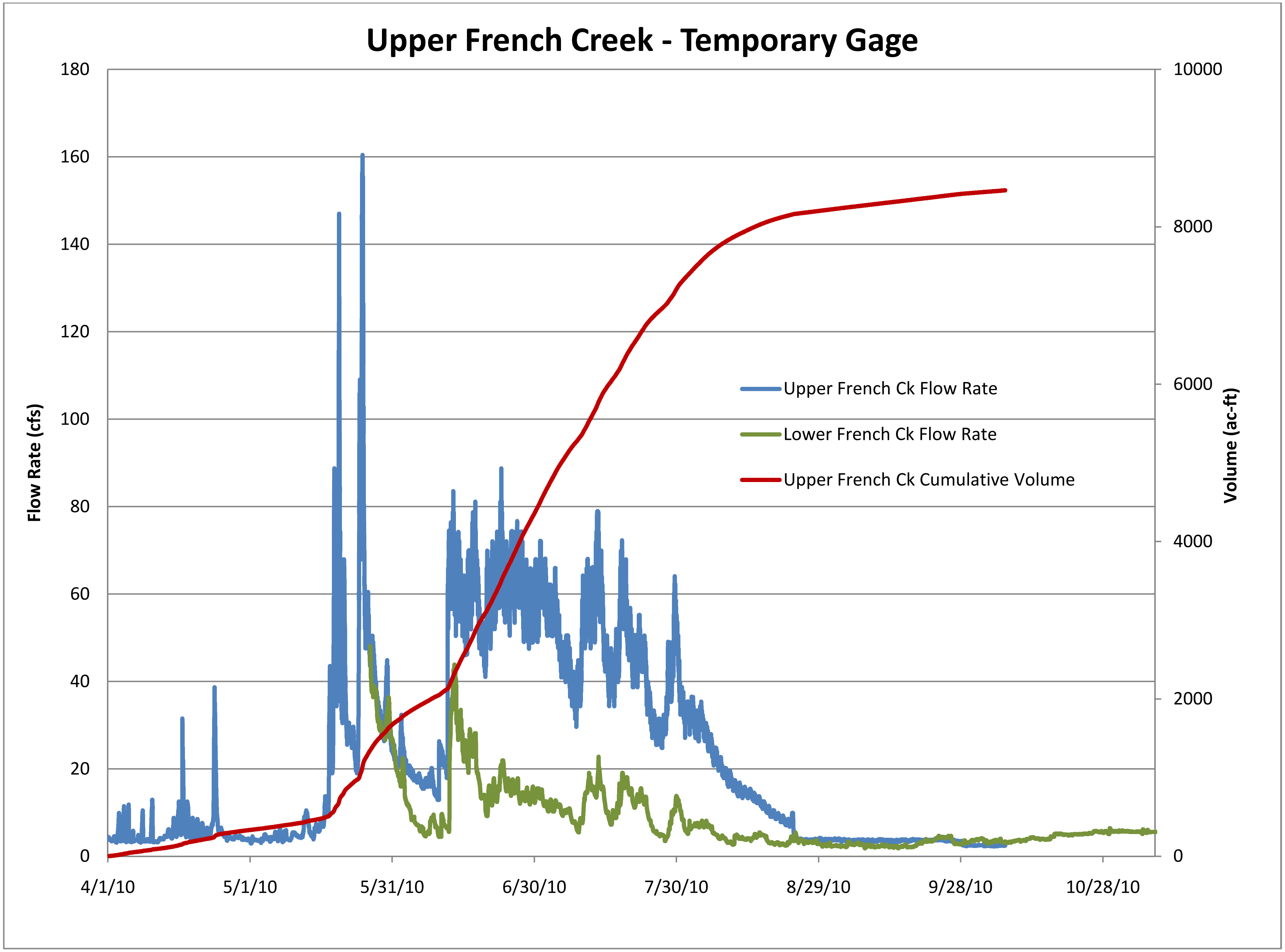
Middle Clear Creek 9/18/09										**GH = 0.91**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
22	0	0	0		0				0.03	0.00
23	0.25	0	0		0	0.00	0.13	0.00	0.25	0.00
24	0.5	2	30	0.07	0.09	0.05	0.38	0.02	0.46	0.04
25	0.6	34	60	0.57	0.58	0.34	0.55	0.19	0.60	0.35
26	0.7	21	60	0.35	0.37	0.48	0.65	0.31	0.73	0.27
27	0.9	27	60	0.45	0.47	0.42	0.80	0.34	0.88	0.41
28	1	38	60	0.63	0.65	0.56	0.95	0.53	1.04	0.67
29	1.25	23	60	0.38	0.40	0.52	1.13	0.59	1.21	0.49
30	1.35	21	60	0.35	0.37	0.39	1.30	0.50	1.33	0.49
31	1.35	26	60	0.43	0.45	0.41	1.35	0.55	1.36	0.61
32	1.4	52	75	0.69	0.71	0.58	1.38	0.80	1.41	1.00
33	1.5	37	60	0.62	0.63	0.67	1.45	0.97	1.48	0.93
34	1.5	30	60	0.50	0.52	0.57	1.50	0.86	1.49	0.77
35	1.45	37	60	0.62	0.63	0.57	1.48	0.85	1.43	0.90
36	1.3	38	60	0.63	0.65	0.64	1.38	0.88	1.26	0.82
37	1	30	60	0.50	0.52	0.58	1.15	0.67	1.08	0.56
38	1	53	60	0.88	0.89	0.70	1.00	0.70	0.98	0.87
39	0.9	22	60	0.37	0.39	0.64	0.95	0.61	0.88	0.34
40	0.7	26	60	0.43	0.45	0.42	0.80	0.34	0.60	0.27
41	0.1	0	0	0.00	0	0.23	0.40	0.09	0.15	0.00
41.3	0	0	0	0.00	0	0.00	0.01	0.00	0.51	0.00
							Total	**9.776**		**9.776**

Middle_Clear_051910										**GH = 1.64**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
41	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
40	1.4	123	60	2.05	2.03	1.02	0.70	0.71	1.08	2.18
39	1.5	116	60	1.93	1.92	0.96	1.45	1.39	1.50	2.88
38	1.6	125	60	2.08	2.06	1.99	1.55	3.08	1.65	3.40
37	1.9	121	60	2.02	2.00	2.03	1.75	3.55	1.83	3.65
36	1.9	135	60	2.25	2.23	2.11	1.90	4.01	1.95	4.34
35	2.1	134	60	2.23	2.21	2.22	2.00	4.44	2.05	4.53
34	2.1	120	60	2.00	1.98	2.10	2.10	4.40	2.15	4.26
33	2.3	107	60	1.78	1.77	1.88	2.20	4.13	2.25	3.98
32	2.3	114	60	1.90	1.88	1.83	2.30	4.20	2.25	4.24
31	2.1	97	60	1.62	1.61	1.75	2.20	3.84	2.18	3.50
30	2.2	91	60	1.52	1.51	1.56	2.15	3.35	2.15	3.25
29	2.1	93	60	1.55	1.54	1.53	2.15	3.28	2.10	3.24
28	2	86	60	1.43	1.43	1.49	2.05	3.04	1.98	2.82
27	1.8	126	60	2.10	2.08	1.75	1.90	3.33	1.78	3.69
26	1.5	124	60	2.07	2.05	2.06	1.65	3.40	1.55	3.17
25	1.4	119	60	1.98	1.97	2.01	1.45	2.91	1.43	2.80
24	1.4	121	60	2.02	2.00	1.98	1.40	2.77	1.33	2.65
23	1.1	105	60	1.75	1.74	1.87	1.25	2.34	1.10	1.91
22	0.8	90	60	1.50	1.49	1.62	0.95	1.53	0.85	1.27
21	0.7	120	60	2.00	1.98	1.74	0.75	1.30	0.68	1.34
20	0.5	117	60	1.95	1.93	1.96	0.60	1.17	0.53	1.01
19	0.4	95	60	1.58	1.57	1.75	0.45	0.79	0.40	0.63
18	0.3	134	60	2.23	2.21	1.89	0.35	0.66	0.30	0.66
17	0.2	96	60	1.60	1.59	1.90	0.25	0.48	0.23	0.36
16	0.2	83	60	1.38	1.38	1.49	0.20	0.30	0.20	0.28
15	0.2	50	60	0.83	0.84	1.11	0.20	0.22	0.20	0.17
14	0.2	60	60	1.00	1.01	0.92	0.20	0.18	0.25	0.25
13	0.4	126	60	2.10	2.08	1.54	0.30	0.46	0.20	0.42
12.4	0	0	0	0.00	0	1.04	0.12	0.12	0.65	0.00
							Total	**64.715**		**66.878**

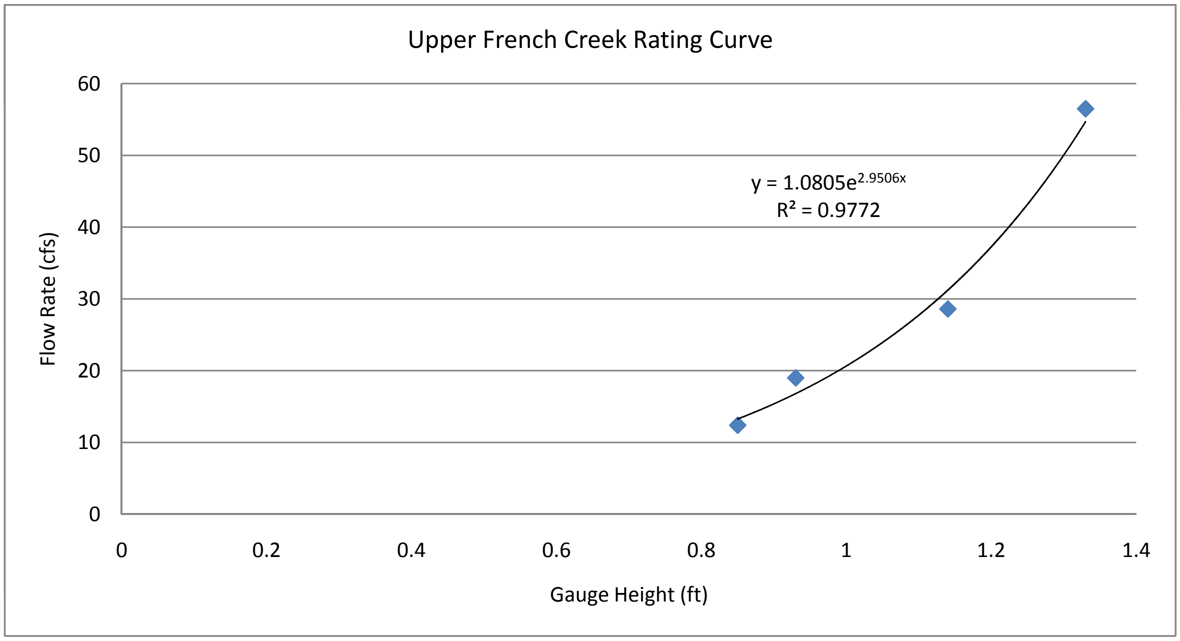
Middle_Clear_52810_715AM-830AM										**GH = 1.8**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
41.2	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
40.6	1	45	60	0.75	0.76	0.38	0.30	0.11	0.53	0.41
40	1.55	174	60	2.90	2.86	1.43	0.77	1.09	1.16	3.32
39	1.7	159	60	2.65	2.62	2.74	1.63	4.45	1.68	4.38
38	1.75	186	60	3.10	3.06	2.84	1.73	4.89	1.78	5.43
37	1.9	171	60	2.85	2.81	2.93	1.83	5.36	1.91	5.38
36	2.1	153	60	2.55	2.52	2.67	2.00	5.33	2.06	5.20
35	2.15	172	60	2.87	2.83	2.67	2.13	5.68	2.15	6.08
34	2.2	152	60	2.53	2.50	2.67	2.18	5.80	2.24	5.60
33	2.4	165	60	2.75	2.71	2.61	2.30	6.00	2.38	6.45
32	2.5	162	60	2.70	2.67	2.69	2.45	6.59	2.46	6.56
31	2.45	150	60	2.50	2.47	2.57	2.48	6.36	2.45	6.05
30	2.4	153	60	2.55	2.52	2.49	2.43	6.05	2.39	6.01
29	2.3	137	60	2.28	2.26	2.39	2.35	5.61	2.28	5.14
28	2.1	144	60	2.40	2.37	2.32	2.20	5.09	2.08	4.92
27	1.8	167	60	2.78	2.75	2.56	1.95	4.99	1.85	5.08
26	1.7	187	60	3.12	3.07	2.91	1.75	5.09	1.69	5.19
25	1.55	206	60	3.43	3.38	3.23	1.63	5.24	1.56	5.28
24	1.45	199	60	3.32	3.27	3.33	1.50	4.99	1.43	4.66
23	1.25	186	60	3.10	3.06	3.16	1.35	4.27	1.21	3.71
22	0.9	186	60	3.10	3.06	3.06	1.08	3.29	0.99	3.02
21	0.9	169	60	2.82	2.78	2.92	0.90	2.63	0.86	2.40
20	0.75	155	60	2.58	2.55	2.67	0.83	2.20	0.75	1.91
19	0.6	125	60	2.08	2.06	2.31	0.68	1.56	0.59	1.21
18	0.4	176	60	2.93	2.89	2.48	0.50	1.24	0.44	1.27
17	0.35	175	60	2.92	2.88	2.89	0.38	1.08	0.38	1.08
16	0.4	135	60	2.25	2.23	2.55	0.38	0.96	0.39	0.86
15	0.4	99	60	1.65	1.64	1.93	0.40	0.77	0.40	0.66
14	0.4	118	60	1.97	1.95	1.79	0.40	0.72	0.44	0.85
13	0.55	131	60	2.18	2.16	2.06	0.48	0.98	0.50	1.08
12	0.5	68	60	1.13	1.14	1.65	0.53	0.87	0.37	0.42
11.5	0.4	86	60	1.43	1.43	1.28	0.23	0.29	0.24	0.35
10.5	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
							Total	**109.471**		**109.953**

Middle_Clear_060410_530-600pm										**GH = 1.93**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
41.5	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
41	0.4	42	60	0.70	0.71	0.36	0.10	0.04	0.49	0.35
40.3	1.8	44	60	0.73	0.74	0.73	1.08	0.79	1.50	1.12
40	1.8	83	60	1.38	1.38	1.06	1.10	1.17	2.16	2.97
39	2	84	60	1.40	1.40	1.39	1.90	2.64	3.04	4.24
38	2.1	122	60	2.03	2.01	1.71	2.05	3.50	3.32	6.69
37	2.3	166	60	2.77	2.73	2.37	2.20	5.22	3.54	9.68
36	2.65	179	60	2.98	2.94	2.84	2.48	7.02	3.88	11.42
35	2.75	211	60	3.52	3.46	3.20	2.70	8.65	4.09	14.16
34	2.75	246	60	4.10	4.03	3.75	2.75	10.31	4.13	16.64
33	2.75	292	60	4.87	4.78	4.41	2.75	12.12	4.13	19.73
32	2.75	260	60	4.33	4.26	4.52	2.75	12.44	3.99	17.02
31	2.75	250	60	4.17	4.10	4.18	2.75	11.50	3.99	16.37
30	2.4	218	60	3.63	3.58	3.84	2.58	9.88	3.69	13.22
29	2.4	190	60	3.17	3.12	3.35	2.40	8.04	3.38	10.54
28	2.3	181	60	3.02	2.98	3.05	2.35	7.16	3.32	9.87
27	1.8	199	60	3.32	3.27	3.12	2.05	6.40	2.89	9.44
26	1.85	170	60	2.83	2.80	3.03	1.83	5.53	2.63	7.34
25	1.8	178	60	2.97	2.93	2.86	1.83	5.22	2.57	7.52
24	1.5	177	60	2.95	2.91	2.92	1.65	4.82	2.18	6.33
23	1.4	134	60	2.23	2.21	2.56	1.45	3.71	1.93	4.27
22	1	128	60	2.13	2.11	2.16	1.20	2.59	1.58	3.33
21	0.85	160	60	2.67	2.63	2.37	0.93	2.19	1.24	3.26
20	0.8	130	60	2.17	2.14	2.39	0.83	1.97	1.09	2.33
19	0.6	131	60	2.18	2.16	2.15	0.70	1.51	0.92	1.99
18	0.45	165	60	2.75	2.71	2.44	0.53	1.28	0.73	1.99
17	0.45	163	60	2.72	2.68	2.70	0.45	1.21	0.68	1.81
16	0.45	139	60	2.32	2.29	2.49	0.45	1.12	0.69	1.59
15	0.45	108	60	1.80	1.79	2.04	0.45	0.92	0.73	1.31
14	0.5	135	60	2.25	2.23	2.01	0.48	0.95	0.73	1.63
13	0.6	115	60	1.92	1.90	2.06	0.55	1.13	0.79	1.50
12	0.5	68	60	1.13	1.14	1.52	0.55	0.83	0.80	0.91
11	0.4	63	60	1.05	1.05	1.09	0.45	0.49	1.95	2.06
9	0	0	0	0.00	0	0.53	0.00	0.00	0.55	0.00
							Total	**141.536**		**212.580**

Middle_Clear_060710_10AM-1130AM										**GH = 2.25'**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
43	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
42	0.4	18	30	0.60	0.61	0.31	0.20	0.06	0.43	0.26
41.5	1.5	39	30	1.30	1.30	0.65	0.48	0.31	0.68	0.88
41	2	44	30	1.47	1.46	1.38	0.88	1.21	1.44	2.11
40	2.2	60	30	2.00	1.98	1.72	2.10	3.62	2.18	4.31
39	2.3	86	30	2.87	2.83	2.41	2.25	5.41	2.29	6.47
38	2.35	112	30	3.73	3.68	3.25	2.33	7.56	2.38	8.73
37	2.5	148	30	4.93	4.85	4.26	2.43	10.33	2.56	12.42
36	2.9	147	30	4.90	4.82	4.83	2.70	13.05	2.83	13.60
35	3	155	30	5.17	5.08	4.95	2.95	14.59	10.19	51.74
29	2.75	120	30	4.00	3.94	4.51	17.25	77.73	11.81	46.49
26	2	145	30	4.83	4.75	4.34	7.13	30.94	5.16	24.49
24	1.5	100	30	3.33	3.28	4.02	3.50	14.06	3.05	10.02
22	1.1	70	30	2.33	2.31	2.80	2.60	7.27	2.20	5.08
20	0.7	72	30	2.40	2.37	2.34	1.80	4.21	1.50	3.56
18	0.5	35	30	1.17	1.17	1.77	1.20	2.12	1.15	1.34
16	0.6	33	30	1.10	1.10	1.14	1.10	1.25	1.18	1.30
14	0.65	21	30	0.70	0.71	0.91	1.25	1.13	1.15	0.82
12	0.4	11	30	0.37	0.39	0.55	1.05	0.58	0.73	0.28
10	0	0	0	0.00	0	0.19	0.40	0.08	0.60	0.00
							Total	**195.449**		**193.908**


Upper French Creek - Temporary Gage
Flow Rate (cfs)
Volume (ac-ft)
180
160
140
120
100
80
60
40
20
0
10000
8000
6000
4000
2000
0
4/1/10
5/1/10
5/31/10
6/30/10
7/30/10
8/29/10
9/28/10
10/28/10
Upper French Ck Flow Rate
Lower French Ck Flow Rate
Upper French Ck Cumulative Volume

	Gauge Height (ft)	**Est. Flow (cfs)**
9/17/2010	0.85	12.4
5/20/2010	1.14	28.6
6/8/2010	0.93	19
6/29/2010	1.33	56.5

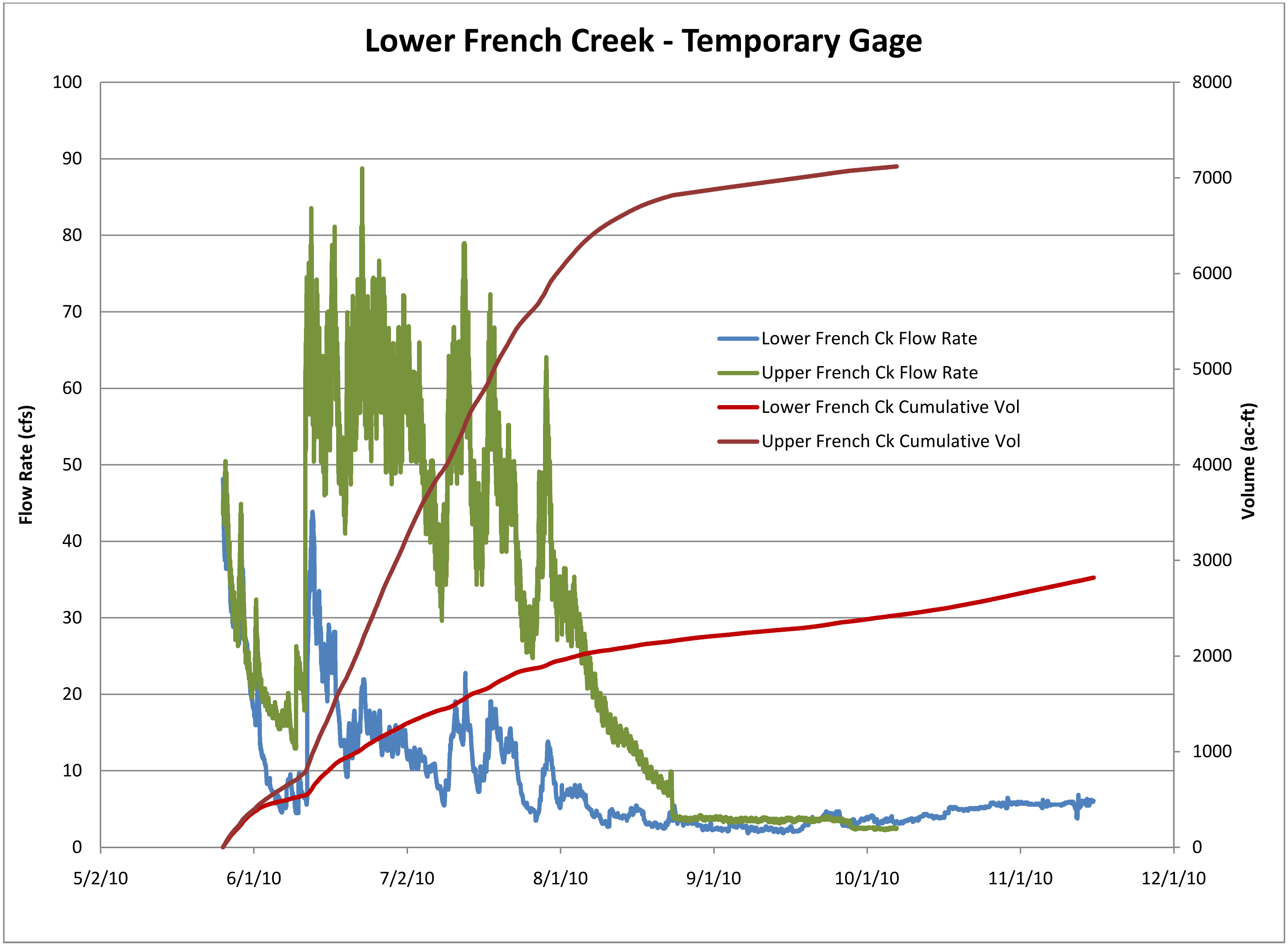


French Creek 9/17/09										**GH = 0.85**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs)	Avg Area	Flow (avg area)
7.4	0	0	0		0				0.14	0.00
9	0.72	0	0		0	0.00	0.58	0.00	0.70	0.00
10	0.7	0	0		0	0.00	0.71	0.00	0.83	0.00
11	1.2	9	60	0.15	0.17	0.09	0.95	0.08	1.23	0.21
12	1.8	20	60	0.33	0.35	0.26	1.50	0.40	1.70	0.60
13	2	43	60	0.72	0.73	0.54	1.90	1.03	1.95	1.42
14	2	90	60	1.50	1.49	1.11	2.00	2.22	1.98	2.95
15	1.9	85	60	1.42	1.41	1.45	1.95	2.83	1.44	2.04
15.5	1.9	103	60	1.72	1.71	1.56	0.95	1.48	0.86	1.47
16	1.2	123	60	2.05	2.03	1.87	0.78	1.45	0.98	1.98
17	0.9	72	60	1.20	1.20	1.62	1.05	1.70	0.90	1.08
18	0.6	49	60	0.82	0.83	1.01	0.75	0.76	0.73	0.60
19	0.8	12	60	0.20	0.22	0.52	0.70	0.37	0.61	0.14
20.2	0	0	0		0	0.11	0.48	0.05	0.12	0.00
							Total	**12.367**		**12.488**

French Creek 5/20/10										**GH = 1.14**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
6	0	0	0		0				0.05	0.00
7.5	0.25	10	60		0	0.00	0.19	0.00	0.23	0.00
8	0.4	31	60	0.52	0.53	0.27	0.16	0.04	0.31	0.16
9	0.6	30	60	0.50	0.52	0.52	0.50	0.26	0.68	0.35
10	1.1	21	60	0.35	0.37	0.44	0.85	0.38	1.10	0.41
11	1.6	38	60	0.63	0.65	0.51	1.35	0.69	1.60	1.03
12	2.1	69	60	1.15	1.15	0.90	1.85	1.66	2.05	2.36
13	2.4	113	60	1.88	1.87	1.51	2.25	3.40	2.30	4.30
14	2.3	172	60	2.87	2.83	2.35	2.35	5.52	2.33	6.58
15	2.3	161	60	2.68	2.65	2.74	2.30	6.30	2.08	5.50
16	1.4	122	60	2.03	2.01	2.33	1.85	4.31	1.58	3.17
17	1.2	80	60	1.33	1.33	1.67	1.30	2.17	1.28	1.70
18	1.3	108	60	1.80	1.79	1.56	1.25	1.95	1.23	2.19
19	1.1	50	60	0.83	0.84	1.31	1.20	1.58	0.98	0.82
20	0.4	8	60	0.13	0.16	0.50	0.75	0.38	0.36	0.06
20.5	0	0	0		0	0.08	0.10	0.01	1.00	0.00
							Total	**28.645**		**28.623**

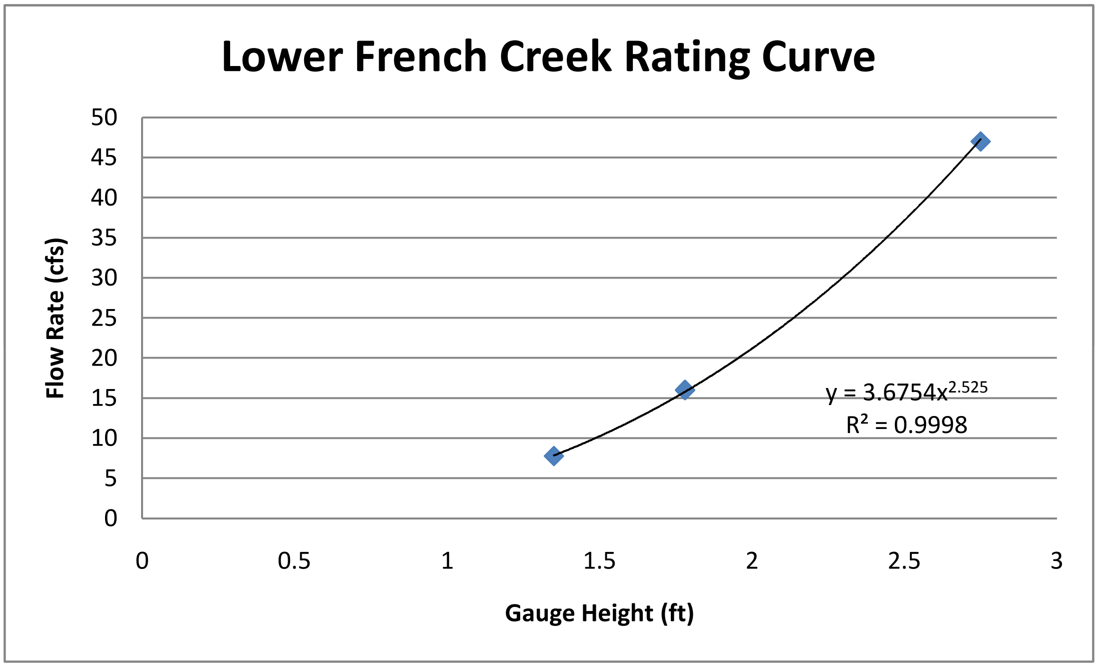
French Creek 6/8/10										**GH=0.93**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs)	Avg Area	Flow (avg area)
7.5	0	0	0	0.00	0.00	0			0.09	0.00
9.8	0.3	12	30	0.40	0.42	0.21	0.35	0.07	0.66	0.27
11	0.9	10	30	0.33	0.35	0.39	0.72	0.28	0.99	0.35
12	1.5	12	30	0.40	0.42	0.39	1.20	0.46	1.48	0.62
13	2	24	30	0.80	0.81	0.61	1.75	1.07	1.93	1.56
14	2.2	42	30	1.40	1.40	1.10	2.10	2.32	2.13	2.97
15	2.1	62	30	2.07	2.05	1.72	2.15	3.70	2.13	4.35
16	2.1	63	30	2.10	2.08	2.06	2.10	4.33	1.90	3.95
17	1.3	59	30	1.97	1.95	2.01	1.70	3.42	1.40	2.73
18	0.9	31	30	1.03	1.04	1.49	1.10	1.64	0.99	1.02
19	0.85	45	30	1.50	1.49	1.27	0.88	1.11	0.88	1.31
20	0.9	22	30	0.73	0.74	1.12	0.88	0.98	0.64	0.48
20.6	0.55	3	30	0.10	0.13	0.44	0.44	0.19	0.35	0.04
21.4	0	0	0	0.00	0.03	0.08	0.22	0.02	1.42	0.04
							Total	**19.599**		**19.690**

French Creek 6/29/10										**GH=1.33**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs)	Avg Area	Flow (avg area)
5	0	0	0	0.00	0.00				0.05	0.00
7	0.2	13	30	0.43	0.45	0.23	0.20	0.05	0.34	0.15
8	0.5	48	60	0.80	0.81	0.63	0.35	0.22	0.48	0.38
9	0.7	67	60	1.12	1.12	0.96	0.60	0.58	0.69	0.77
10	0.85	76	60	1.27	1.27	1.19	0.78	0.92	0.93	1.17
11	1.3	38	30	1.27	1.27	1.27	1.08	1.36	1.35	1.71
12	1.95	43	30	1.43	1.43	1.35	1.63	2.19	1.93	2.75
13	2.5	47	30	1.57	1.56	1.49	2.23	3.32	2.40	3.74
14	2.65	73	30	2.43	2.41	1.98	2.58	5.10	2.63	6.31
15	2.7	115	30	3.83	3.77	3.09	2.68	8.26	2.66	10.05
16	2.6	130	30	4.33	4.26	4.02	2.65	10.65	2.55	10.87
17	2.3	109	30	3.63	3.58	3.92	2.45	9.60	2.13	7.60
18	1.3	61	30	2.03	2.01	2.80	1.80	5.03	1.58	3.17
19	1.4	106	30	3.53	3.48	2.75	1.35	3.71	0.69	2.39
20	1.4	59	30	1.97	1.95	2.71	1.40	3.80	0.66	1.28
21	1.05	15	30	0.50	0.52	1.23	1.23	1.51	0.19	0.10
21.4	0.6	17	30	0.57	0.58	0.55	0.33	0.18	0.05	0.03
21.6	0	0	0	0.00	0.00	0.29	0.06	0.02	0.00	0.00
							Total	**56.509**		**52.474**



Lower French Creek - Temporary Gage
Flow Rate (cfs)
Volume (ac-ft)
100
90
80
70
60
50
40
30
20
10
0
8000
7000
6000
5000
4000
3000
2000
1000
0
5/2/10
6/1/10
7/2/10
8/1/10
9/1/10
10/1/10
11/1/10
12/1/10
Lower French Ck Flow Rate
Upper French Ck Flow Rate
Lower French Ck Cumulative Vol
Upper French Ck Cumulative Vol

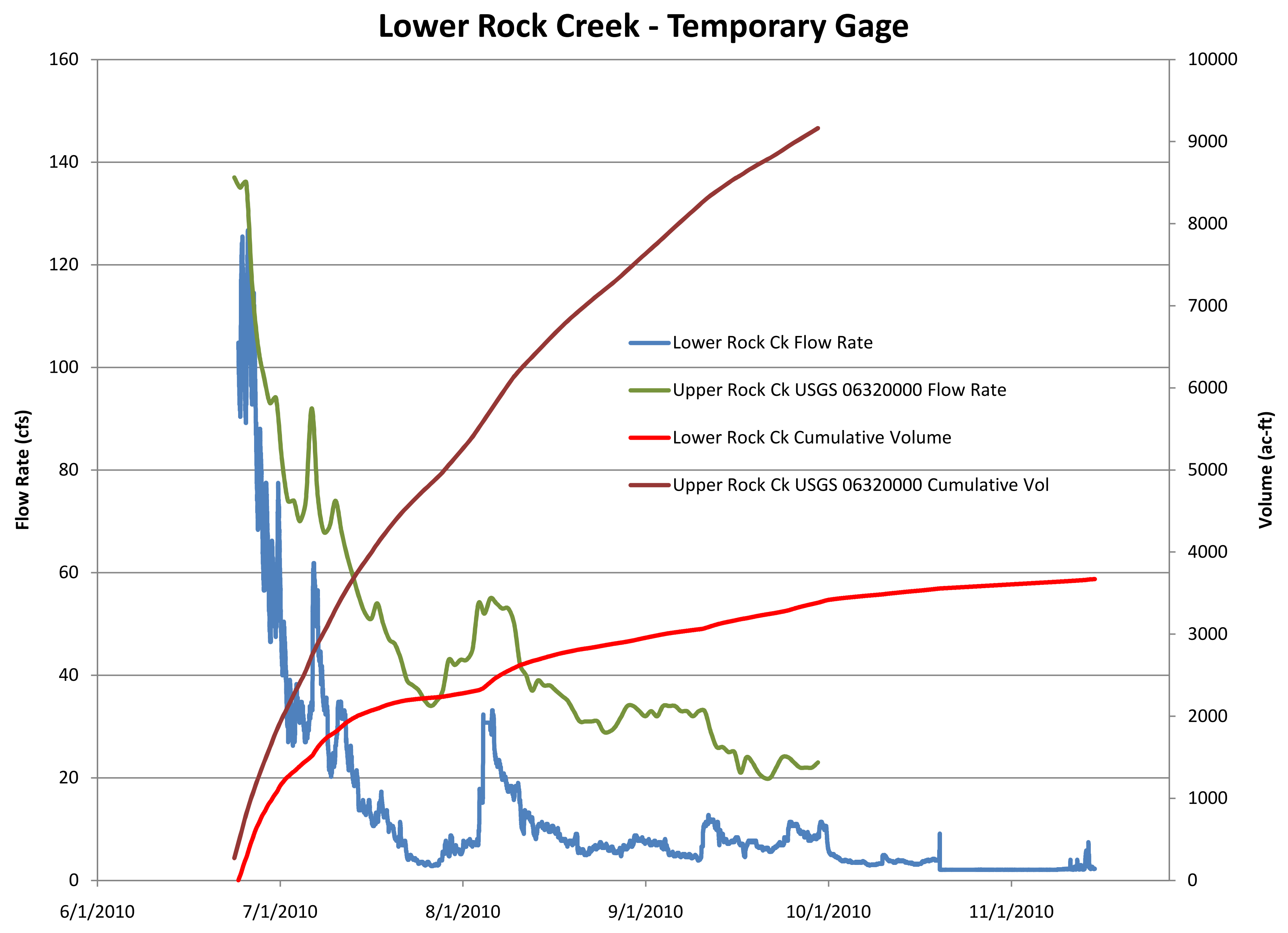
	Gauge Height (ft)	Est. Flow (cfs)
6/4/2010	1.35	7.77
5/26/2010	2.75	47
6/29/2010	1.78	16

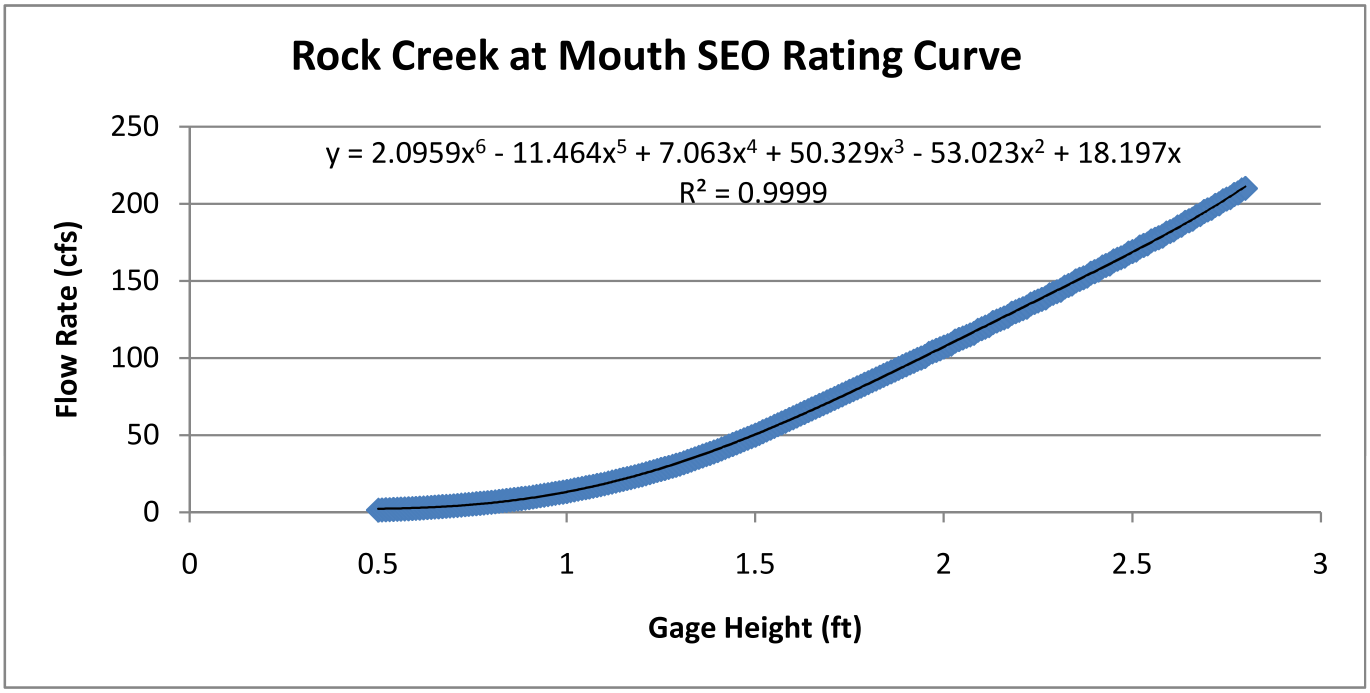


Lower French Creek 6/4/10 - 7:05pm								**Gauge Ht.**	**1.35**	**ft**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
6.25	0.15	0	0	0	0	0	0	0	0.07	0.00
7	0.3	23	60	0.38	0.40	0.20	0.17	0.03	0.30	0.12
8	0.6	29	60	0.48	0.50	0.45	0.45	0.20	0.60	0.30
9	0.9	97	60	1.62	1.61	1.05	0.75	0.79	0.85	1.37
10	1	138	60	2.30	2.28	1.94	0.95	1.84	0.98	2.22
11	1	85	60	1.42	1.41	1.84	1.00	1.84	0.99	1.39
12	0.95	98	60	1.63	1.62	1.52	0.98	1.48	0.66	1.08
12.4	0.9	112	60	1.87	1.85	1.74	0.37	0.64	0.42	0.78
13	0.6	56	60	0.93	0.94	1.40	0.45	0.63	0.36	0.34
13.5	0.5	30	60	0.50	0.52	0.73	0.28	0.20	0.26	0.14
14	0.5	10	60	0.17	0.19	0.35	0.25	0.09	0.23	0.04
14.7	0	0	0	0.00	0	0.10	0.18	0.02	0.88	0.00
							Total	**7.772**		**7.768**

Lower French Creek 5/26/10 - 9:30 am								**Gauge Ht.**	**2.75**	**ft**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
4.2	0.2	0	0	0	0	0	0	0	0.12	0.00
5	0.6	0	60	0.00	0.03	0.01	0.32	0.00	0.53	0.01
5.6	1.6	0	60	0.00	0.03	0.03	0.66	0.02	0.70	0.02
6	1.8	60	60	1.00	1.01	0.52	0.68	0.35	1.31	1.32
7	2.3	108	60	1.80	1.79	1.40	2.05	2.86	2.23	3.98
8	2.5	199	60	3.32	3.27	2.53	2.40	6.07	2.48	8.09
9	2.6	210	60	3.50	3.45	3.36	2.55	8.56	2.58	8.88
10	2.6	176	60	2.93	2.89	3.17	2.60	8.24	2.60	7.52
11	2.6	199	60	3.32	3.27	3.08	2.60	8.01	2.53	8.25
12	2.3	176	60	2.93	2.89	3.08	2.45	7.55	2.35	6.80
13	2.2	76	60	1.27	1.27	2.08	2.25	4.68	1.68	2.12
14	0	0	0	0.00	0	0.63	1.10	0.70	3.58	0.00
							Total	**47.043**		**46.992**

Lower French Creek 6/28/10 - 5:10 pm								**Gauge Ht.**	**1.78**	**ft**
Station	Depth	Clicks	Seconds	Rev/Sec	Velocity (ft/s)	Avg Velocity	Area ft^2	Flow (cfs) (avg velocity)	Avg Area	Flow (avg area)
6.8	0	0	0	0	0	0	0	0	0.05	0.00
7.5	0.6	60	60	1.00	1.01	0.50	0.21	0.11	0.17	0.17
8	0.9	24	30	0.80	0.81	0.91	0.38	0.34	0.51	0.41
9	1.35	58	30	1.93	1.92	1.36	1.13	1.53	0.68	1.31
10	1.4	80	30	2.67	2.63	2.28	1.38	3.13	0.70	1.84
11	1.4	72	30	2.40	2.37	2.50	1.40	3.50	0.69	1.63
12	1.3	74	30	2.47	2.44	2.41	1.35	3.25	0.62	1.51
13	1.05	51	30	1.70	1.69	2.06	1.18	2.42	0.50	0.84
14	0.85	77	60	1.28	1.28	1.49	0.95	1.41	0.13	0.17
14.3	0.9	17	30	0.57	0.58	0.93	0.26	0.24	0.17	0.10
14.7	0.7	0	0	0.00	0.00	0.29	0.32	0.09	3.86	0.00
							Total	**16.032**		**7.978**


Lower Rock Creek - Temporary Gage
Flow Rate (cfs)
Volume (ac-ft)
160
140
120
100
80
60
40
20
0
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
6/1/2010
7/1/2010
8/1/2010
9/1/2010
10/1/2010
11/1/2010
Lower Rock Ck Flow Rate
Upper Rock Ck USGS 06320000 Flow Rate
Lower Rock Ck Cumulative Volume
Upper Rock Ck USGS 06320000 Cumulative Vol


Rock Creek at Mouth SEO Rating Curve
y = 2.0959x6 - 11.464x5 + 7.063x4 + 50.329x3 - 53.023x2 + 18.197x
R² = 0.9999
Flow Rate (cfs)
250
200
150
100
50
0
0
0.5
1
1.5
2
2.5
3
Gage Height (ft)

Appendix 4A
Livestock and Wildlife Water Source Improvements

LIVESTOCK AND WILDLIFE WATER SOURCE IMPROVEMENTS

1 Spring Developments

Individual springs can be developed as local watering sites or supply sources to feed pipelines conveying flows to multiple tanks. The specific method(s) used to develop a spring or seep area depend on the site-specific conditions. In general, the following factors and recommendations should be considered and implemented/adopted as appropriate:

- Carefully examine the spring/seep to determine the source (or "eye"), and to determine if any known or potential sources of contamination exist.
- Observe the rate of flow (estimated or measured) during a dry season or the season of intended use to determine if flow rate will be sufficient or to guide design of the spring development.
- Remove obstructions to spring flow (fine grained soils, surficial deposits, dense vegetation, etc.).
- Remove phreatophytic vegetation that can significantly reduce the amount of spring flow via transpiration (in accordance with any necessary environmental analysis, permitting and mitigation).
- Collect the available flow by appropriate means/methods (perforated pipe; ditching; drainage trench/gallery; etc.).
- Construct a means to settle sediment, protect the spring flow from external debris or contaminants, and facilitate maintenance of the spring (e.g., a spring box).
- Consider lowering the outlet elevation of the spring to increase the head at the discharge and thereby increase the flow.
- Use of explosives for spring development is discouraged as this practice can result in lower instead of higher flows and is dangerous unless performed by fully qualified personnel.
- Protect the spring development from washout or sediment burial during periods of flooding by diking and ditching as appropriate.
- Construct and maintain fencing or other barrier around the source to minimize impact to the source by wildlife or livestock.

Detailed information on the occurrence and characteristics of springs and the design of spring development, collection and protection is included in Chapter 12 – Springs and Wells of the Engineering Field Handbook (NRCS, 1983). This reference may be downloaded at the following website:

http://directives.sc.egov.usda.gov/17550.wba

Alternative guidance for the design, construction and maintenance of spring developments as published by USAID (1982) is available at the following website:

http://www.lifewater.org/surface-water

Figure G.1 shows several typical spring development schemes abstracted from these two references.

Figure 1 Schematics of Typical Spring Developments

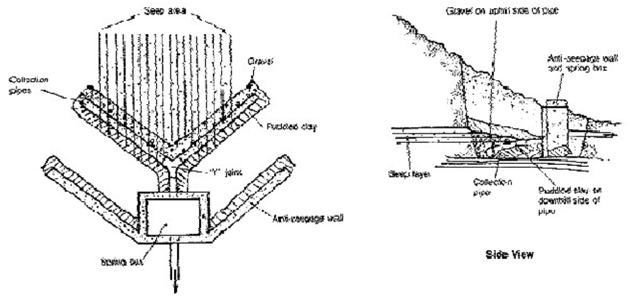


Figure 3. Seep Collection System

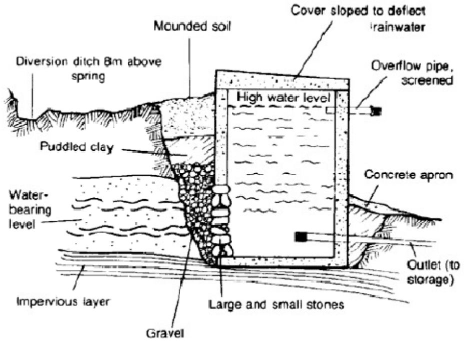


Figure 1. Spring Box with Pervious Side

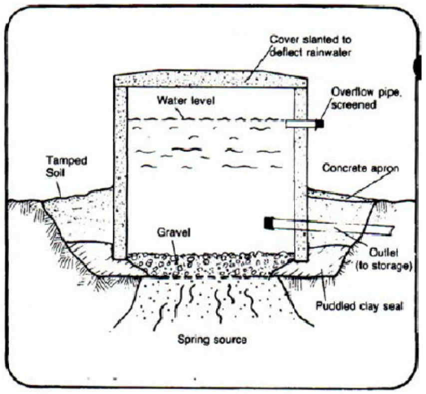


Figure 2: Spring box with permeable bottom for collecting spring water flowing from an opening on level ground (Courtesy of USAID, 1982, available online at www.lifewater.org).

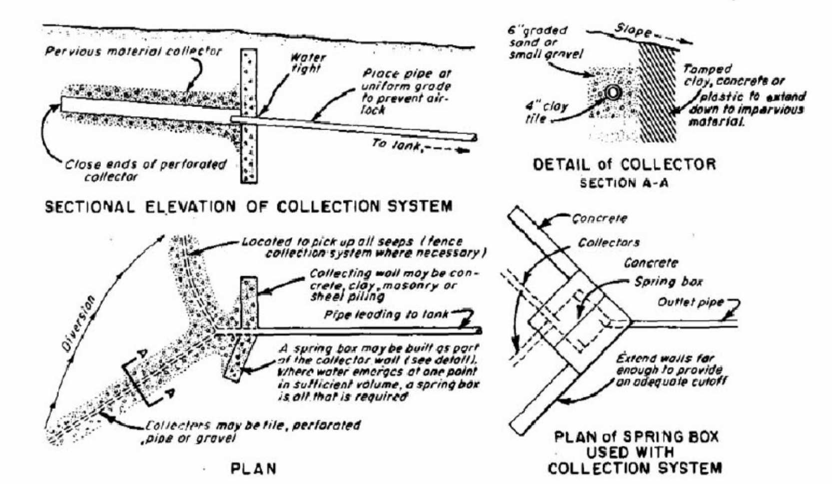
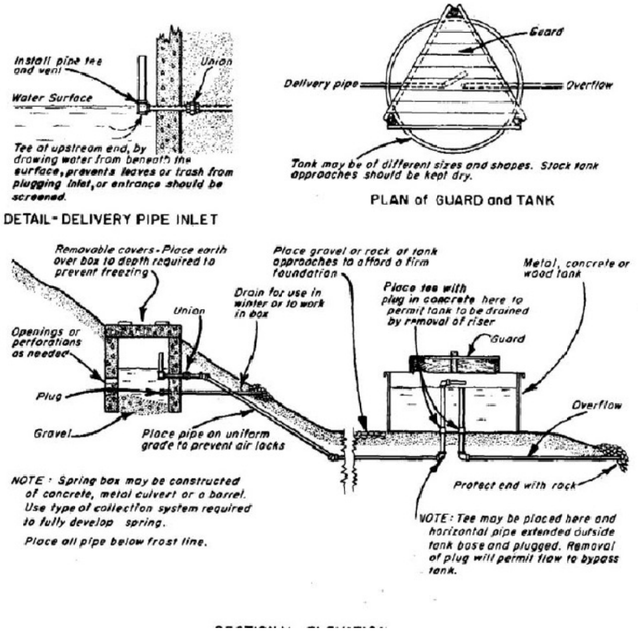


Figure 12-11.—Spring collection system.



2 Existing Wells with Conventional Windmills, Wind Turbines and Combined Solar/Wind Systems

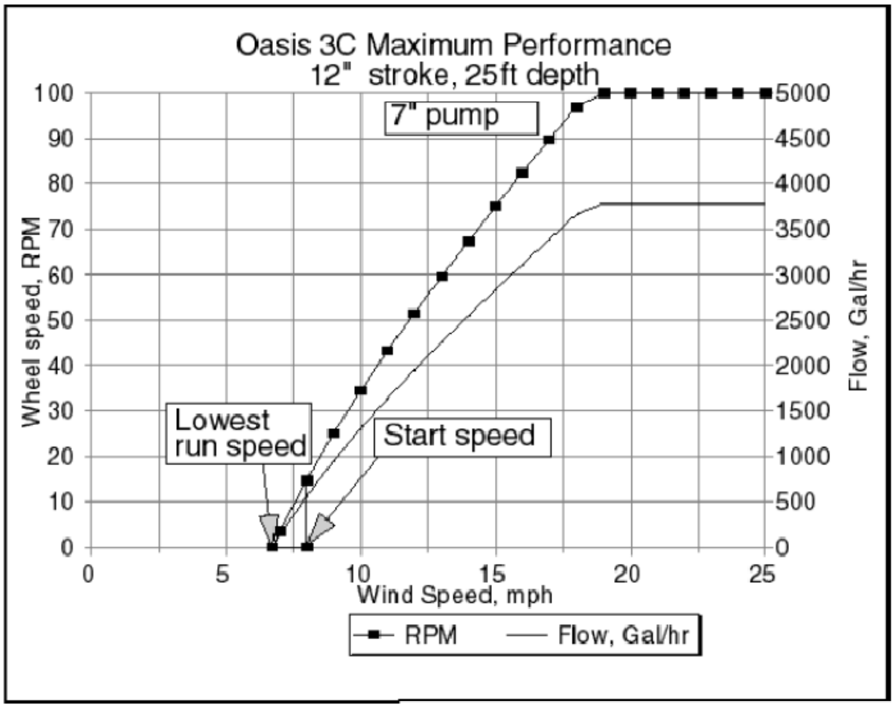
Conventional Windmills. Windmills are a traditional method used to collect groundwater by means of a conventional well equipped with a mechanical pump powered by the wind-driven rotation of a set of high-torque, low-speed gears. Windmills are most typically used where: distance to power lines is greater than about a mile; reliability of supply is not crucial; high pumping rates are not required; ease of maintenance is important or desirable (i.e., no electrical and associated control components); and where cost per gallon of water produced needs to be low compared to other alternatives. Modern windmills are capable of pumping from depths up to about 1000 feet if needed (at low pumping rates); however, most applications are where relatively shallow groundwater is available (typically less than a few hundred feet). Pumping rates from shallow depths typically range from a less than 50 to as much as several thousand gallons per hour (gph) under favorable conditions. Mechanical single action piston pumps are most commonly used. Performance parameters for a high efficiency, modern-era Oasis 3 windmill manufactured by WINDTech International, LLC are presented on Figure G.2. Wind speeds necessary to drive modern windmills may be as low as about 5 miles per hour (mph) for highly efficient designs; more typically winds of at least 12 mph are needed, with efficiency increasing notably at wind speeds greater than about 18 mph. The life of a windmill is usually on the order of 20 years under a normal range of operating and environmental conditions.

A windmill would normally fill a local tank and serve as a single point source of wildlife and livestock watering. A typical mechanical windmill set-up is shown schematically on Figure G.3.

Wind Turbines. A wind turbine can be used as an alternate source of power for a conventional pump installed in a groundwater well. In this type of system a wind turbine is mounted on a tower either at the site of the groundwater well or a more wind-suitable site near the well. The turbine converts wind energy to electrical energy through a generator or alternator that in turn powers a conventional submersible pump. If desired, storage batteries could be included in the system so that pumping could continue during times when the wind velocities are not sufficient. Information about wind turbines in a water pumping application is available from the U.S. Department of Energy Efficiency and Renewable Energy (EERE) website at:

http://www.energysavers.gov/your_home/electricity/index.cfm/mytopic=10890

Information on commercial wind water pumping systems utilizing a Bergey wind turbine and Grundfos submersible pumps are available at: http://www.bergey.com/pages/bergey_xl1 and http://net.grundfos.com/doc/webnet/sq_flex/int/combi_systems.html. These particular systems range from 4,800 to 40,000 gal/day production with an 11 mph wind and a pumping/head of 100 feet.



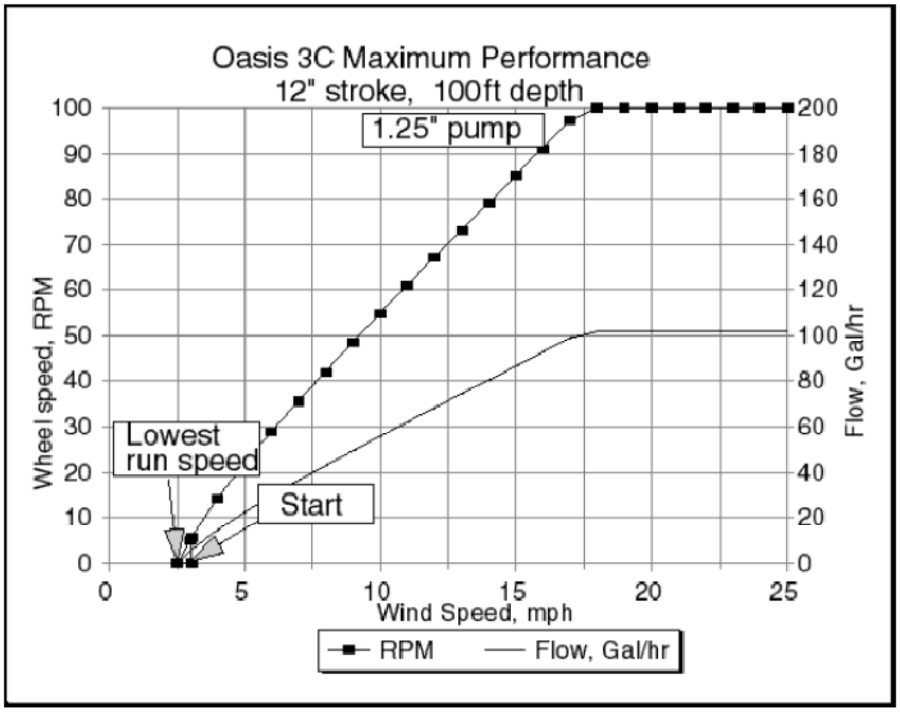


Figure 2 Windmill Performance Curves

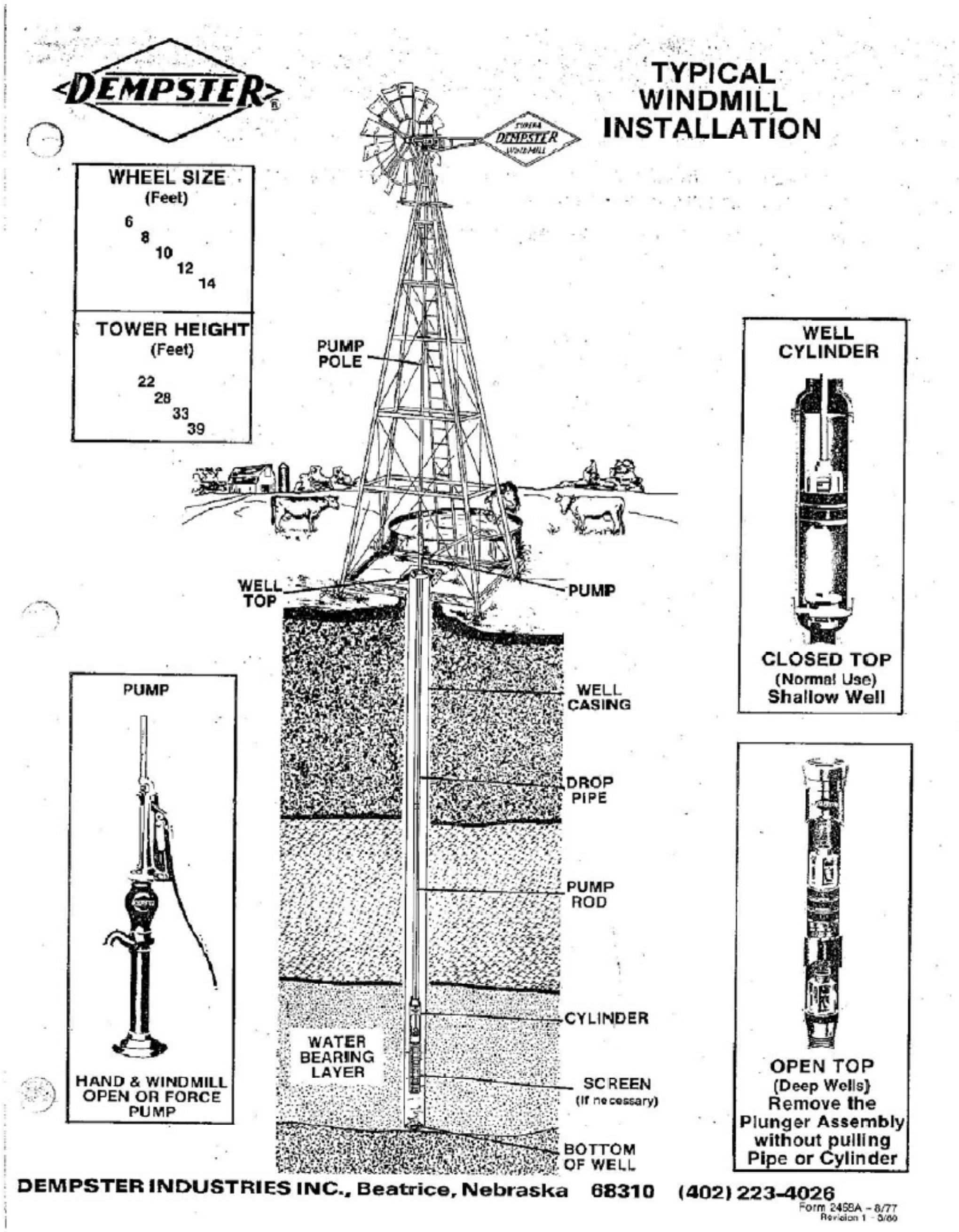


Figure 3 Windmill Schematic

Combined Solar/Wind Powered Systems. An alternative to a conventional windmill or a wind turbine powered pumping system is a combined system that includes both a wind turbine and solar panels as power sources for a generator and conventional submersible water pump. This system allows the pump to be operated by solar power alone, wind power alone, or a combination of both sources depending on environmental conditions at the site at any given time. Although more expensive to install and maintain, this system provides more reliable power for stock water pumping than either single source alone. A commercially available source of this type of system is produced by Grundfos; information on this system is available at:

http://net.grundfos.com/doc/webnet/sq_flex/int/combi_systems.html

3 Wells

Wells are a potential source of water for wildlife and livestock watering. Because of the cost of drilling and completing a well and the unavoidable uncertainty as to the production that will be achieved (without very expensive prior site-specific exploration), a new well would usually only be considered as a source where no other more practical and cost-effective options are available. On the other hand, conversion of an existing well to serve as a source of wildlife/livestock watering may be very cost-effective. For this to be the case, some or all of the following conditions should be met:

- Located near an area in need of additional watering opportunities
- Sufficient capacity to serve this and any other existing uses (or potential to increase well yield through re-conditioning or possibly deepening)
- Capable of operation by wind or solar power (unless already served by a power line)

It may be possible to convert a dormant oil (or gas) well to water production; however, there are a number of factors that may render this impractical. First, the well must be open to at least the depth of the target aquifers(s). If open deeper, it may be necessary to plug the hole up to or for some distance below the base of the lowest target aquifer to minimize pumping residual oil and/or natural gas. Depending on the nature of the aquifer(s) (hydrocarbon content) it may be necessary to install a “treater” or “skimmer” at the surface to separate the hydrocarbons from the water. If the well is cased across the producing zone(s), it will have to be perforated, and depending on formation properties, protection against piping of the sidewall provided by some means. Unless conditions are generally favorable, the cost of conversion of an existing oil well may end up exceeding the cost of drilling and completing a new well. This is not to say that such opportunities do not exist or are always impractical. Oil wells have been reportedly successfully converted and serve as a year-round watering installation. Any such conversion opportunities should be carefully evaluated on a case-by-case basis.

Conditions most advantageous to use of a new well are summarized as follows:

- Shallow depth to aquifer(s) with adequate transmissivity to meet projected needs.

- Located where hydrogeologic conditions are reasonably well known from prior drilling and/or well installation.
- Either close to existing power lines or suitable for wind or solar operation.
- Location upgradient of an area or areas of significant wildlife/livestock watering
- Shortage.

If a new well is planned, it is recommended that a water well driller with substantial experience in the local area be utilized to take best advantage of prior experience with the relevant geologic units and conditions. Depending on the size (depth and anticipated yield) of the well, it may be worthwhile to consult a groundwater geologist with experience in this or similar geologic settings prior to finalizing a decision as to drilling a new well.

Information on the planning, design, drilling, completion, development of groundwater wells is available from many sources. One source of such information is available from the NRCS (1983) Engineering Field Handbook at the following website:

http://directives.sc.egov.usda.gov/17550.wba

4 Pipeline/Tank Systems

Pipeline/tank systems are generally considered to be the best method for conveyance of flows from any suitable source of water, since they can put the water where it is needed (at multiple locations), when it is needed. These systems can operate by gravity, be fed by a pumped source, or combine both gravity and pumping reaches (usually with a surge/storage tank in the system). Sources of water may include any of those described in this section, including a groundwater well, developed spring, pond, reservoir, or stream diversion.

Considerations in the layout and design of a pipeline/tank system include, but are not limited to the following:

- *Location of the source relative to the points of use* – ideally the water source will be located upgradient of the points of use so that all delivery can be by gravity
- *Temporary storage* - if necessary, one or more locations for temporary storage of pumped supply can be provided that then feed the remainder of the system by gravity; typically a 2-3 day supply for the wildlife and livestock using the system is provided
- *Terrain* – an alignment with some variation in grade is desirable to minimize problems with air-locking by installation of air relief valves at appropriate locations; very rugged terrain is less desirable due to the higher installation costs
- *Geologic conditions* – ideally pipeline alignments will be located where rock excavation and/or adverse soils conditions are avoided or minimized to the degree practical (adverse soils conditions may include landslides, areas of significant active erosion, etc.)

- *System length/size* – the longer the system and the more tanks planned or desired, the greater the flow capacity from the source required; friction losses in the pipe and through the fittings can be significant over long distances relative to the available energy of the source water
- *Property ownership* – systems may be designed to serve a single landowner; alternatively, there may be opportunities for cooperative projects in which the system is designed to serve two or more entities (see additional discussion later in this section)
- *Environmental conditions/issues* – it is necessary, to the extent feasible, to avoid impacts to the environment including but not limited to wetlands, riparian zones, high value sage grouse habitat, and cultural resources

The pipeline/tank systems planned and/or installed already in the watershed include some or all of the following elements/components:

- Spring development or well as water source
- HDPE piping
- Air release vents/valves
- Pipeline drains
- Tanks (with pressure reducing valves, rescue ladders, gate or ball valves, float valves, air and vacuum release or pressure relief valves, overflow piping, and pump manifold gages, valves and fittings)

There is a wide array of different wildlife/livestock watering tanks that can be used in a pipeline/tank system or with any of the other water sources described in this section. At present, converted heavy equipment tires appear to be the preferred tank type in the watershed. This is due to their relative availability, comparative cost effectiveness, durability, freeze-resistance, long-life, and ease of installation (with the proper equipment available). A typical 12-foot by 2.5-foot tire tank holds on the order of 1500 gallons when full. Other types of tanks that could be considered on a case-by-case basis include, but are not necessarily limited to:

- Cast-in-place or precast concrete tank or trough
- Bottomless corrugated metal tanks
- Pit/pond (sealed or lined where necessary)
- Fiberglass or galvanized tanks

The larger pipeline/tank systems are typically are designed to fill the tanks automatically as the contents are drawn down. There is provision for taking individual tanks out of service when necessary for maintenance or repair. Overflow drainage is provided in the event of malfunction.

5 Ponds

Small ponds can provide seasonal watering opportunities to both wildlife and livestock. Watering can occur directly from the pond, or a pipeline can be fed from the pond to deliver water to one or more tanks downgradient. For purposes of this study, a watering ("stock") pond is defined as a reservoir or pit/dugout (excavation below original grade) with a maximum capacity of less than 20 acre-feet and a dam height less than 20 feet. Reservoirs/pits of this size qualify for application to the State Engineer's Office as "stock reservoirs" and thereby avoid the more restrictive and costly administrative, design, and construction requirements associated with permitting under the standard reservoir regulations.

A pond is typically created by excavation of soils in the pond area and placing the excavated soil as embankment fill to create a dam. This approach is most cost effective initially; however, it may be more cost-effective in the long run to secure soils from areas near but not immediately at the reservoir site depending on the properties of the soils. In particular, clay soils with dispersive properties or with significant percentages of soluble salts should not be used for embankment fill if other more suitable soils are available nearby. Embankment fill should be placed in relatively thin horizontal lifts, compacted with rubber-tired (versus tracked) equipment, and not placed too wet or too dry. This will result in a more erosion resistant embankment.

An overflow earthen spillway should be provided for ponds constructed in ephemeral or intermittent drainages and in swales with relatively large drainage areas. If possible, the spillway section should be excavated in or to rock. If this is not feasible, the spillway should be constructed with as broad a crest and as shallow a discharge channel as practical to lower flow velocities and thereby limit erosion during times of use. Revegetating the spillway with grasses will also increase its erosional resistance. The arrangement of the spillway relative to the dam embankment and the general configuration of the spillway are shown by the centerline profiles shown in Figure G.4. An outlet pipe is usually only included in this type of pond if it is needed to feed one or more tanks downgradient (supply pipe) or if there is enough spring-fed flow or intermittent runoff events to cause excessive use of the overflow spillway ("trickle tube"). A supply pipe is placed with its inlet near but not at the lowest point of the foundation (to allow for some sediment accumulation). Flow is controlled by a downstream valve (e.g., a float valve regulated by water level in the down-gradient tank or pipeline/tank system being supplied). The trickle tube is an appropriately sized open pipe installed through the embankment dam at an elevation slightly lower than the overflow crest elevation of the spillway.

If direct watering is intended (which allows for watering more animals at a time), then it is recommended that protection of the dam embankment, spillway (and outlet if present) be considered to reduce the need for and cost of future maintenance. Although initially more costly, consideration should also be given to armoring of the pond rim to lessen erosion and excessive sedimentation. This decision should be based on the site soils conditions, planned usage, and estimated cost of future maintenance in the absence of such protection. One alternative on larger ponds may be to selectively armor only portions of the rim and fence the remainder to exclude use by wildlife and livestock. If armoring is used it should consist of reasonably durable gravel (over larger rock if necessary) to encourage use by wildlife/livestock and minimize sloughing and erosion of the pond banks.

Information on the planning, design and construction of small ponds is available from the NRCS at: http://directives.sc.egov.usda.gov/17549.wba. The local NRCS staff in Buffalo and Sheridan

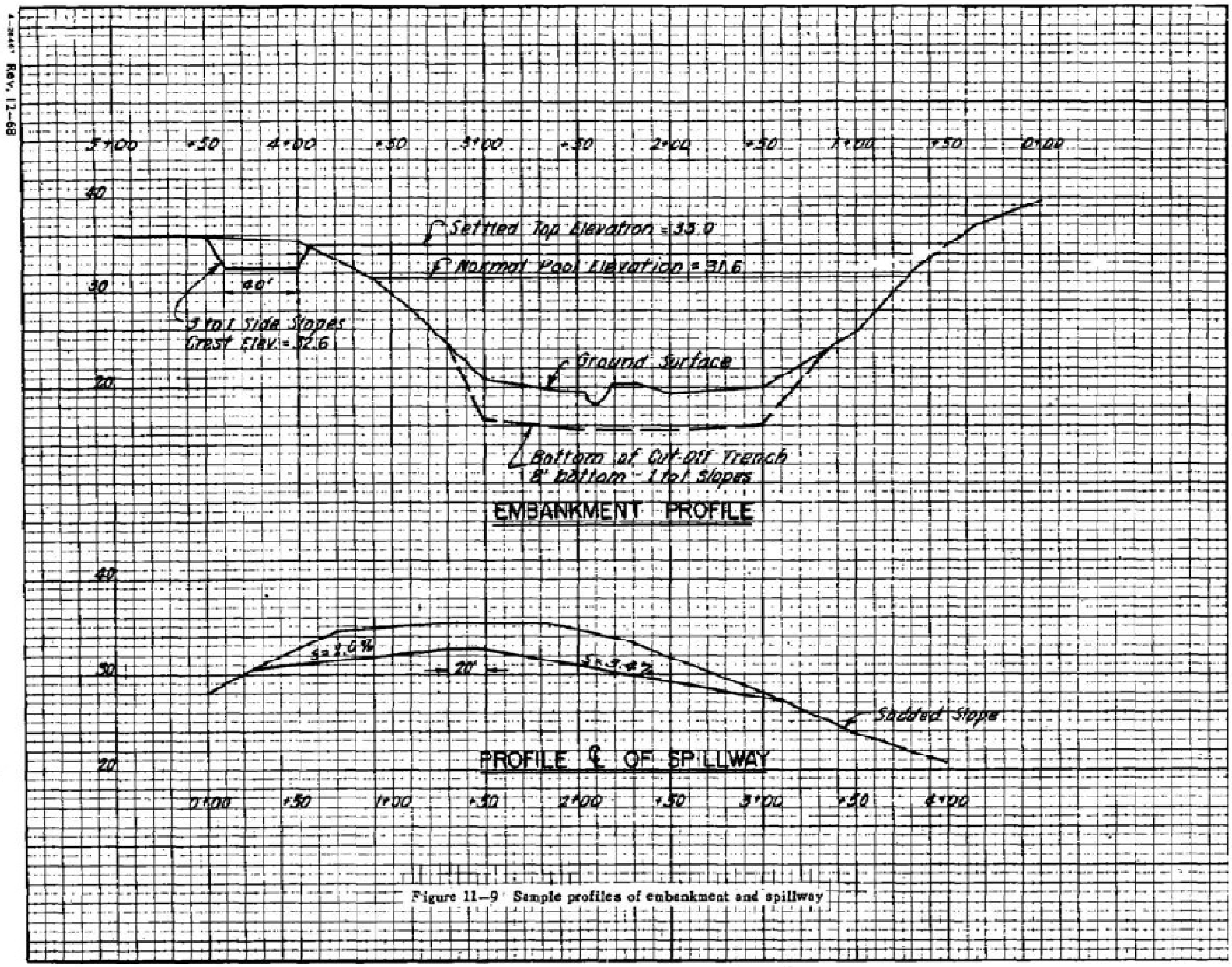


Figure 11—9 Sample profiles of embankment and spillway

Figure 4 Pond Embankment and Spillway Profile Schematics

(and other staff they may contact) may also be able to provide technical assistance for projects to be constructed under an NRCS program.

6 Reservoirs

A new surface water storage reservoir could serve as a source of supply to a wildlife/livestock watering system. This could involve direct gravity to one or more pipeline/tank systems arrayed downgradient of the reservoir. Alternatively, the reservoir could serve as the source for pumping water to one or more pipeline/tank systems.

Any new reservoir could also serve as a direct source of wildlife and livestock watering. Depending on the location of the reservoir relative to grazing locations, it may be appropriate to include one or several watering access sites around the reservoir rim. These sites should be sized to accommodate the anticipated or desired use, and designed with appropriate grades to and in the near-shore pool to facilitate watering. The access ramps and watering areas should be adequately armored as described above in the section above regarding stockponds.

7 Guzzlers

A guzzler is a wildlife watering system utilizing direct precipitation as a source of supply, with a storage tank of capacity suitable to the watering need, and designed to discourage use and protect from damage by livestock. A complete guzzler system is comprised of the following components:

- Catchment apron – typically made of textured HDPE; secured with rocks placed on a suitable grid spacing, and protected by suitable fencing from trampling by wildlife or livestock (Figure G.5).
- Catchment outlet - pipe boot, clamps and well screen section.
- HDPE pipe – typically 1.5-2-inch, 160 psi, SDR 11.
- Catchment tank – HDPE tank sized to accommodate wildlife or livestock watering needs, with integral drinker (ideally with no float valve required), small animal escape ladder and overflow adapter (1800-gallon tank with patented features is available from Boss Tanks and Elko Bighorns Unlimited, Elko,Nevada).
- Overflow pipe – with erosion protection at discharge.

Figure G.5 Guzzler installed in the Cottonwood Creek watershed.

The guzzler operates by intercepting direct rainfall or snowmelt on the catchment, routing the captured water via a pipe to the tank, and controlling the tank level via a simple overflow outlet pipe. Figure G.6 shows a typical set up

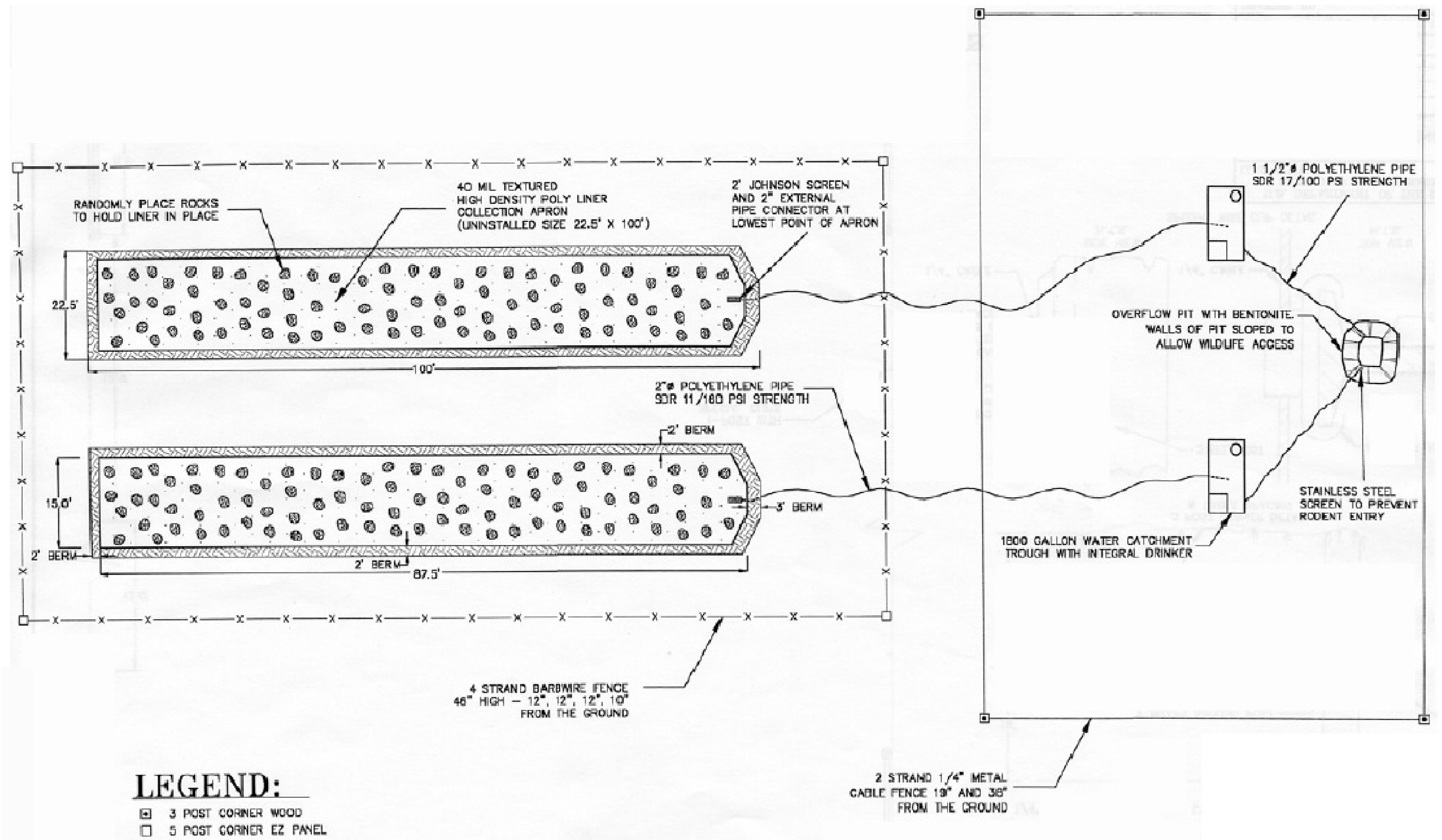


Figure 6 Schematic of Typical Guzzler Installation

with dual catchments and tanks. Information on a commercially available system compatible with the design described above is available from Boss Tanks and Elkhorn Bighorns Unlimited at: http://www.bosstanks.com/guzzler.htm. A self contained guzzler is available from Wildlife Water Guzzler; information on this product line is available at: http://www.wildlifewaterguzzler.com/.

8 Power Sources

Conventional Electrical Service. In most cases the cost to bring overhead power to a single well or lift station site for wildlife/livestock watering would probably be prohibitive. This option should normally be considered only when the point of power use is close to existing service (usually less than about ¼ to ½ mile) or the power demands are higher than can be feasibly supplied by other sources (wind, solar).

Portable/Remote Generator. Although possible, the use of portable or remotely installed gasoline or diesel powered generators is generally not an economically feasible alternative to operate pumps to supply wildlife/livestock water. This type of power is usually only considered in temporary or emergency conditions. If used, special care is required to ensure safe transport, storage and use of fuel to prevent accidental fires and/or releases of fuel to the environment.

Solar Water Pump. Solar power can be an appropriate, efficient and long-term cost-effective means to power a pump used to extract groundwater from a well or to convey water upgradient from another source of supply (pond, spring, storage tank, etc.) to temporary storage or point of use (watering tank or pipeline/tanks system). This type of system is best suited to remote locations with sufficient sunlight, typical of conditions where additional wildlife/livestock watering is needed in the Nowood watershed. Solar water pump systems are typically comprised of one or more photovoltaic (PV) panels, sometimes a set of storage batteries, and a DC-capable pump. Figure G.7 shows two typical set-ups, one with storage batteries and direct delivery to the watering tank(s) and the other with a storage tank set above the watering tank(s) and without storage batteries. Other arrangements are also possible. Batteries are used where pumping during low-light and nighttime periods is necessary or desirable (e.g., to fill a storage tank or refill a watering tank overnight when watering demands are low).

Overall, solar water pump systems are relatively easy to install and maintain. However, the solar panels are relatively fragile and need to be mounted in a suitable location and well-secured against wind and livestock damage. The other components in the system (pump, controller, switches and possibly batteries) also need to be properly installed, protected from weather and incidental damage, and require some periodic maintenance and/or replacement.

Solar water pumps are specially designed to work efficiently with DC solar power, including during low-light (reduced voltage) conditions. Many different types of pumps can be used depending on the pumping head and flow rates for the particular application. These include positive displacement types (piston and jack pumps, diaphragm, vane and screw pumps) that maintain lift capacity at slow, varying speeds resulting from changing light conditions. In low-lift and/or high-volume applications, centrifugal-type pumps are often used. The pumping rates that can be achieved vary with the lift (head) from the

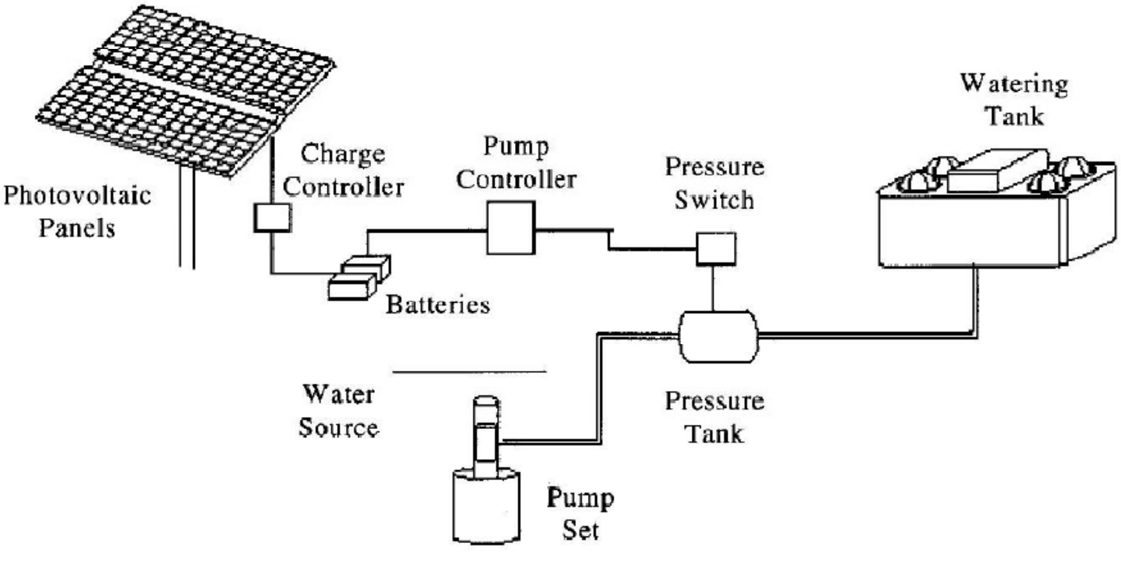
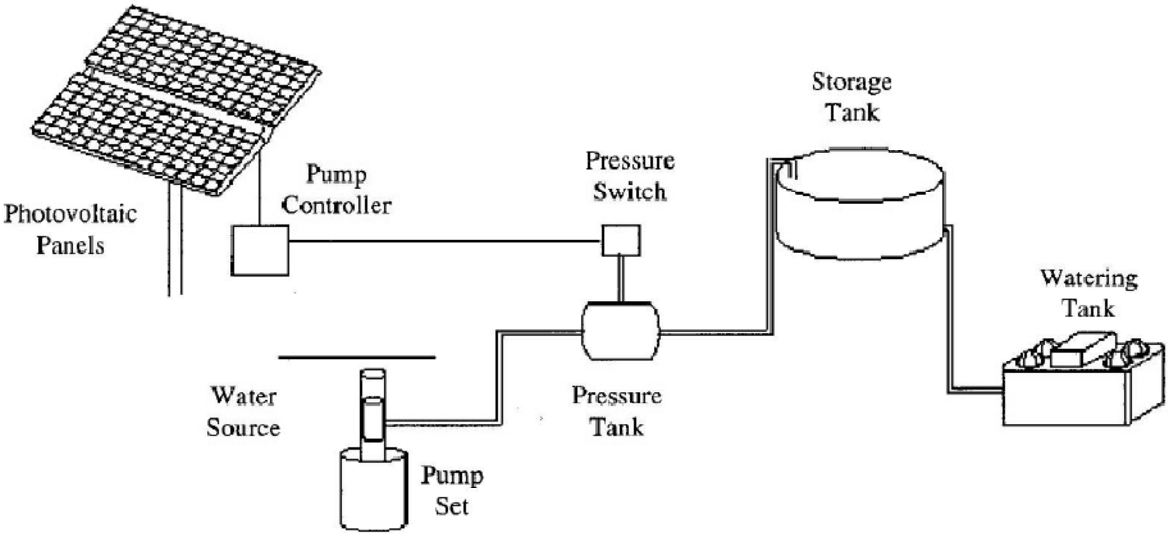


Figure 2. Battery-coupled solar water pumping system

Battery-coupled solar watering system



Direct-coupled solar watering system

Figure 7 Schematic of Typical Water Pump

pump to storage or point of use and the amount of power supplied by the solar system. At relatively low heads (say less than 100 feet) and with modest power (say less than 150 watts), pumping rates on the order of 150-200 gph (3.0-3.5 gpm) are possible. With greater available power at low heads (50-100 feet), pumping rates up to several thousand gph (25-75 gpm) are possible with centrifugal pumps. For high lifts (say 400-500 feet) and sufficient power, pumping rates of several hundred gph are attainable with helical rotor pumps.

Appendix 5A

Unit Costs

Unit Cost Item Summary

Costs were developed for the Rocky Mountain Region. A Regional Adjustment Factor is used to adjust the costs for different locations based on the RSMeans Location Factor for a nearby city. The Regional Adjustment Factor for this project is (1.00) .

Unit Item Description	Units	Base Unit Cost	Regional Unit Cost
12" Irrigation Pipe	FT	$14.42	$14.42
18" Diameter Canal Gate	Each	$1,964.36	$1,964.36
18" Irrigation Pipe	FT	$29.87	$29.87
2.5-ft x 2.5-ft Slide Gate	Each	$3,072.83	$3,072.83
24" Diameter Canal Gate	Each	$2,868.20	$2,868.20
2-ft x 2-ft Slide Gate	Each	$2,670.63	$2,670.63
3.5-ft x 3.5-ft Slide Gate	Each	$4,516.91	$4,516.91
36" Diameter Canal Gate	Each	$5,314.01	$5,314.01
3-ft x 3-ft Slide Gate	Each	$3,728.89	$3,728.89
4-ft x 4-ft Slide Gate	Each	$6,460.84	$6,460.84
5-ft x 5-ft Slide Gate	Each	$8,847.60	$8,847.60
Canal Cleaning	SY	$0.62	$0.62
Check Guides: Replace	FT	$19.87	$19.87
CIP Concrete	CY	$1,135.47	$1,135.47
Compacted Embankment	CY	$7.50	$7.50
Concrete Demo. & Disposal	CY	$209.94	$209.94
Erosion Control Blanket	SY	$3.75	$3.75
Galvanized 2"x2" #12 Steel Mesh	SF	$1.50	$1.50
General Fill	CY	$3.77	$3.77
Handrail	FT	$50.71	$50.71
HDPE 18" Pipe	FT	$21.93	$21.93
HDPE 24" Pipe	FT	$38.03	$38.03
HDPE 30" Pipe	FT	$50.61	$50.61
HDPE 36" Pipe	FT	$65.57	$65.57
HDPE 42" Pipe	FT	$100.45	$100.45
HDPE 48" Pipe	FT	$122.77	$122.77
Miscellaneous	$	$1.03	$1.03
NRCS Concrete Check (4'x4' Notch)	Each	$6,142.94	$6,142.94
Overshot Gate	SF	$510.96	$510.96
Overshot Gate: Compressor & Control	Each	$18,735.29	$18,735.29
Parshall Flume (35 cfs)	Each	$4,534.04	$4,534.04
Precast Concrete	CY	$493.93	$493.93
Precast Turnout	Each	$4,680.48	$4,680.48
Pressure Relieve Valve	Each	$10,000.00	$10,000.00
RCP 18" D	FT	$77.87	$77.87
RCP 24" D	FT	$89.40	$89.40
RCP 30" D	FT	$99.93	$99.93
RCP 36" D	FT	$132.48	$132.48
RCP 42" D	FT	$176.14	$176.14
RCP 48" D	FT	$256.97	$256.97
RCP 5' D	FT	$395.74	$395.74
Riprap Bank Protection	CY	$55.40	$55.40
Rock Vane Diversion	Each	$30,900.00	$30,900.00
Safety Cable	FT	$36.05	$36.05
Safety Ladder (10 feet)	Each	$235.66	$235.66
Shotcrete lining	SF	$3.33	$3.33
Stream Control (Medium)	Each	$27,559.61	$27,559.61

Unit Cost Item Summary

Unit Item Description	Units	Base Unit Cost	Regional Unit Cost
Stream Control (Small)	Each	$6,812.78	$6,812.78
Structural Excavation	CY	$22.95	$22.95
Structural Fill	CY	$36.65	$36.65
Structure Removal: Check (15')	Each	$756.16	$756.16
Trash Rack	SF	$34.22	$34.22
Turnout Valve	Each	$5,000.00	$5,000.00
Unclassified Excavation	CY	$2.59	$2.59
USBR Baffled Pipe Outlet: No. 3	Each	$7,546.95	$7,546.95
USBR Concrete Weir (9' Notch)	Each	$11,710.55	$11,710.55
Walkway (Expanded Steel)	SF	$17.95	$17.95
Weir Plate (9')	Each	$755.88	$755.88

Unit Item Cost Determination

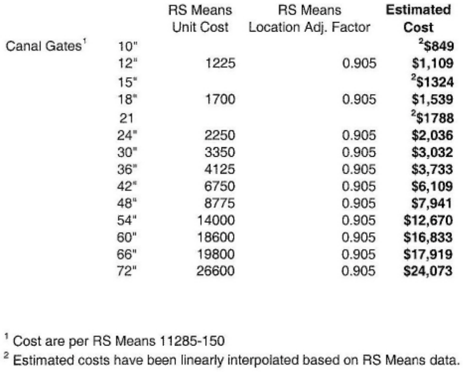
The purpose of this report is to document the history of each unit cost. Original cost data was developed for cost year 2005. The principle source used was RSMeans "Site Work and Landscape Cost Data, 24th Edition." In January 2007 a comprehensive review of costs was performed to bring them to the current cost year and review their appropriateness, adjustments were made as required. Adjustments have been made in each subsequent year to adjust for inflation and changing construction costs. Additional costs are added as necessary to include items that are unique to the current project.

12" Irrigation Pipe (FT)

Year	Base Unit Cost	Notes
2009	$14.00	Supplier quote (Mullinax) with 2x multiplier for installation.
2011	$14.42	Estimated 2011 cost (assuming 3% cost cost increase).

18" Diameter Canal Gate (Each)

Year	Base Unit Cost	Notes
2005	$1,539.00	RSMeans 24th Edition.
2007	$1,730.00	Gate Supplier Quote (Aquatech Incorporated Billings, MT / Nardinger Irrigation Billings, MT)
2008	$1,833.80	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$1,907.15	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$1,964.36	Estimated 2011 cost (assuming 3% cost cost increase).



		RS Means Unit Cost	RS Means Location Adj. Factor	**Estimated Cost**
Canal Gates[1]	10"			**[2]$849**
	12"	1225	0.905	**$1,109**
	15"			**[2]$1324**
	18"	1700	0.905	**$1,539**
	21			**[2]$1788**
	24"	2250	0.905	**$2,036**
	30"	3350	0.905	**$3,032**
	36"	4125	0.905	**$3,733**
	42"	6750	0.905	**$6,109**
	48"	8775	0.905	**$7,941**
	54"	14000	0.905	**$12,670**
	60"	18600	0.905	**$16,833**
	66"	19800	0.905	**$17,919**
	72"	26600	0.905	**$24,073**

[1] Cost are per RS Means 11285-150

[2] Estimated costs have been linearly interpolated based on RS Means data.

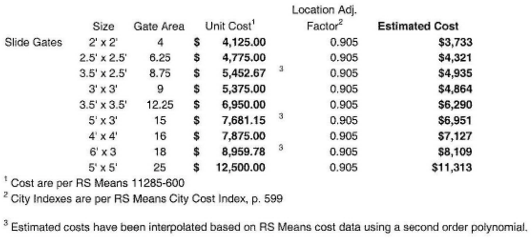
18" Irrigation Pipe (FT)

Year	Base Unit Cost	Notes
2009	$29.00	Supplier quote (Mullinax) with 2x multiplier for installation.
2011	$29.87	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

2.5-ft x 2.5-ft Slide Gate (Each)

Year	Base Unit Cost	Notes
2005	$4,321.00	RSMeans 24th Edition.

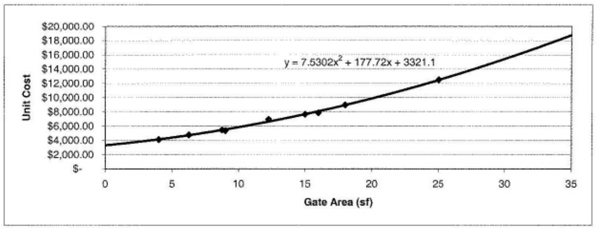


	Size	Gate Area		Unit Cost[1]		Location Adj. Factor[2]	Estimated Cost
Slide Gates	2' x 2'	4	$	4,125.00		0.905	**$3,733**
	2.5' x 2.5'	6.25	$	4,775.00		0.905	**$4,321**
	3.5' x 2.5'	8.75	$	5,452.67	[3]	0.905	**$4,935**
	3' x 3'	9	$	5,375.00		0.905	**$4,864**
	3.5' x 3.5'	12.25	$	6,950.00		0.905	**$6,290**
	5' x 3'	15	$	7,681.15	[3]	0.905	**$6,951**
	4' x 4'	16	$	7,875.00		0.905	**$7,127**
	6' x 3	18	$	8,959.78	[3]	0.905	**$8,109**
	5' x 5'	25	$	12,500.00		0.905	**$11,313**

[1] Cost are per RS Means 11285-600

[2] City Indexes are per RS Means City Cost Index, p. 599

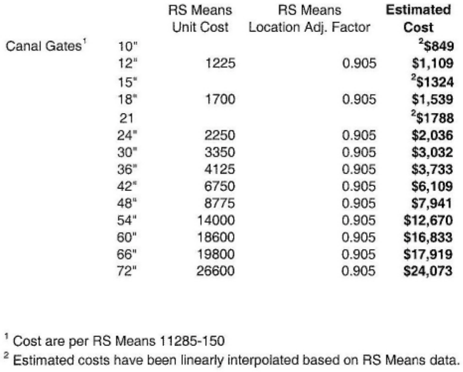
[3] Estimated costs have been interpolated based on RS Means cost data using a second order polynomial.



2007	$2,706.00	Gate Supplier Quote (Roscoe Steel Billings, MT)
2008	$2,868.36	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$2,983.09	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$3,072.83	Estimated 2011 cost (assuming 3% cost cost increase).

24" Diameter Canal Gate (Each)

Year	Base Unit Cost	Notes
2005	$2,036.00	RSMeans 24th Edition.



		RS Means Unit Cost	RS Means Location Adj. Factor	**Estimated Cost**
Canal Gates[1]	10"			**[2]$849**
	12"	1225	0.905	**$1,109**
	15"			**[2]$1324**
	18"	1700	0.905	**$1,539**
	21			**[2]$1788**
	24"	2250	0.905	**$2,036**
	30"	3350	0.905	**$3,032**
	36"	4125	0.905	**$3,733**
	42"	6750	0.905	**$6,109**
	48"	8775	0.905	**$7,941**
	54"	14000	0.905	**$12,670**
	60"	18600	0.905	**$16,833**
	66"	19800	0.905	**$17,919**
	72"	26600	0.905	**$24,073**

[1] Cost are per RS Means 11285-150

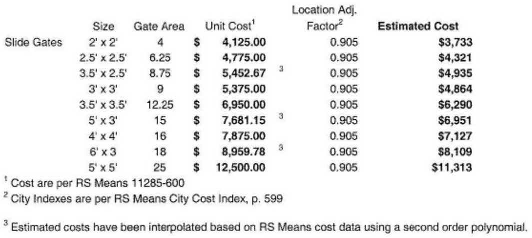
[2] Estimated costs have been linearly interpolated based on RS Means data.

2007	$2,526.00	Gate Supplier Quote (Aquatech Incorporated Billings, MT / Nardinger Irrigation Billings, MT)
2008	$2,677.56	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$2,784.66	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$2,868.20	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

2-ft x 2-ft Slide Gate (Each)

Year	Base Unit Cost	Notes
2005	$3,733.00	RSMeans 24th Edition.

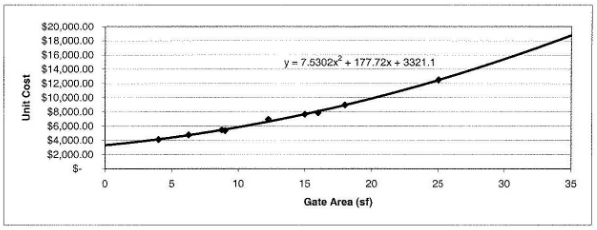


	Size	Gate Area	Unit Cost[1]	Location Adj. Factor[2]	Estimated Cost
Slide Gates	2' x 2'	4	$ 4,125.00	0.905	$3,733
	2.5' x 2.5'	6.25	$ 4,775.00	0.905	$4,321
	3.5' x 2.5'	8.75	$ 5,452.67 [3]	0.905	$4,935
	3' x 3'	9	$ 5,375.00	0.905	$4,864
	3.5' x 3.5'	12.25	$ 6,950.00	0.905	$6,290
	5' x 3'	15	$ 7,681.15 [3]	0.905	$6,951
	4' x 4'	16	$ 7,875.00	0.905	$7,127
	6' x 3	18	$ 8,959.78 [3]	0.905	$8,109
	5' x 5'	25	$ 12,500.00	0.905	$11,313

[1] Cost are per RS Means 11285-600

[2] City Indexes are per RS Means City Cost Index, p. 599

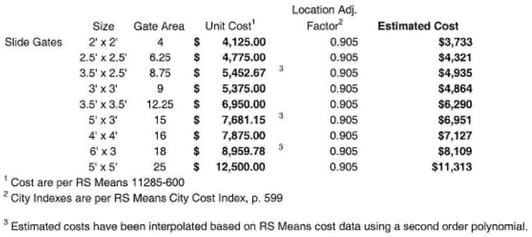
[3] Estimated costs have been interpolated based on RS Means cost data using a second order polynomial.



Year	Base Unit Cost	Notes
2007	$2,352.00	Gate Supplier Quote (Roscoe Steel Billings, MT)
2008	$2,493.12	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$2,592.84	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$2,670.63	Estimated 2011 cost (assuming 3% cost cost increase).

3.5-ft x 3.5-ft Slide Gate (Each)

Year	Base Unit Cost	Notes
2005	$6,290.00	RSMeans 24th Edition.

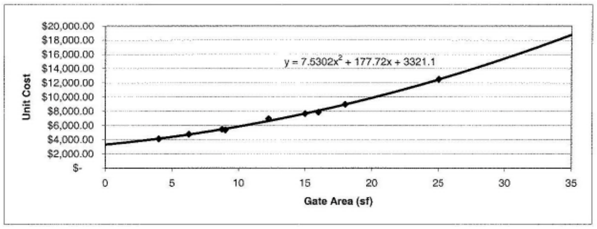


	Size	Gate Area	Unit Cost[1]	Location Adj. Factor[2]	Estimated Cost
Slide Gates	2' x 2'	4	$ 4,125.00	0.905	$3,733
	2.5' x 2.5'	6.25	$ 4,775.00	0.905	$4,321
	3.5' x 2.5'	8.75	$ 5,452.67 [3]	0.905	$4,935
	3' x 3'	9	$ 5,375.00	0.905	$4,864
	3.5' x 3.5'	12.25	$ 6,950.00	0.905	$6,290
	5' x 3'	15	$ 7,681.15 [3]	0.905	$6,951
	4' x 4'	16	$ 7,875.00	0.905	$7,127
	6' x 3	18	$ 8,959.78 [3]	0.905	$8,109
	5' x 5'	25	$ 12,500.00	0.905	$11,313

[1] Cost are per RS Means 11285-600

[2] City Indexes are per RS Means City Cost Index, p. 599

[3] Estimated costs have been interpolated based on RS Means cost data using a second order polynomial.

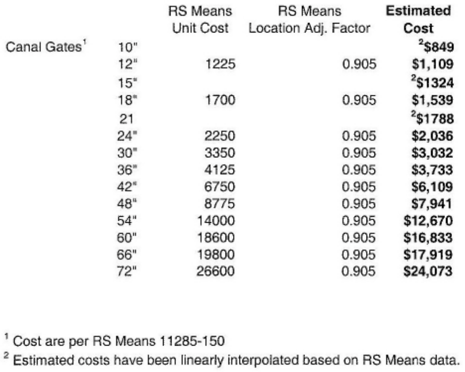


Year	Base Unit Cost	Notes
2007	$3,978.00	Gate Supplier Quote (Roscoe Steel Billings, MT)
2008	$4,216.68	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$4,385.35	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$4,516.91	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

36" Diameter Canal Gate (Each)

Year	Base Unit Cost	Notes
2005	$3,733.00	RSMeans 24th Edition.



		RS Means Unit Cost	RS Means Location Adj. Factor	Estimated Cost
Canal Gates[1]	10"			[2]$849
	12"	1225	0.905	$1,109
	15"			[2]$1324
	18"	1700	0.905	$1,539
	21			[2]$1788
	24"	2250	0.905	$2,036
	30"	3350	0.905	$3,032
	36"	4125	0.905	$3,733
	42"	6750	0.905	$6,109
	48"	8775	0.905	$7,941
	54"	14000	0.905	$12,670
	60"	18600	0.905	$16,833
	66"	19800	0.905	$17,919
	72"	26600	0.905	$24,073

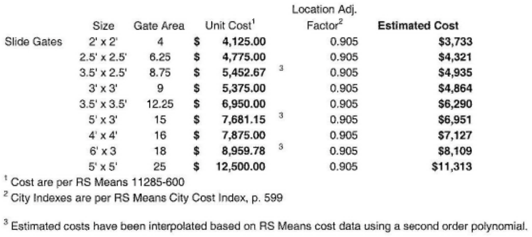
[1] Cost are per RS Means 11285-150

[2] Estimated costs have been linearly interpolated based on RS Means data.

2007	$4,680.00	Gate Supplier Quote (Aquatech Incorporated Billings, MT / Nardinger Irrigation Billings, MT)
2008	$4,960.80	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$5,159.23	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$5,314.01	Estimated 2011 cost (assuming 3% cost cost increase).

3-ft x 3-ft Slide Gate (Each)

Year	Base Unit Cost	Notes
2005	$4,864.00	RSMeans 24th Edition.

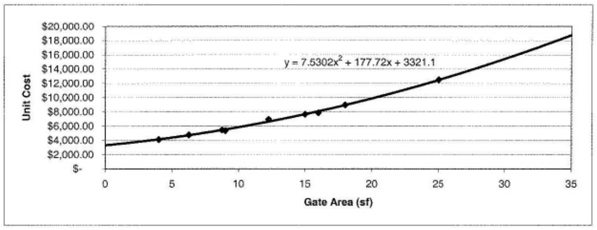


	Size	Gate Area	Unit Cost[1]		Location Adj. Factor[2]	Estimated Cost
Slide Gates	2' x 2'	4	$ 4,125.00		0.905	$3,733
	2.5' x 2.5'	6.25	$ 4,775.00		0.905	$4,321
	3.5' x 2.5'	8.75	$ 5,452.67	3	0.905	$4,935
	3' x 3'	9	$ 5,375.00		0.905	$4,864
	3.5' x 3.5'	12.25	$ 6,950.00		0.905	$6,290
	5' x 3'	15	$ 7,681.15	3	0.905	$6,951
	4' x 4'	16	$ 7,875.00		0.905	$7,127
	6' x 3	18	$ 8,959.78	3	0.905	$8,109
	5' x 5'	25	$ 12,500.00		0.905	$11,313

[1] Cost are per RS Means 11285-600

[2] City Indexes are per RS Means City Cost Index, p. 599

[3] Estimated costs have been interpolated based on RS Means cost data using a second order polynomial.

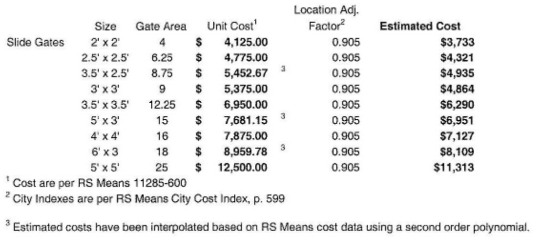


2007	$3,284.00	Gate Supplier Quote (Roscoe Steel Billings, MT)
2008	$3,481.04	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$3,620.28	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$3,728.89	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

4-ft x 4-ft Slide Gate (Each)

Year	Base Unit Cost	Notes
2005	$7,127.00	RSMeans 24th Edition.

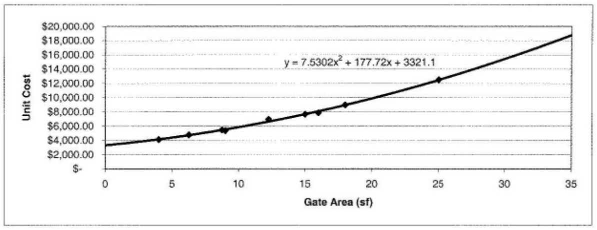


	Size	Gate Area		Unit Cost[1]		Location Adj. Factor[2]	Estimated Cost
Slide Gates	2' x 2'	4	$	4,125.00		0.905	$3,733
	2.5' x 2.5'	6.25	$	4,775.00		0.905	$4,321
	3.5' x 2.5'	8.75	$	5,452.67	3	0.905	$4,935
	3' x 3'	9	$	5,375.00		0.905	$4,864
	3.5' x 3.5'	12.25	$	6,950.00		0.905	$6,290
	5' x 3'	15	$	7,681.15	3	0.905	$6,951
	4' x 4'	16	$	7,875.00		0.905	$7,127
	6' x 3	18	$	8,959.78	3	0.905	$8,109
	5' x 5'	25	$	12,500.00		0.905	$11,313

[1] Cost are per RS Means 11285-600

[2] City Indexes are per RS Means City Cost Index, p. 599

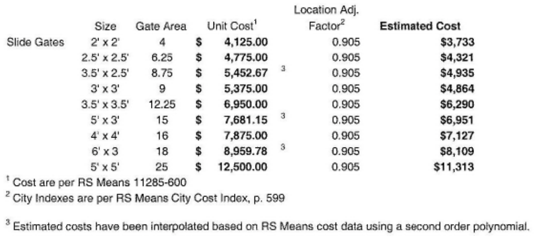
[3] Estimated costs have been interpolated based on RS Means cost data using a second order polynomial.



Year	Base Unit Cost	Notes
2007	$5,690.00	Gate Supplier Quote (Roscoe Steel Billings, MT)
2008	$6,031.40	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$6,272.66	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$6,460.84	Estimated 2011 cost (assuming 3% cost cost increase).

5-ft x 5-ft Slide Gate (Each)

Year	Base Unit Cost	Notes
2005	$11,313.00	RSMeans 24th Edition.

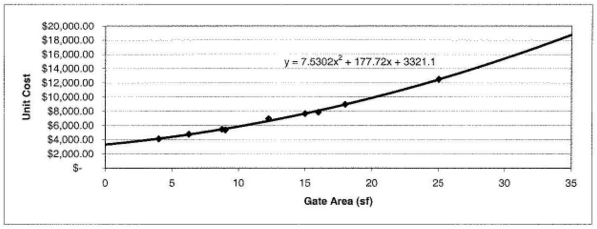


	Size	Gate Area		Unit Cost[1]		Location Adj. Factor[2]	Estimated Cost
Slide Gates	2' x 2'	4	$	4,125.00		0.905	$3,733
	2.5' x 2.5'	6.25	$	4,775.00		0.905	$4,321
	3.5' x 2.5'	8.75	$	5,452.67	3	0.905	$4,935
	3' x 3'	9	$	5,375.00		0.905	$4,864
	3.5' x 3.5'	12.25	$	6,950.00		0.905	$6,290
	5' x 3'	15	$	7,681.15	3	0.905	$6,951
	4' x 4'	16	$	7,875.00		0.905	$7,127
	6' x 3	18	$	8,959.78	3	0.905	$8,109
	5' x 5'	25	$	12,500.00		0.905	$11,313

[1] Cost are per RS Means 11285-600

[2] City Indexes are per RS Means City Cost Index, p. 599

[3] Estimated costs have been interpolated based on RS Means cost data using a second order polynomial.



Year	Base Unit Cost	Notes
2007	$7,792.00	Gate Supplier Quote (Roscoe Steel Billings, MT)
2008	$8,259.52	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$8,589.90	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$8,847.60	Estimated 2011 cost (assuming 3% cost cost increase).

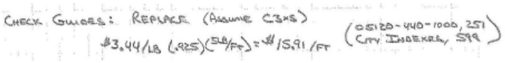
Unit Item Cost Determination

Canal Cleaning (SY)

Year	*Base Unit Cost*	*Notes*
2005	$0.50	Contractor Quote.
2007	$0.55	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$0.58	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$0.60	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$0.62	Estimated 2011 cost (assuming 3% cost cost increase).

Check Guides: Replace (FT)

Year	*Base Unit Cost*	*Notes*
2005	$15.91	RSMeans 24th Edition.
2007	$17.50	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$18.55	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$19.29	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$19.87	Estimated 2011 cost (assuming 3% cost cost increase).

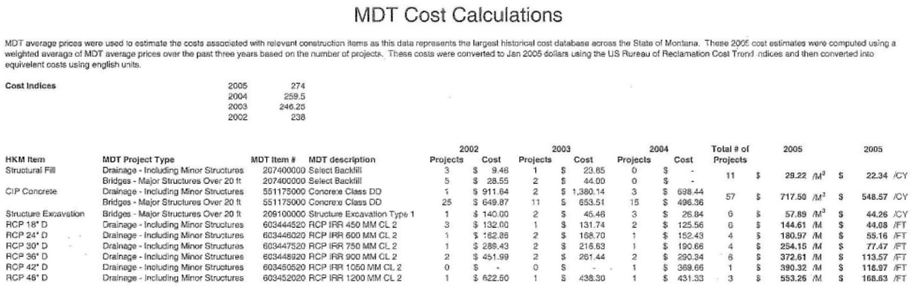


CHECK GUIDES: REPLACE (ASSUME C3X5)

$3.44/LB (.925)(5LB/FT) = $15.91/FT (05120-440-1000, 251 CITY INDEXES, 599)

CIP Concrete (CY)

Year	*Base Unit Cost*	*Notes*
2005	$548.57	RSMeans 24th Edition.
2007	$794.76	Cost Based On Recently Completed Projects
2008	$1,060.00	Cost Based On Recently Completed Projects (updated in January and then again mid-year)
2009	$1,102.40	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$1,135.47	Estimated 2011 cost (assuming 3% cost cost increase).



MDT Cost Calculations

MDT average prices were used to estimate the costs associated with relevant construction items as this data represents the largest historical cost database across the State of Montana. These 2005 cost estimates were computed using a weighted average of MDT average prices over the past three years based on the number of projects. These costs were converted to Jan 2005 dollars using the US Rureau of Reclamation Cost Trend ndices and then converted into equivelent costs using english units.

Cost Indices		
	2005	274
	2004	259.5
	2003	246.25
	2002	238

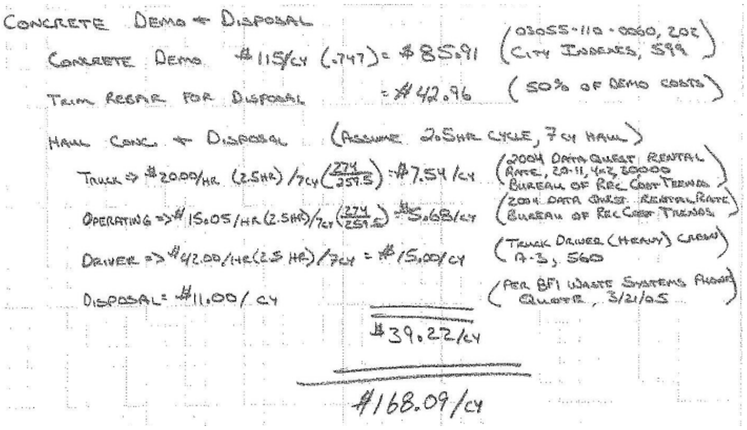
				2002		2003		2004		Total # of	2005	2005
HKM Item	MDT Project Type	MDT Item #	MDT description	Projects	Cost	Projects	Cost	Projects	Cost	Projects		
Structural Fill	Drainage - Including Minor Structures	207400000	Select Backfill	3	$ 9.46	1	$ 23.85	0	$ -	11	$ 29.22 /M^3	$ 22.34 /CY
	Bridges - Major Structures Over 20 ft	207400000	Select Backfill	5	$ 28.55	2	$ 44.00	0	$ -			
CIP Concrete	Drainage - Including Minor Structures	551175000	Concrete Class DD	1	$ 911.64	2	$ 1,380.14	3	$ 698.44	57	$ 717.50 /M^3	$ 548.57 /CY
	Bridges - Major Structures Over 20 ft	551175000	Concrete Class DD	25	$ 649.87	11	$ 653.51	15	$ 496.36			
Structure Excavation	Bridges - Major Structures Over 20 ft	209100000	Structure Excavation Type 1	1	$ 140.00	2	$ 45.46	3	$ 26.84	6	$ 57.89 /M^3	$ 44.26 /CY
RCP 18" D	Drainage - Including Minor Structures	603444520	RCP IRR 450 MM CL 2	3	$ 132.00	1	$ 131.74	2	$ 125.56	6	$ 144.61 /M	$ 44.08 /FT
RCP 24" D	Drainage - Including Minor Structures	603446020	RCP IRR 600 MM CL 2	1	$ 162.85	2	$ 168.70	1	$ 152.43	4	$ 180.97 /M	$ 55.16 /FT
RCP 30" D	Drainage - Including Minor Structures	603447520	RCP IRR 750 MM CL 2	1	$ 289.43	2	$ 216.63	1	$ 190.66	4	$ 254.15 /M	$ 77.47 /FT
RCP 36" D	Drainage - Including Minor Structures	603448920	RCP IRR 900 MM CL 2	2	$ 451.99	2	$ 261.44	2	$ 290.34	6	$ 372.61 /M	$ 113.57 /FT
RCP 42" D	Drainage - Including Minor Structures	603450520	RCP IRR 1050 MM CL 2	0	$ -	0	$ -	1	$ 369.66	1	$ 390.32 /M	$ 118.97 /FT
RCP 48" D	Drainage - Including Minor Structures	603452020	RCP IRR 1200 MM CL 2	1	$ 622.50	1	$ 438.30	1	$ 431.33	3	$ 553.26 /M	$ 168.63 /FT

Compacted Embankment (CY)

Year	*Base Unit Cost*	*Notes*
2007	$6.60	Cost Based On Recently Completed Projects
2008	$7.00	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$7.28	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$7.50	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

Concrete Demo. & Disposal (CY)

Year	Base Unit Cost	Notes
2005	$168.09	RSMeans 24th Edition.  CONCRETE DEMO + DISPOSAL CONCRETE DEMO $\$115/\text{CY}\,(.747)=\$85.91$ (03055-110-0060, 202 CITY INDEXES, 599) TRIM REBAR FOR DISPOSAL $=\$42.96$ (50% OF DEMO COSTS) HAUL CONC. + DISPOSAL (ASSUME 2.5HR CYCLE, 7 CY HAUL) TRUCK $\Rightarrow \$20.00/\text{HR}\,(2.5\text{HR})/7\text{CY}\left(\frac{274}{257.5}\right)=\$7.54/\text{CY}$ (2004 DATAQUEST RENTAL RATE, 20-11, 4x2, 30000 BUREAU OF REC COST TRENDS) OPERATING $\Rightarrow \$15.05/\text{HR}\,(2.5\text{HR})/7\text{CY}\left(\frac{274}{257.5}\right)=\$5.68/\text{CY}$ (2004 DATA QUEST RENTAL RATE BUREAU OF REC COST TRENDS) DRIVER $\Rightarrow \$42.00/\text{HR}\,(2.5\text{ HR})/7\text{CY}=\$15.00/\text{CY}$ (TRUCK DRIVER (HEAVY) CREW A-3, 560) DISPOSAL = $\$11.00/\text{CY}$ (PER BFI WASTE SYSTEMS PHONE QUOTE, 3/21/05) $\$39.22/\text{CY}$ $\$168.09/\text{CY}$
2007	$184.90	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$195.99	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$203.83	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$209.94	Estimated 2011 cost (assuming 3% cost cost increase).

Erosion Control Blanket (SY)

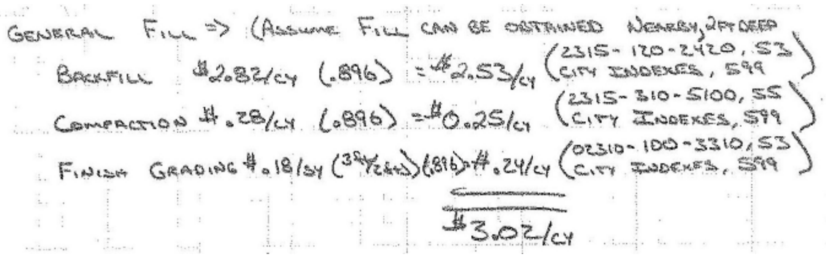
Year	Base Unit Cost	Notes
2007	$3.30	MDT Bid Tabulation
2008	$3.50	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$3.64	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$3.75	Estimated 2011 cost (assuming 3% cost cost increase).

Galvanized 2"x2" #12 Steel Mesh (SF)

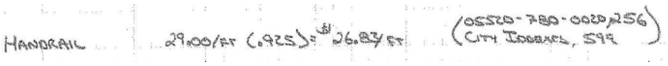
Year	Base Unit Cost	Notes
2009	$1.46	Steel mesh for gunnite/shotcrete reinforcing. RS Means, 22nd Edition.
2011	$1.50	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

General Fill (CY)

Year	Base Unit Cost	Notes
2005	$3.02	Contractor Quote.  GENERAL FILL => (ASSUME FILL CAN BE OBTAINED NEARBY, 2FT DEEP BACKFILL #2.82/CY (.896) = #2.53/CY (2315-120-2420, 53 CITY INDEXES, 599) COMPACTION #.28/CY (.896) = #0.25/CY (2315-310-5100, 55 CITY INDEXES, 599) FINISH GRADING #.18/SY (3SY/2CY) (.896) = #.24/CY (02310-100-3310, 53 CITY INDEXES, 599) #3.02/CY
2007	$3.32	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$3.52	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$3.66	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$3.77	Estimated 2011 cost (assuming 3% cost cost increase).

Handrail (FT)

Year	Base Unit Cost	Notes
2005	$26.83	RSMeans 24th Edition.  HANDRAIL 29.00/FT (.925) = #26.83/FT (05520-780-0020, 256 CITY INDEXES, 599)
2007	$44.66	MDT Bid Tabulation
2008	$47.34	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$49.23	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$50.71	Estimated 2011 cost (assuming 3% cost cost increase).

HDPE 18" Pipe (FT)

Year	Base Unit Cost	Notes
2009	$21.29	This price is quoted by Rosco Culvert company, with a 1.5 multiplier to assume installation cost.
2011	$21.93	Estimated 2011 cost (assuming 3% cost cost increase).

HDPE 24" Pipe (FT)

Year	Base Unit Cost	Notes
2009	$36.92	This price is quoted by Rosco Culvert company, with a 1.5 multiplier to assume installation cost.
2011	$38.03	Estimated 2011 cost (assuming 3% cost cost increase).

HDPE 30" Pipe (FT)

Year	Base Unit Cost	Notes
2009	$49.14	This price is quoted by Rosco Culvert company, with a 1.5 multiplier to assume installation cost.
2011	$50.61	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

HDPE 36" Pipe (FT)

Year	Base Unit Cost	Notes
2009	$63.66	This price is quoted by Rosco Culvert company, with a 1.5 multiplier to assume installation cost.
2011	$65.57	Estimated 2011 cost (assuming 3% cost cost increase).

HDPE 42" Pipe (FT)

Year	Base Unit Cost	Notes
2009	$97.52	This price is quoted by Rosco Culvert company, with a 1.5 multiplier to assume installation cost.
2011	$100.45	Estimated 2011 cost (assuming 3% cost cost increase).

HDPE 48" Pipe (FT)

Year	Base Unit Cost	Notes
2009	$119.19	This price is quoted by Rosco Culvert company, with a 1.5 multiplier to assume installation cost.
2011	$122.77	Estimated 2011 cost (assuming 3% cost cost increase).

Miscellaneous ($)

Year	Base Unit Cost	Notes
2005	$1.00	NA
2007	$1.00	NA
2008	$1.00	no change
2009	$1.00	no change
2011	$1.03	Estimated 2011 cost (assuming 3% cost cost increase).

NRCS Concrete Check (4'x4' Notch) (Each)

Year	Base Unit Cost	Notes
2005	$3,581.12	Lump Sum
2007	$4,691.66	Updated Lump Sum
2008	$5,734.63	Updated Lump Sum
2009	$5,964.02	Updated Lump Sum
2011	$6,142.94	Estimated 2011 cost (assuming 3% cost cost increase).

Assumptions This structure assumes a 4 ft x 4 ft notch opening with a 2 ft deep cutoff wall on both the upstream and downstream walls. Riprap was assumed to extend 4ft downstream.

Item Description	Quantity	Units	Base Unit Cost	Total
Walkway (Expanded Steel)	12.50	SF	$17.95	$224.38
Structure Removal: Check (15')	1.00	Each	$756.16	$756.16
Structural Fill	10.50	CY	$36.65	$384.83
Structural Excavation	11.00	CY	$22.95	$252.45
Riprap Bank Protection	2.50	CY	$55.40	$138.50
Handrail	5.00	FT	$50.71	$253.55
CIP Concrete	3.50	CY	$1,135.47	$3,974.15
Check Guides: Replace	8.00	FT	$19.87	$158.96
			Total Cost:	**$6,142.97**

Unit Item Cost Determination

Overshot Gate (SF)

Year	Base Unit Cost	Notes
2005	$300.00	Manufacturer's Estimate (Obermeyer Hydro): Item Formerly Described As Obermeyer Gate.
2007	$450.00	Manufacturer's Estimate (Obermeyer Hydro): Item Formerly Described As Obermeyer Gate
2008	$477.00	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$496.08	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$510.96	Estimated 2011 cost (assuming 3% cost cost increase).

Overshot Gate: Compressor & Control (Each)

Year	Base Unit Cost	Notes
2005	$15,000.00	Manufacturer's Estimate (Obermeyer Hydro): Item Formerly Described As Obermeyer Gate.
2007	$16,500.00	Manufacturer's Estimate (Obermeyer Hydro): Item Formerly Described As Obermeyer Gate
2008	$17,490.00	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$18,189.60	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$18,735.29	Estimated 2011 cost (assuming 3% cost cost increase).

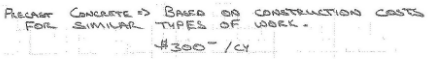
Parshall Flume (35 cfs) (Each)

Year	Base Unit Cost	Notes
2008	$4,251.91	Parshall Flume conveying up to 35 cfs, lump sum
2009	$4,401.98	Updated lump sum
2011	$4,534.04	Estimated 2011 cost (assuming 3% cost cost increase).

Assumptions This structure is a Parshall Flume which can convey flows up to 35 cfs. A majority of the structures are steel. The demo and disposal is assumed to account for the removal of the existing structure. The miscellaneous costs associated establishing a staff gage and verifying flows. Telemetry unit costs are not associated with this structure.

Item Description	Quantity	Units	Base Unit Cost	Total
Structural Fill	11.00	CY	$36.65	$403.15
Structural Excavation	11.00	CY	$22.95	$252.45
Miscellaneous	500.00	$	$1.03	$515.00
Concrete Demo. & Disposal	2.50	CY	$209.94	$524.85
CIP Concrete	2.50	CY	$1,135.47	$2,838.68
			Total Cost:	**$4,534.13**

Precast Concrete (CY)

Year	Base Unit Cost	Notes
2005	$300.00	Cost Based On Previously Completed Projects.  PRECAST CONCRETE => BASED ON CONSTRUCTION COSTS FOR SIMILAR TYPES OF WORK. $300⁻ /CY
2007	$435.00	Percent Cost Increase Assumed Equal to that of CIP Concrete
2008	$461.10	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$479.54	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$493.93	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

Precast Turnout (Each)

Year	*Base Unit Cost*	*Notes*
2005	$3,222.74	Lump Sum
2007	$4,131.45	Updated Lump Sum
2008	$4,373.24	Updated Lump Sum
2009	$4,544.16	Updated Lump Sum
2011	$4,680.48	Estimated 2011 cost (assuming 3% cost cost increase).

Assumptions The quantities for this structure are based on dimensions of structures inventoried for this project. To remain consistent it was assumed that an 18" diameter gate and RCP would be used on all turnouts. Miscellaneous cost for pipe demolition.

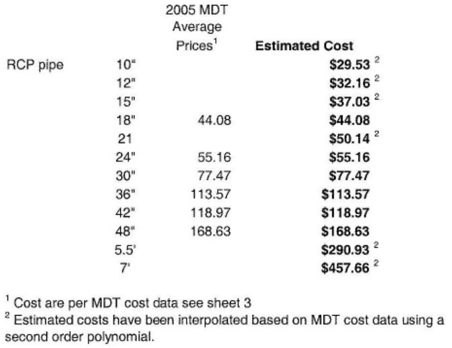
Item Description	*Quantity*	*Units*	*Base Unit Cost*	*Total*
RCP 18" D	20.00	FT	$77.87	$1,557.40
Precast Concrete	1.50	CY	$493.93	$740.90
Miscellaneous	100.00	$	$1.03	$103.00
Concrete Demo. & Disposal	1.50	CY	$209.94	$314.91
18" Diameter Canal Gate	1.00	Each	$1,964.36	$1,964.36
			Total Cost:	**$4,680.57**

Pressure Relieve Valve (Each)

Year	*Base Unit Cost*	*Notes*
2011	$10,000.00	from recent bid tabulation - DOWL HKM

RCP 18" D (FT)

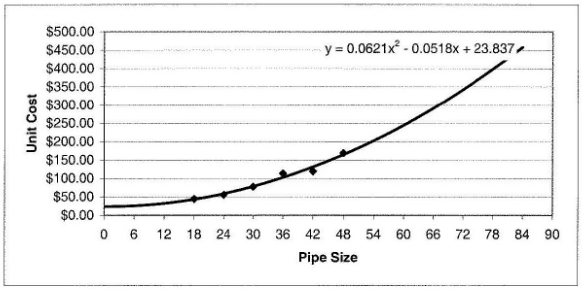
Year	*Base Unit Cost*	*Notes*
2005	$44.08	MDT Bid Tabulation.



		2005 MDT Average Prices[1]	Estimated Cost
RCP pipe	10"		**$29.53** [2]
	12"		**$32.16** [2]
	15"		**$37.03** [2]
	18"	44.08	**$44.08**
	21		**$50.14** [2]
	24"	55.16	**$55.16**
	30"	77.47	**$77.47**
	36"	113.57	**$113.57**
	42"	118.97	**$118.97**
	48"	168.63	**$168.63**
	5.5'		**$290.93** [2]
	7'		**$457.66** [2]

[1] Cost are per MDT cost data see sheet 3

[2] Estimated costs have been interpolated based on MDT cost data using a second order polynomial.

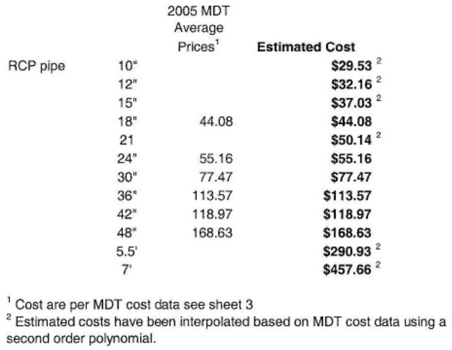


2007	$68.58	MDT Bid Tabulation
2008	$72.69	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$75.60	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$77.87	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

RCP 24" D (FT)

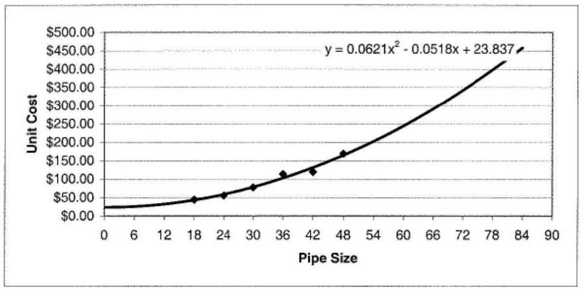
Year	*Base Unit Cost*	*Notes*
2005	$55.16	MDT Bid Tabulation.



		2005 MDT Average Prices[1]	Estimated Cost
RCP pipe	10"		**$29.53** [2]
	12"		**$32.16** [2]
	15"		**$37.03** [2]
	18"	44.08	**$44.08**
	21		**$50.14** [2]
	24"	55.16	**$55.16**
	30"	77.47	**$77.47**
	36"	113.57	**$113.57**
	42"	118.97	**$118.97**
	48"	168.63	**$168.63**
	5.5'		**$290.93** [2]
	7'		**$457.66** [2]

[1] Cost are per MDT cost data see sheet 3

[2] Estimated costs have been interpolated based on MDT cost data using a second order polynomial.

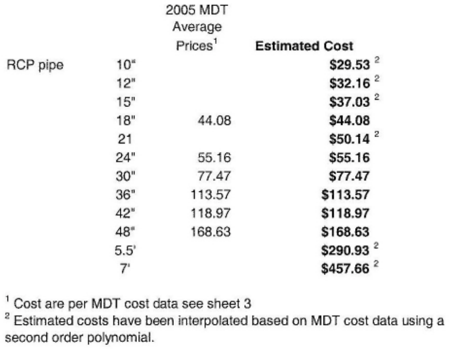


2007	$78.74	MDT Bid Tabulation
2008	$83.46	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$86.80	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$89.40	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

RCP 30" D (FT)

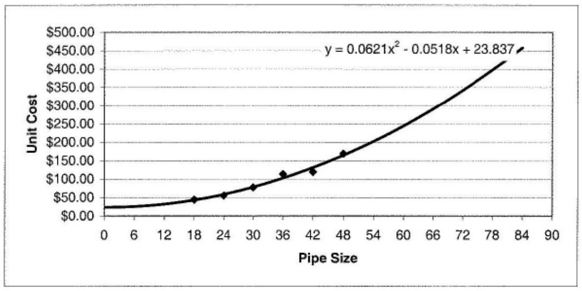
Year	Base Unit Cost	Notes
2005	$77.47	MDT Bid Tabulation.



		2005 MDT Average Prices[1]	Estimated Cost
RCP pipe	10"		**$29.53** [2]
	12"		**$32.16** [2]
	15"		**$37.03** [2]
	18"	44.08	**$44.08**
	21		**$50.14** [2]
	24"	55.16	**$55.16**
	30"	77.47	**$77.47**
	36"	113.57	**$113.57**
	42"	118.97	**$118.97**
	48"	168.63	**$168.63**
	5.5'		**$290.93** [2]
	7'		**$457.66** [2]

[1] Cost are per MDT cost data see sheet 3

[2] Estimated costs have been interpolated based on MDT cost data using a second order polynomial.

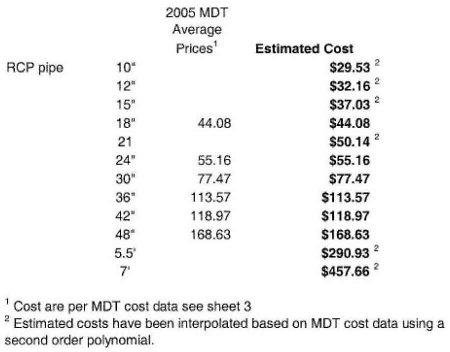


2007	$88.01	MDT Bid Tabulation
2008	$93.29	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$97.02	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$99.93	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

RCP 36" D (FT)

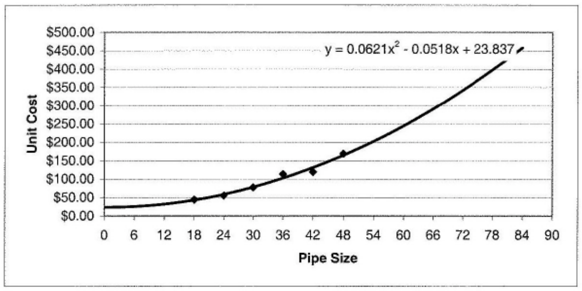
Year	Base Unit Cost	Notes
2005	$113.57	MDT Bid Tabulation.



		2005 MDT Average Prices[1]	Estimated Cost
RCP pipe	10"		**$29.53** [2]
	12"		**$32.16** [2]
	15"		**$37.03** [2]
	18"	44.08	**$44.08**
	21		**$50.14** [2]
	24"	55.16	**$55.16**
	30"	77.47	**$77.47**
	36"	113.57	**$113.57**
	42"	118.97	**$118.97**
	48"	168.63	**$168.63**
	5.5'		**$290.93** [2]
	7'		**$457.66** [2]

[1] Cost are per MDT cost data see sheet 3

[2] Estimated costs have been interpolated based on MDT cost data using a second order polynomial.

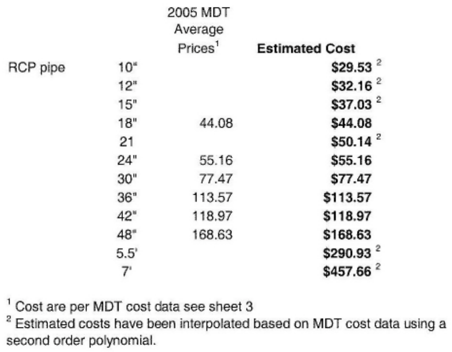


Year	Base Unit Cost	Notes
2007	$116.67	MDT Bid Tabulation
2008	$123.67	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$128.62	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$132.48	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

RCP 42" D (FT)

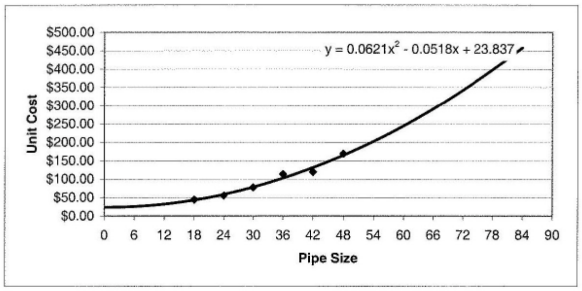
Year	Base Unit Cost	Notes
2005	$118.97	MDT Bid Tabulation.



		2005 MDT Average Prices[1]	Estimated Cost
RCP pipe	10"		**$29.53** [2]
	12"		**$32.16** [2]
	15"		**$37.03** [2]
	18"	44.08	**$44.08**
	21		**$50.14** [2]
	24"	55.16	**$55.16**
	30"	77.47	**$77.47**
	36"	113.57	**$113.57**
	42"	118.97	**$118.97**
	48"	168.63	**$168.63**
	5.5'		**$290.93** [2]
	7'		**$457.66** [2]

[1] Cost are per MDT cost data see sheet 3

[2] Estimated costs have been interpolated based on MDT cost data using a second order polynomial.

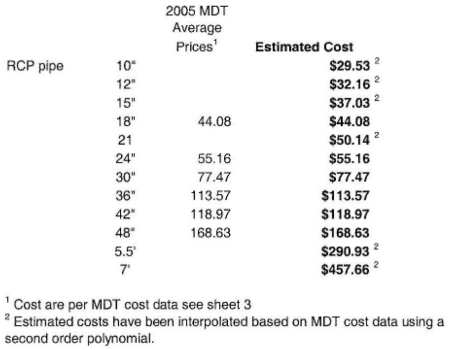


Year	Base Unit Cost	Notes
2007	$155.12	MDT Bid Tabulation
2008	$164.43	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$171.01	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$176.14	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

RCP 48" D (FT)

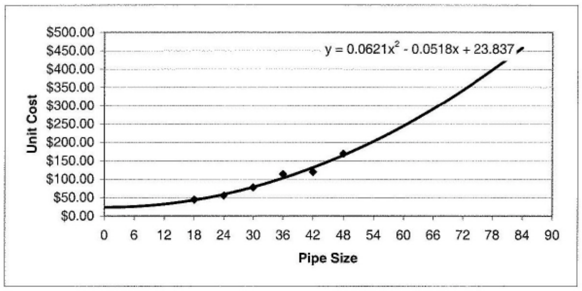
Year	Base Unit Cost	Notes
2005	$168.63	MDT Bid Tabulation.



		2005 MDT Average Prices[1]	Estimated Cost
RCP pipe	10"		**$29.53** [2]
	12"		**$32.16** [2]
	15"		**$37.03** [2]
	18"	44.08	**$44.08**
	21		**$50.14** [2]
	24"	55.16	**$55.16**
	30"	77.47	**$77.47**
	36"	113.57	**$113.57**
	42"	118.97	**$118.97**
	48"	168.63	**$168.63**
	5.5'		**$290.93** [2]
	7'		**$457.66** [2]

[1] Cost are per MDT cost data see sheet 3

[2] Estimated costs have been interpolated based on MDT cost data using a second order polynomial.



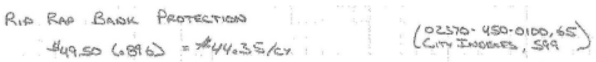
Year	Base Unit Cost	Notes
2007	$226.31	MDT Bid Tabulation
2008	$239.89	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$249.49	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$256.97	Estimated 2011 cost (assuming 3% cost cost increase).

RCP 5' D (FT)

Year	Base Unit Cost	Notes
2007	$348.52	Cost Based on Manufacturer's Estimate (Cretex)
2008	$369.43	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$384.21	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$395.74	Estimated 2011 cost (assuming 3% cost cost increase).

Riprap Bank Protection (CY)

Year	Base Unit Cost	Notes
2005	$44.35	RSMeans 24th Edition.



RIP RAP BANK PROTECTION
$49.50 (.896) = $44.35/CY

(02370-450-0100, 65)
(CITY INDEXES, 599)

Year	Base Unit Cost	Notes
2007	$48.79	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$51.72	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$53.79	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$55.40	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

Rock Vane Diversion (Each)

Year	Base Unit Cost	Notes
2009	$30,000.00	Cost estimate from SteadyStream Hydrology, Cheryl Harrelson.
2011	$30,900.00	Estimated 2011 cost (assuming 3% cost cost increase).

Safety Cable (FT)

Year	Base Unit Cost	Notes
2009	$35.00	Contractor Quote.
2011	$36.05	Estimated 2011 cost (assuming 3% cost cost increase).

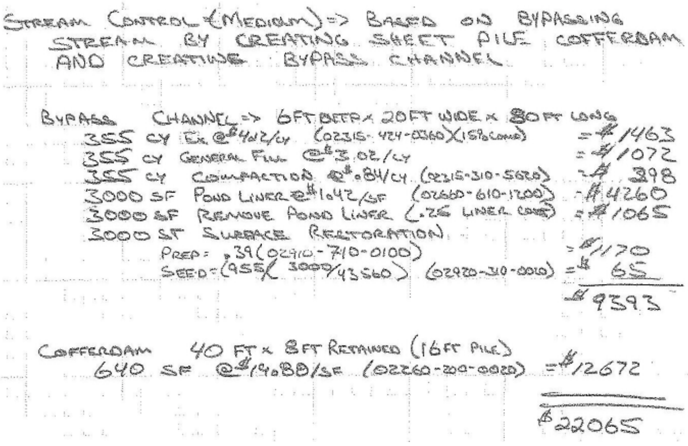
Safety Ladder (10 feet) (Each)

Year	Base Unit Cost	Notes
2008	$220.00	Contractor's Estimate.
2009	$228.80	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$235.66	Estimated 2011 cost (assuming 3% cost cost increase).

Shotcrete lining (SF)

Year	Base Unit Cost	Notes
2009	$3.23	Shotcrete lining cost per square foot, assuming approximately 4" thick cover. Cost based on recently completed projects.
2011	$3.33	Estimated 2011 cost (assuming 3% cost cost increase).

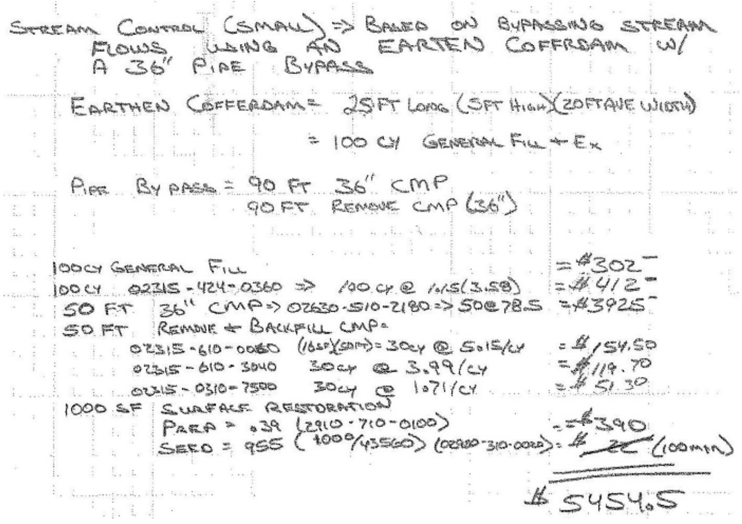
Stream Control (Medium) (Each)

Year	Base Unit Cost	Notes
2005	$22,065.00	RSMeans 24th Edition.  STREAM CONTROL (MEDIUM) => BASED ON BYPASSING STREAM BY CREATING SHEET PILE COFFERDAM AND CREATING BYPASS CHANNEL BYPASS CHANNEL => 6FT DEEP x 20FT WIDE x 80FT LONG 355 CY EX. @$4.12/CY (02315-424-0360)(15% COMB) = $1463 355 CY GENERAL FILL @$3.02/CY = $1072 355 CY COMPACTION @$.84/CY (02315-310-5020) = $298 3000 SF POND LINER @$1.42/SF (02660-610-1200) = $4260 3000 SF REMOVE POND LINER (.25 LINER COST) = $1065 3000 SF SURFACE RESTORATION PREP = .39 (02910-710-0100) = $1170 SEED = (955(3000/43560)) (02920-310-0010) = $65 $9393 COFFERDAM 40 FT x 8FT RETAINED (16FT PILE) 640 SF @$19.80/SF (02260-200-0020) = $12672 $22065
2007	$24,271.50	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$25,727.79	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$26,756.90	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$27,559.61	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

Stream Control (Small) (Each)

Year	Base Unit Cost	Notes
2005	$5,454.50	RSMeans 24th Edition.



STREAM CONTROL (SMALL) => BASED ON BYPASSING STREAM
FLOWS USING AN EARTEN COFFRDAM W/
A 36" PIPE BYPASS

EARTHEN COFFERDAM = 25FT LONG (5FT HIGH)(20FT AVE WIDTH)
= 100 CY GENERAL FILL + EX

PIPE BY PASS = 90 FT 36" CMP
90 FT REMOVE CMP (36")

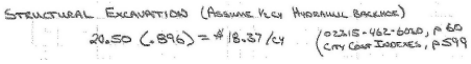
100CY GENERAL FILL = $302
100 CY 02315-424-0360 => 100 CY @ 1.15(3.58) = $412
50 FT 36" CMP => 02630-510-2180 => 50@78.5 = $3925
50 FT REMOVE + BACKFILL CMP:
02315-610-0060 (16SF)(50FT) = 30CY @ 5.15/CY = $154.50
02315-610-3040 30CY @ 3.99/CY = $119.70
02315-0310-7500 30CY @ 1.71/CY = $51.30
1000 SF SURFACE RESTORATION
PAVE = .39 (2910-710-0100) = $390
SEED = 955 (1000/43560) (02920-310-0020) = $ ~~22~~ (100 min)

$5454.5

2007	$5,999.95	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$6,359.95	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$6,614.35	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$6,812.78	Estimated 2011 cost (assuming 3% cost cost increase).

Structural Excavation (CY)

Year	Base Unit Cost	Notes
2005	$18.37	RSMeans 24th Edition.

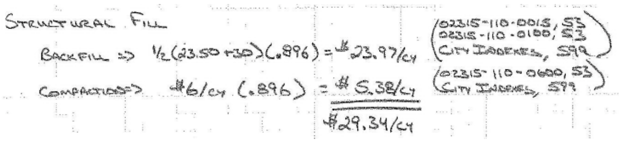


STRUCTURAL EXCAVATION (ASSUME 1CY HYDRAULIC BACKHOE)
20.50 (.896) = $18.37/CY (02315-462-6020, P 60
CITY COST INDEXES, P599

2007	$20.21	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$21.42	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$22.28	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$22.95	Estimated 2011 cost (assuming 3% cost cost increase).

Structural Fill (CY)

Year	Base Unit Cost	Notes
2005	$29.34	RSMeans 24th Edition.



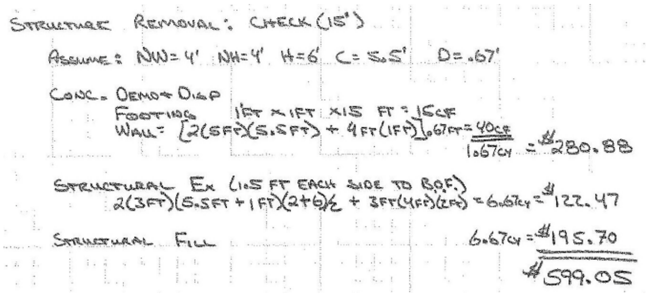
STRUCTURAL FILL
BACKFILL => 1/2 (23.50 + 30)(.896) = $23.97/CY (02315-110-0015, 53
02315-110-0100, 53
CITY INDEXES, 599)
COMPACTION => $6/CY (.896) = $5.38/CY (02315-110-0600, 53
CITY INDEXES, 599)
$29.34/CY

2007	$32.27	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$34.21	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$35.58	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$36.65	Estimated 2011 cost (assuming 3% cost cost increase).

Unit Item Cost Determination

Structure Removal: Check (15') (Each)

Year	Base Unit Cost	Notes
2005	$599.05	RSMeans 24th Edition.



STRUCTURE REMOVAL: CHECK (15')

ASSUME: NW=4' NH=4' H=6' C=5.5' D=.67'

CONC. DEMO+DISP
FOOTING 1FT × 1FT × 15 FT = 15CF
WALL= [2(5FT)(5.5FT) + 4FT(1FT)].67FT = 40CF / 1.67CY = $280.88

STRUCTURAL EX (1.5 FT EACH SIDE TO B.O.F.)
2(3FT)(5.5FT + 1FT)(2+6)/2 + 3FT(4FT)(2FT) = 6.67CY = $122.47

STRUCTURAL FILL 6.67CY = $195.70

$599.05

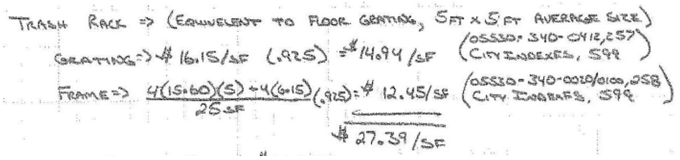
Year	Base Unit Cost	Notes
2007	$665.95	Updated Lump Sum
2008	$705.90	Updated Lump Sum
2009	$734.14	Updated Lump Sum
2011	$756.16	Estimated 2011 cost (assuming 3% cost cost increase).

Assumptions NW=4, NW=4, H=6, C=5.5, D=.67

Item Description	Quantity	Units	Base Unit Cost	Total
Structural Fill	6.70	CY	$36.65	$245.55
Structural Excavation	6.70	CY	$22.95	$153.76
Concrete Demo. & Disposal	1.70	CY	$209.94	$356.90
			Total Cost:	**$756.22**

Trash Rack (SF)

Year	Base Unit Cost	Notes
2005	$27.39	RSMeans 24th Edition.



TRASH RACK => (EQUIVALENT TO FLOOR GRATING, 5FT × 5FT AVERAGE SIZE)
GRATING => $16.15/SF (.925) = $14.94/SF (05530: 340-0412, 257 CITY INDEXES, 599)
FRAME => 4(15.60)(5) + 4(6.15) / 25SF (.925) = $12.45/SF (05530-340-0020/0100, 258 CITY INDEXES, 599)
$27.39/SF

Year	Base Unit Cost	Notes
2007	$30.13	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$31.94	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$33.22	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$34.22	Estimated 2011 cost (assuming 3% cost cost increase).

Turnout Valve (Each)

Year	Base Unit Cost	Notes
2011	$5,000.00	from recent bid tabulation - DOWL HKM

Unit Item Cost Determination

Unclassified Excavation (CY)

Year	Base Unit Cost	Notes
2005	$2.06	Contractor Quote. UNCLASSIFIED EXCAVATION = 230(896) (02315-424-0200, 57, RSMEANS' CITY INDEXES, 594) = 2.06/CY
2007	$2.27	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$2.41	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$2.51	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$2.59	Estimated 2011 cost (assuming 3% cost cost increase).

USBR Baffled Pipe Outlet: No. 3 (Each)

Year	Base Unit Cost	Notes
2007	$5,764.00	New Lump Sum
2008	$7,045.33	Updated Lump Sum
2009	$7,327.14	Updated Lump Sum
2011	$7,546.95	Estimated 2011 cost (assuming 3% cost cost increase).

Assumptions This structure is based on the USBR Baffled Outlet Type 3 taken from USBR Report CB-5, "Commonly Used Drawings for Open Irrigation Systems" (pg. 31). The maximum flow listed is 21 cfs, and the assumed pipe size is 24 inch diameter.

Item Description	Quantity	Units	Base Unit Cost	Total
Structural Fill	18.50	CY	$36.65	$678.03
Structural Excavation	18.50	CY	$22.95	$424.58
Handrail	13.00	FT	$50.71	$659.23
Concrete Demo. & Disposal	4.30	CY	$209.94	$902.74
CIP Concrete	4.30	CY	$1,135.47	$4,882.52
			Total Cost:	**$7,547.09**

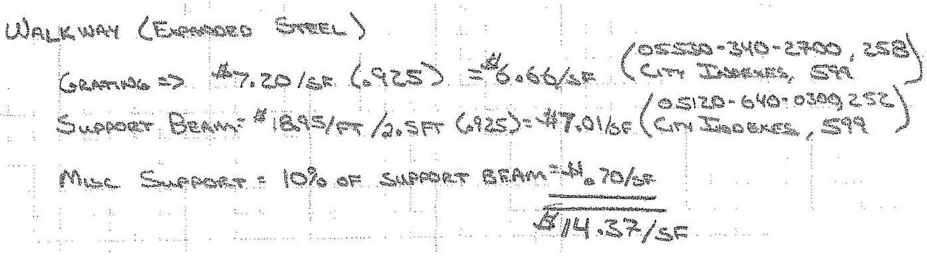
USBR Concrete Weir (9' Notch) (Each)

Year	Base Unit Cost	Notes
2005	$14,142.02	Lump Sum
2007	$17,278.56	Updated Lump Sum
2008	$20,273.31	Updated Lump Sum
2009	$11,369.47	Updated Lump Sum
2011	$11,710.55	Estimated 2011 cost (assuming 3% cost cost increase).

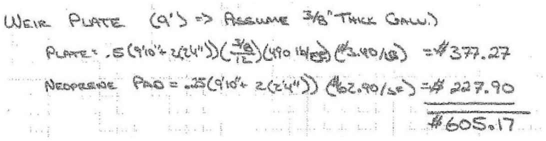
Item Description	Quantity	Units	Base Unit Cost	Total
Weir Plate (9')	1.00	Each	$755.88	$755.88
Structural Fill	40.00	CY	$36.65	$1,466.00
Structural Excavation	60.00	CY	$22.95	$1,377.00
Riprap Bank Protection	25.00	CY	$55.40	$1,385.00
Concrete Demo. & Disposal	5.00	CY	$209.94	$1,049.70
CIP Concrete	5.00	CY	$1,135.47	$5,677.35
			Total Cost:	**$11,710.93**

Unit Item Cost Determination

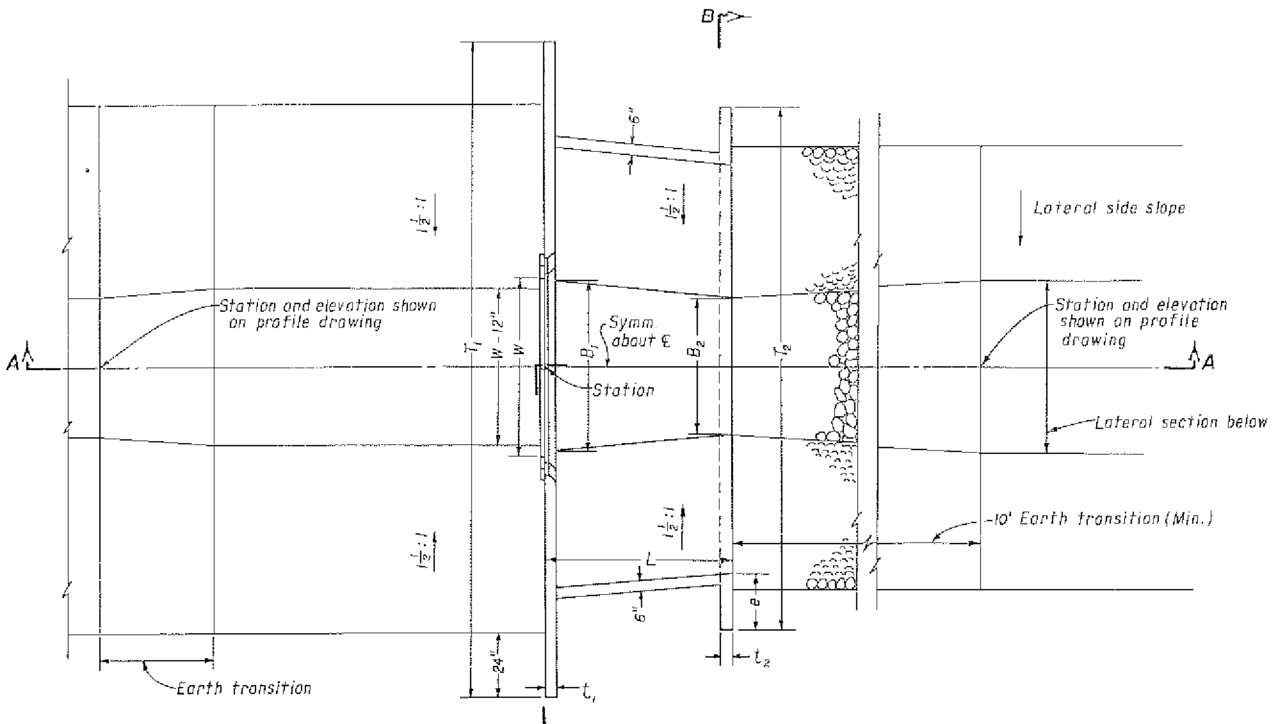
Walkway (Expanded Steel) (SF)

Year	Base Unit Cost	Notes
2005	$14.37	RSMeans 24th Edition.  WALKWAY (EXPANDED STEEL) GRATING => $7.20/SF (.925) = $6.66/SF (05530-340-2700, 258 CITY INDEXES, 599) SUPPORT BEAM: $18.95/FT /2.5FT (.925) = $7.01/SF (05120-640-0300, 252 CITY INDEXES, 599) MISC SUPPORT = 10% OF SUPPORT BEAM = $.70/SF $14.37/SF
2007	$15.81	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$16.76	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$17.43	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$17.95	Estimated 2011 cost (assuming 3% cost cost increase).

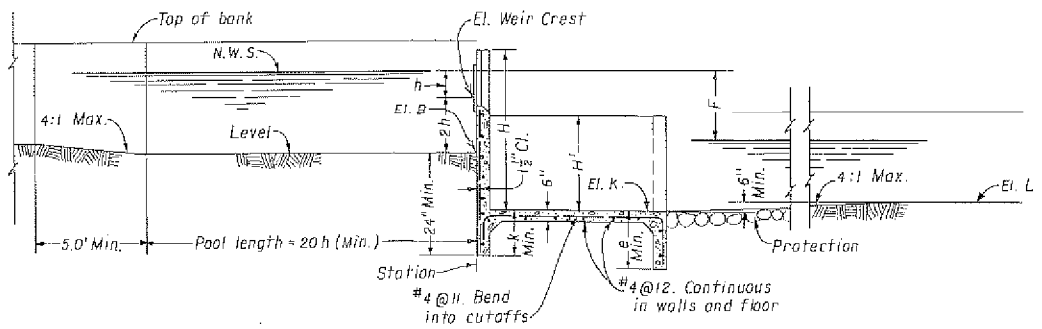
Weir Plate (9') (Each)

Year	Base Unit Cost	Notes
2005	$605.17	RSMeans 24th Edition.  WEIR PLATE (9') => ASSUME 3/8" THICK GALV.) PLATE = .5(9'10" + 2(2'4"))(3/8 / 12)(490 lb/CF)($3.40/LB) = $377.27 NEOPRENE PAD = .25(9'10" + 2(2'4")) ($62.90/SF) = $227.90 $605.17
2007	$665.69	USBR Cost Trends: Cost Increase Factor = 1.10 (Apr 2005 to Jan 2007)
2008	$705.63	USBR Cost Trends: Cost Increase Factor = 1.06 (Jan 2007 to Jan 2008)
2009	$733.86	USBR Cost Trends: Cost Increase Factor = 1.04 (Jan 2008 to Jan 2009)
2011	$755.88	Estimated 2011 cost (assuming 3% cost cost increase).

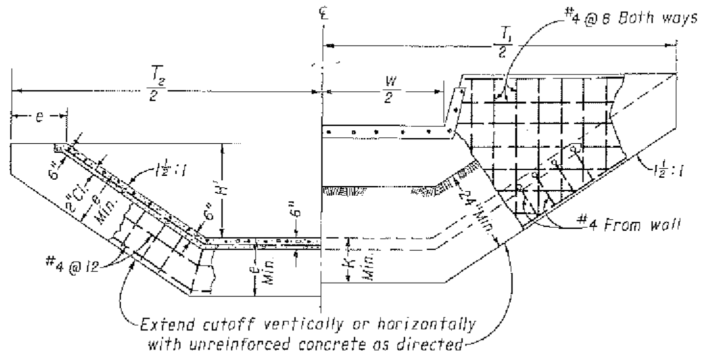
Appendix 5B
Standard USBR and NRCS Structure Drawings



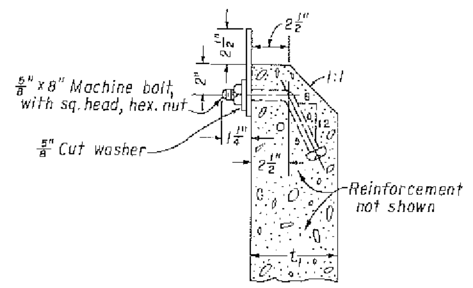
PLAN



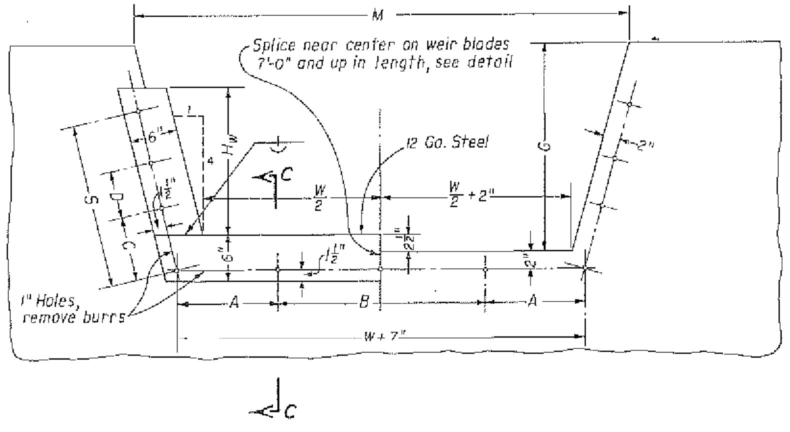
SECTION A-A



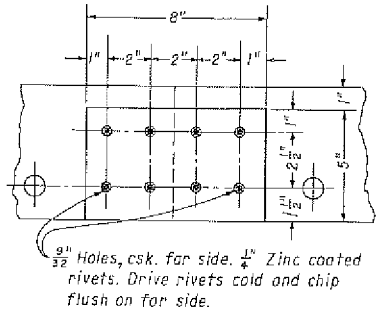
SECTION B-B



SECTION C-C



WEIR DETAILS



9/32" Holes, csk. far side. ¼" Zinc coated rivets. Drive rivets cold and chip flush on far side.

SPLICE DETAIL

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-0-6123.

Weir may be placed so as to provide a maximum drop in water surface of 3 feet, or so that surface of water below weir will not be higher than the weir crest.

"h" is head on weir.

Weir blade to be galvanized by the hot dip process after fabrication.

REFERENCE DRAWING

TYPICAL PROTECTION ____________________

TABLE OF LOCATIONS, ELEVATIONS AND DIMENSIONS

LATERAL	STATION	Q	h	F	W	L	H	H'	T_1	T_2	B_1	B_2	k	e	t_1	t_2	ELEVATIONS					ESTIMATED QUANTITIES		
																	B	K	L	N.W.S. ABOVE	WEIR CREST	CONC. CU. YDS.	REINF. STEEL LBS.	MISC. METAL LBS.

ANCHOR BOLT AND WEIR BLADE DATA

W	H_W	G	M	A	B	S	C	D

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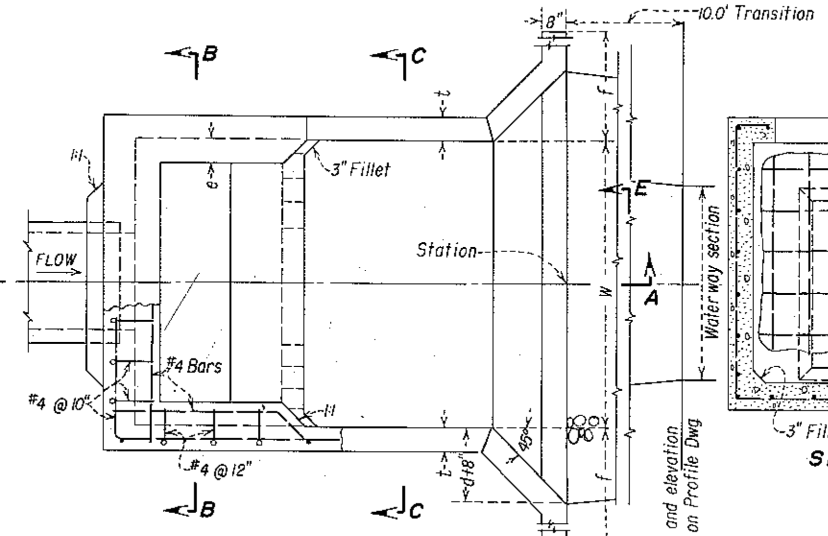
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONCRETE WEIRS
CAPACITY 21 TO 100 SECOND FEET

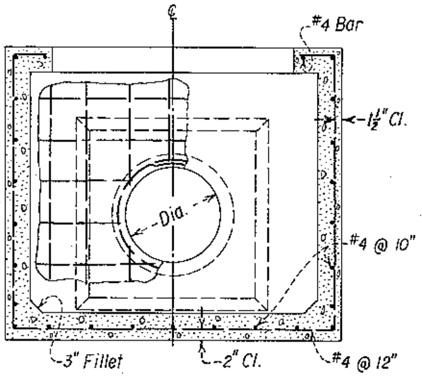
DRAWN R.E.C. SUBMITTED
TRACED J.S.M. JR. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

C 144.20

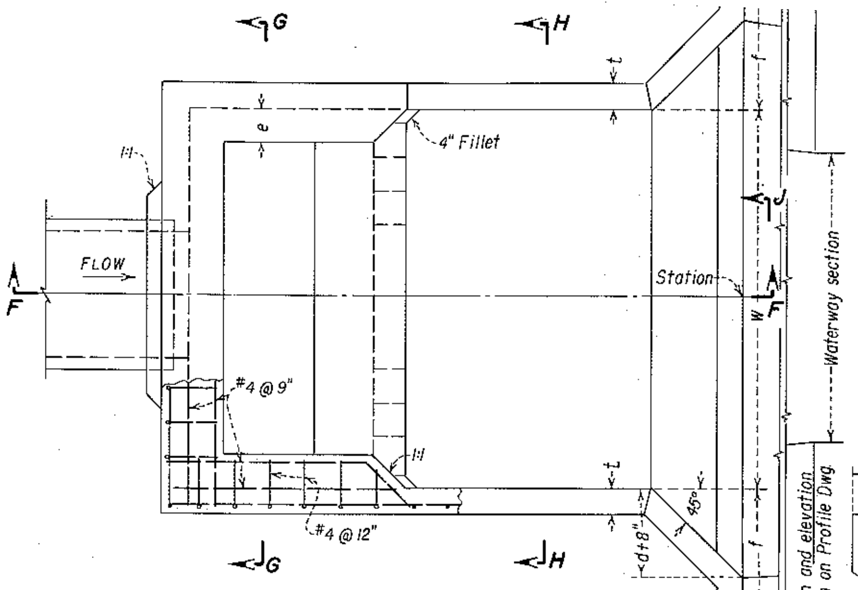
Outlet



PLAN
TYPE 1



SECTION B-B



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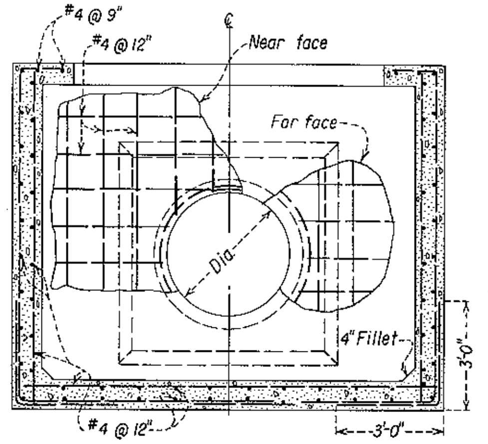
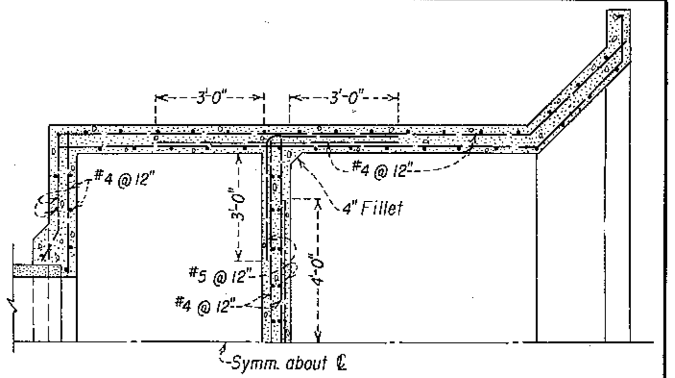
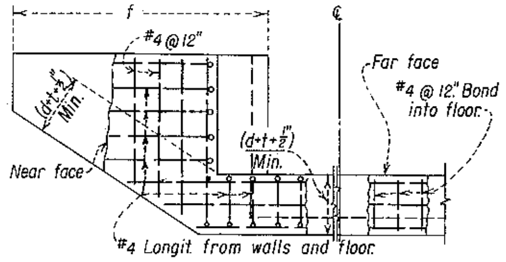
TYPE 2



SECTION G-G

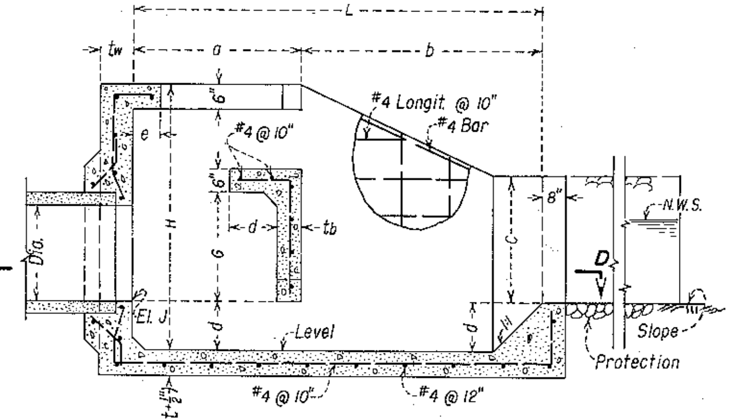


SECTION K-K

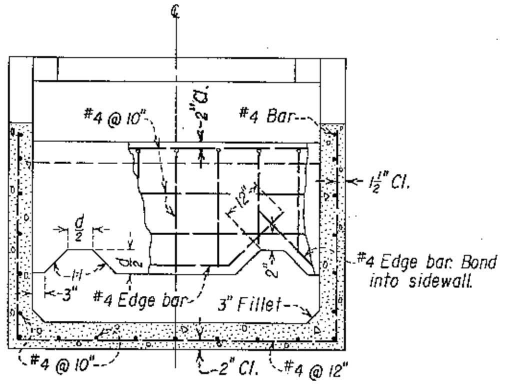


ELEVATION J-J

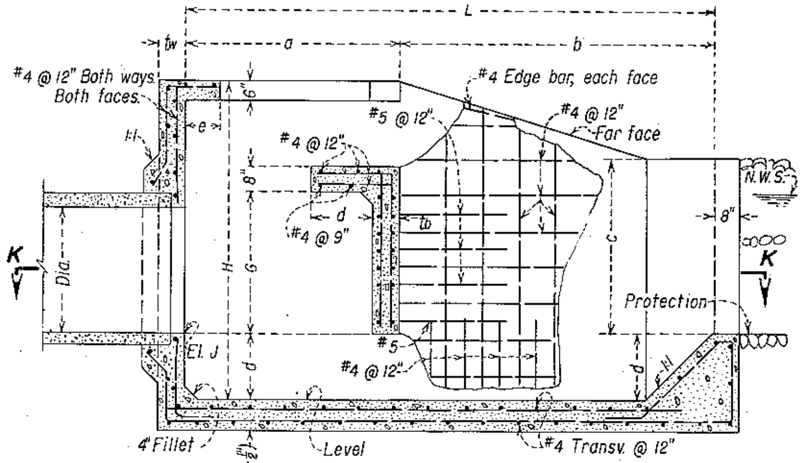
STRUCTURE No.	WATERWAY	STATION	DIA.	Q	EL. J



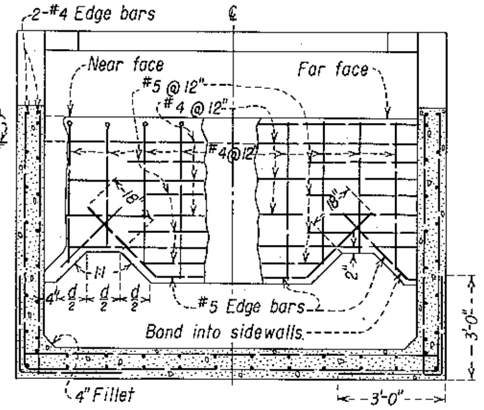
SECTION A-A



SECTION C-C



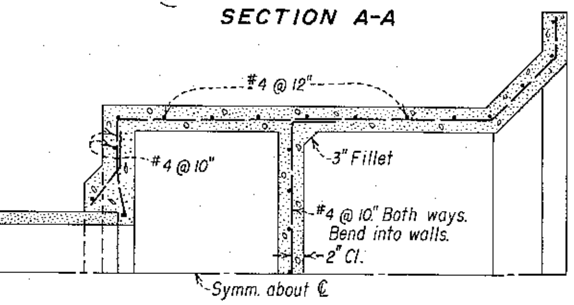
SECTION F-F



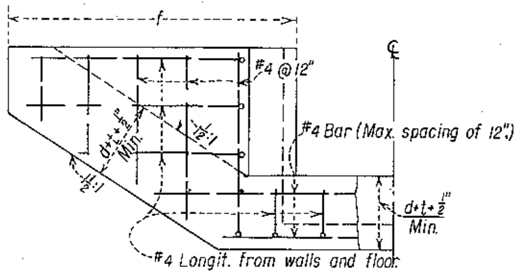
SECTION H-H

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.



SECTION D-D

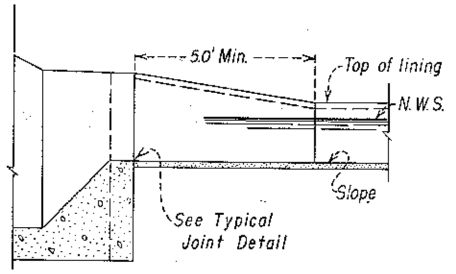


ELEVATION E-E

TABLE OF DIMENSIONS

STRUCTURE No.	TYPE	Q	H	W	a	b	c	d	e	f	G	L		t	tb	tw	CONCRETE CU. YDS.	REINF. STEEL LBS.
1	1	6	4'-3"	3'-6"	3'-3"	5'-0"	2'-0"	11"	6"	6'-1"	2'-1"	8'-3"		6"	6"	6"	3.2	240
2	1	12	4'-3"	4'-6"	3'-3"	5'-0"	2'-4"	11"	6"	6'-5"	2'-1"	8'-3"		6"	6"	6"	3.6	270
3	1	21	4'-3"	5'-6"	3'-3"	5'-0"	2'-8"	11"	6"	6'-9"	2'-1"	8'-3"		6"	6"	6"	4.3	320
4	1	29	4'-9"	6'-2"	3'-7"	5'-8"	3'-0"	12"	6"	7'-2"	2'-4"	9'-3"		6"	6"	6"	5.4	400
5	1	38	5'-3"	6'-9"	3'-11"	6'-3"	3'-4"	14"	6"	7'-10"	2'-6"	10'-2"		6"	6"	6"	6.5	470
6	1	48	5'-9"	7'-5"	4'-3"	6'-10"	3'-8"	15"	7"	8'-5"	3'-0"	11'-1"		6"	7"	6"	7.8	600
7	1	59	6'-3"	8'-0"	4'-7"	7'-5"	4'-0"	16"	8"	9'-0"	3'-0"	12'-0"		6"	7"	6"	8.4	650
8	1	71	6'-9"	8'-8"	4'-11"	8'-1"	4'-4"	18"	8"	9'-8"	3'-6"	13'-0"		7"	7"	7"	11	800
9	1	85	7'-3"	9'-3"	5'-3"	8'-8"	4'-8"	19"	8"	10'-3"	3'-6"	13'-11"		7"	8"	7"	13	950
10 *	2	99	7'-8"	9'-11"	5'-8"	9'-3"	5'-0"	20"	9"	10'-10"	3'-9"	14'-11"		8"	8"	8"	17	2400
11 *	2	115	8'-0"	10'-6"	6'-0"	9'-9"	5'-4"	21"	10"	11'-5"	3'-11"	15'-9"		8"	9"	8"	20	2800

*-use #5 steel in place of #4 steel as shown on the drawing.



DETAIL OF CONNECTION TO CONCRETE LINING

REFERENCE DRAWING

TYPICAL PROTECTION__________
PRECAST PIPE EMBEDMENT__________

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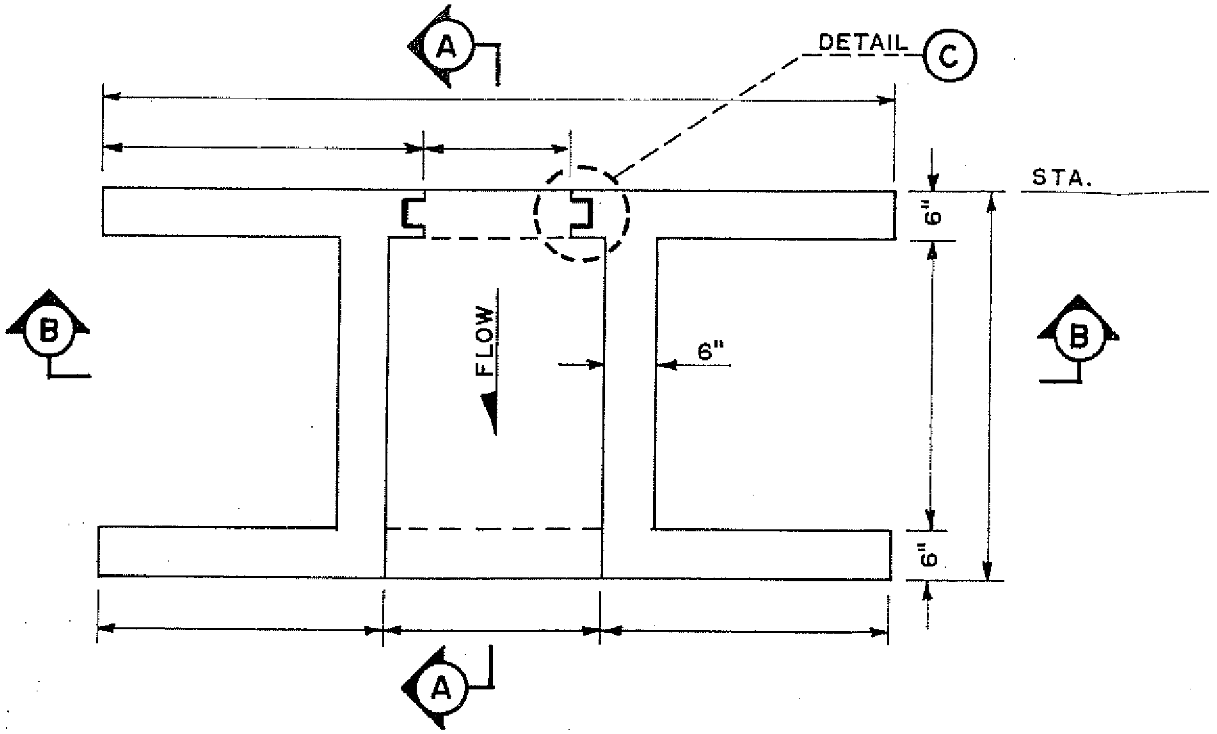
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

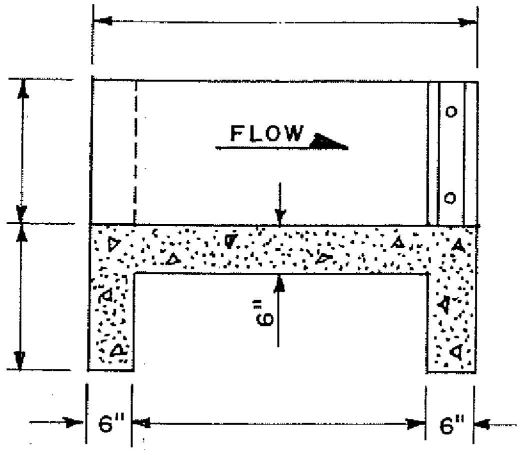
BAFFLED PIPE OUTLET

DRAWN W.A.K. SUBMITTED
TRACED G.D.B. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,

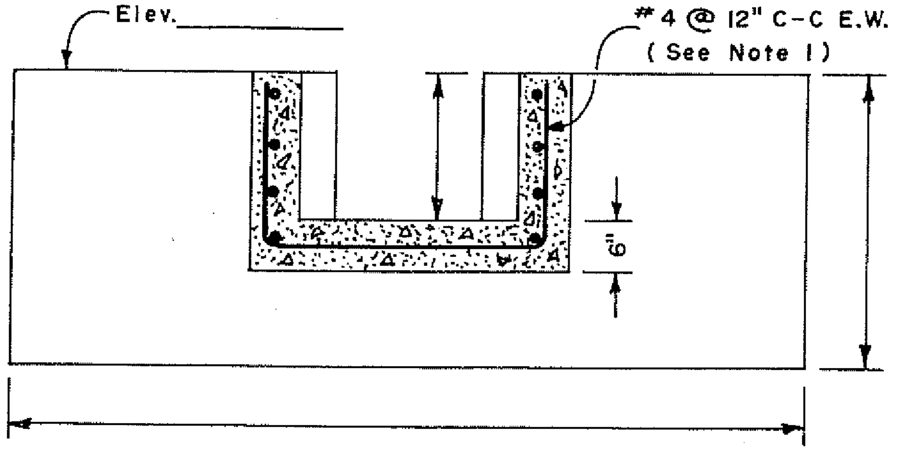
C 131.00



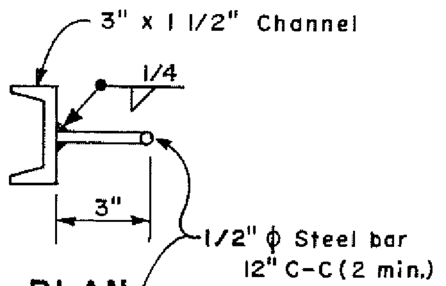
PLAN



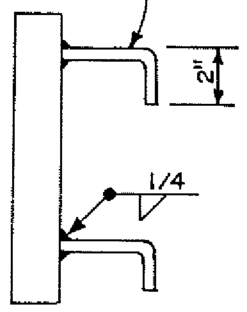
SECTION (A)



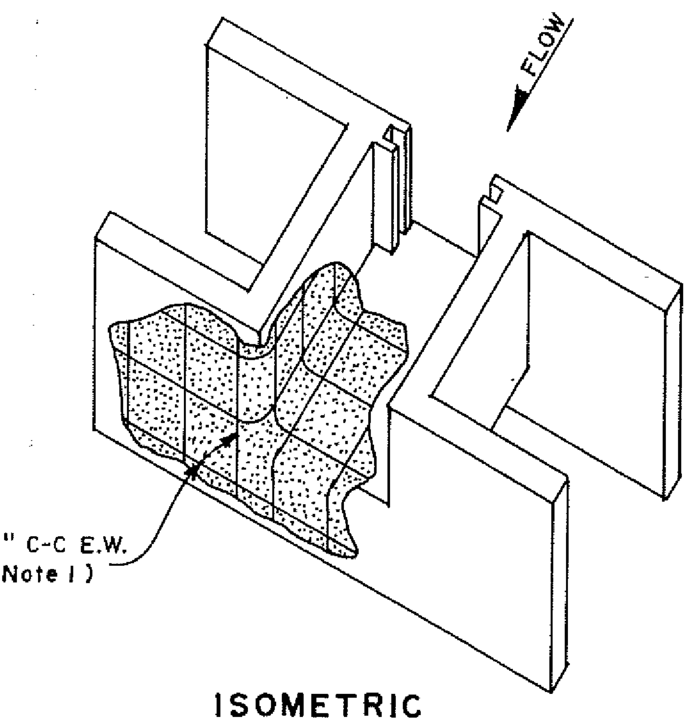
SECTION (B)



PLAN



ELEVATION
DETAIL (C)
FLASHBOARD GUIDE



ISOMETRIC

NOTES:

1. Reinforcing steel shall be #4 bars @ 12" C-C, each way or welded wire fabric 66-22.
2. Minimum splice length shall be 15".
3. Center reinforcing in concrete.

QUANTITIES

ITEM	UNIT	QUANTITY
Concrete	C.Y.	
Reinforcing steel	Lb.	
Welded wire fabric	S.F.	

I have reviewed the plans and specifications, and agree to construct this project to the best of my ability in accordance with them.

______________________ Date:__________
Cooperator

This sheet not to scale.

Revised 9-81

Job Class ______________

CHECK STRUCTURE

COOPERATOR ______________________
__________ SCD ______________ COUNTY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed .... Date ......
Drawn ....
Traced ....
Checked ....
Approved by ....
Title ....
Title ....
Sheet No. ... of ...
Drawing No. MT-SD-587.001

Appendix 5C
Canal Flows

Canal Capacities Source Report

Where available, Irrigation Project reports and design drawings are reviewed to obtain canal capacity data. This data is supplemented with informatioin obtained from Project personnel. In some cases, reduction in main canal capacity is estimated to account for water delivery to lateral ditches, and/or to obtain a better distribution of Asset Priority Rankings. Canal reach descriptions are included when the capacity has not been assumed to be constant over the entire length of the canal.

Clear Creek Unit / Division Canal Capacities

Canal Name	Flow (cfs)	Source	Description
Big Bonanza (BB-1)	22.2	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Big Redman (BR-1)	17.4	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Brown & Foster (BF-1)	2.9	Estimated	Engineer Estimation
Crown Ditch (CR-1)	17.8	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Dunlap Ditch (DUN-1)	10.7	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Fort McKinney Ditch (MK-1)	4	Irrigation Project Personnel	Landowner interview
Fox Ditch (FOX-1)	30	Irrigation Project Personnel	Landower interview
Frank Hopkins (FH-1)	7.1	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Hallie Ditch (HAL-1)	25.7	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
High Line Ditch (HL-1)	3.3	Estimated	Engineer Estimation
Hillyer & Onslow (HO-1)	2.6	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Johnson #2 Ditch (JD-2)	2.8	Estimated	Engineer Estimation
Johnson Creek (JC-1)	3.6	Estimated	Engineer Estimation
Johnson Holt (JH-1)	22.4	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Ladd Ditch (LADD-1)	4	Irrigation Project Personnel	Landowner interview
Lake Desmet Ditch (LDS-1)	54	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Last Chance (LC-1)	9	Irrigation Project Personnel	Landowner interview
Leiter Ditch (LD-1)	40.01	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Little Piney Ditch (LP-1)	18.6	Estimated	Engineer Estimation
LX Ditch (LX-1)	4	Estimated	Landowner Interview
Ono Ditch (ONO-1)	5	Estimated	Landowner interview
Piney Divide (PD-1)	43.9	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Pratt & Ferris #1 (PF-1)	18.1	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Pratt & Ferris #2 (PF-2)	28.3	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Pratt & Ferris #3 (PF-3)	40.3	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Prince Albert (PA-1)	10.1	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Rock Creek & South Piney Ditch (RC-1)	38.4	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Senff Ditch (SEN-1)	3.1	Irrigation Project Personnel	Landowner Interview
Six Mile (6M-1)	29.5	Powder/Tongue Study	Powder/Tongue River Basin Plan, Final Report; February 2002
Sturdovant Ditch (ST-1)	5	Estimated	Landowner Interview
WJD Ditch (WJD-1)	5	Estimated	Landowner Interview

Appendix 5D
System Maps

Clear Creek Systems

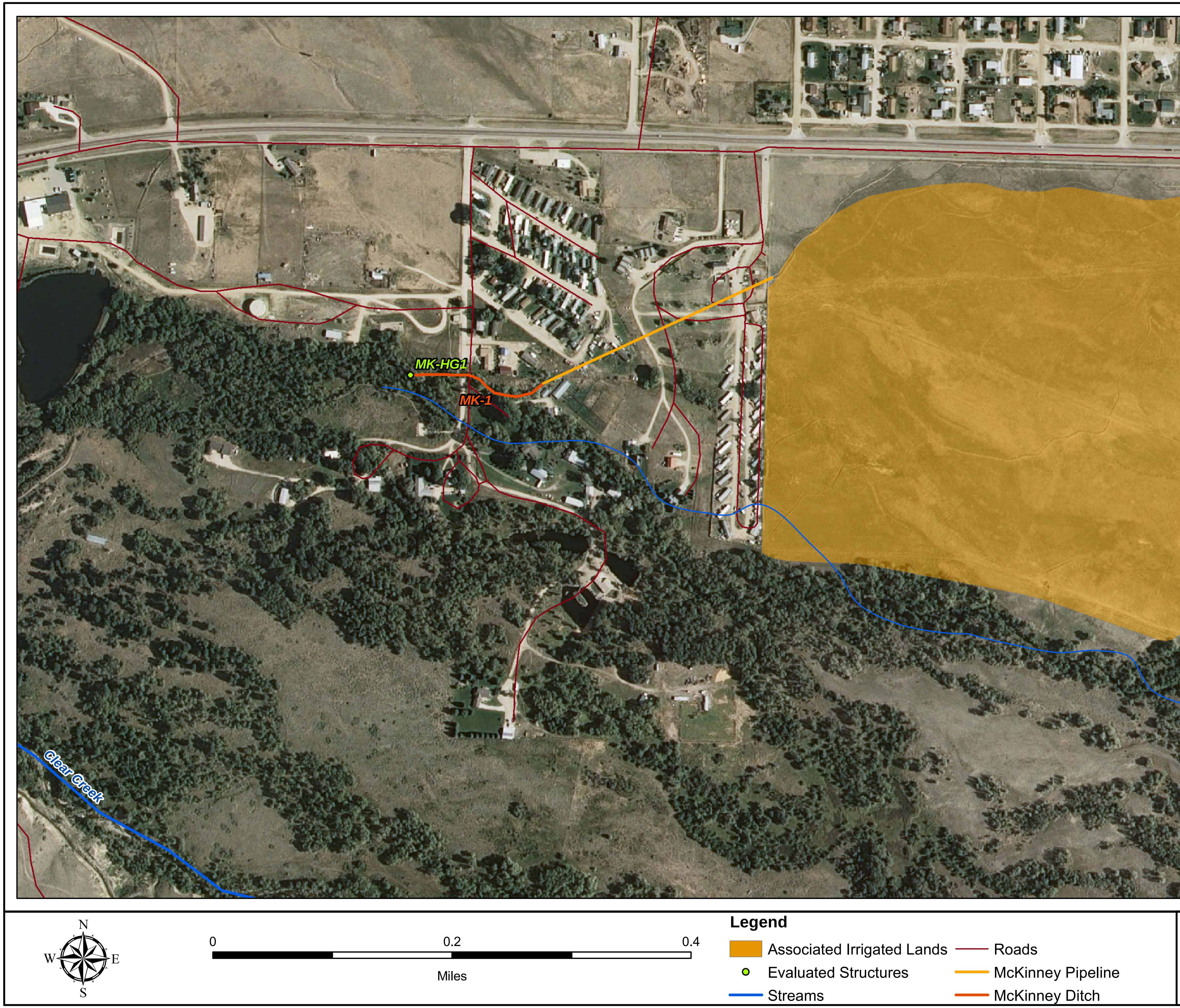


Figure 5-D - 1
Clear Creek Irrigation Assessment
Fort McKinney Ditch

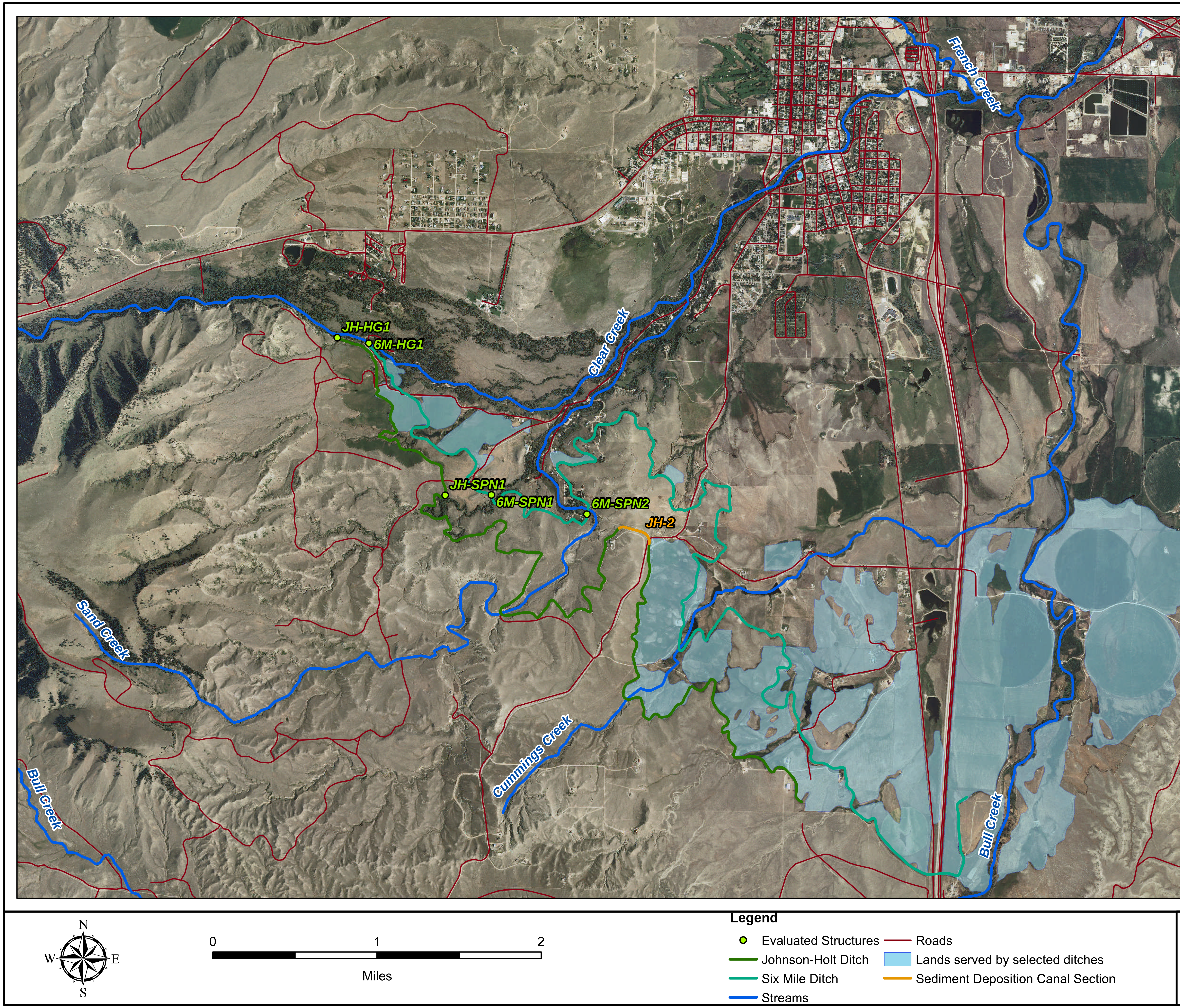


Figure 5-D - 2
Clear Creek Irrigation Assessment
Johnson Holt and Six Mile Ditches

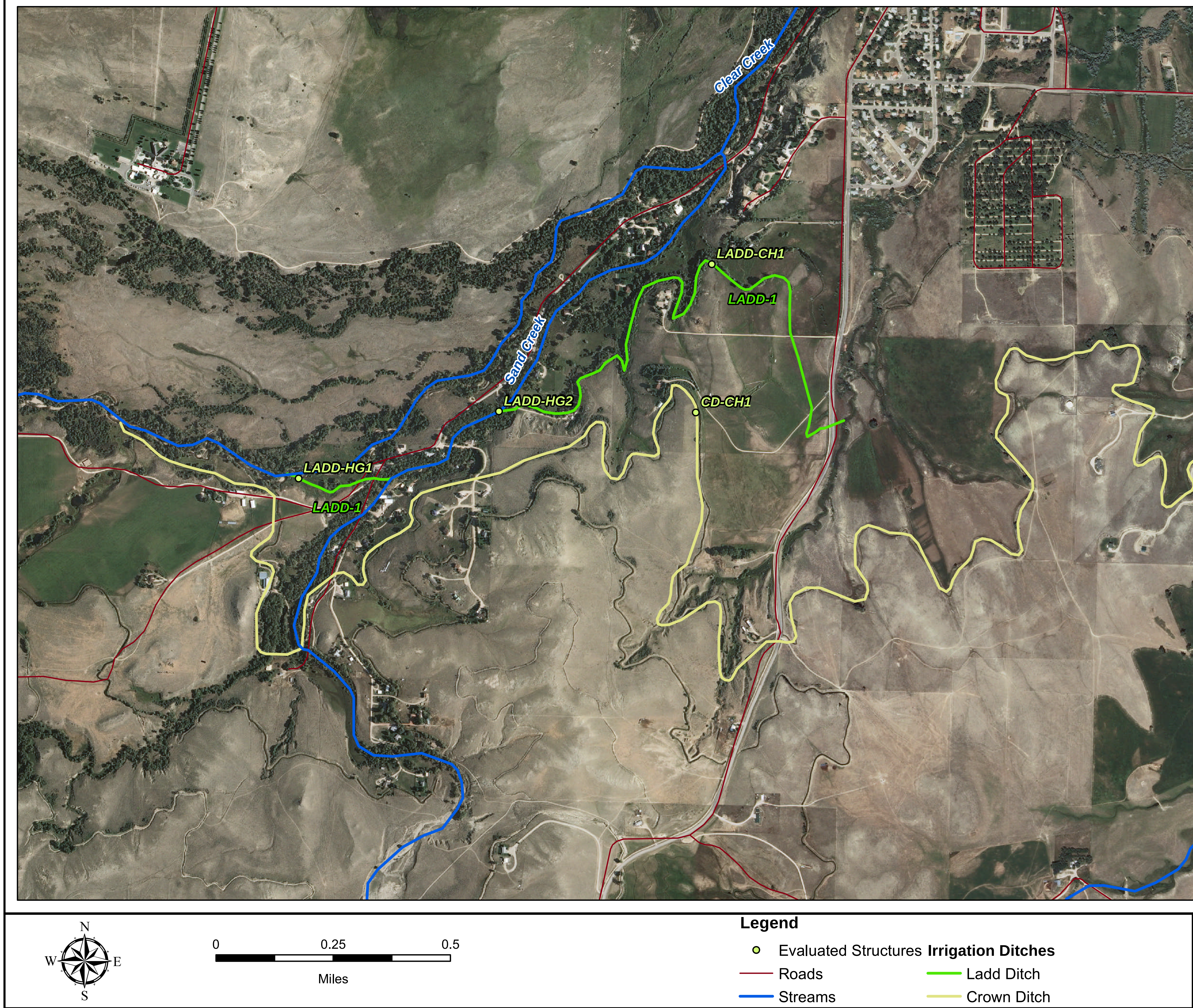


Figure 5-D - 3
Clear Creek Irrigation Assessment
Ladd and Crown Ditches

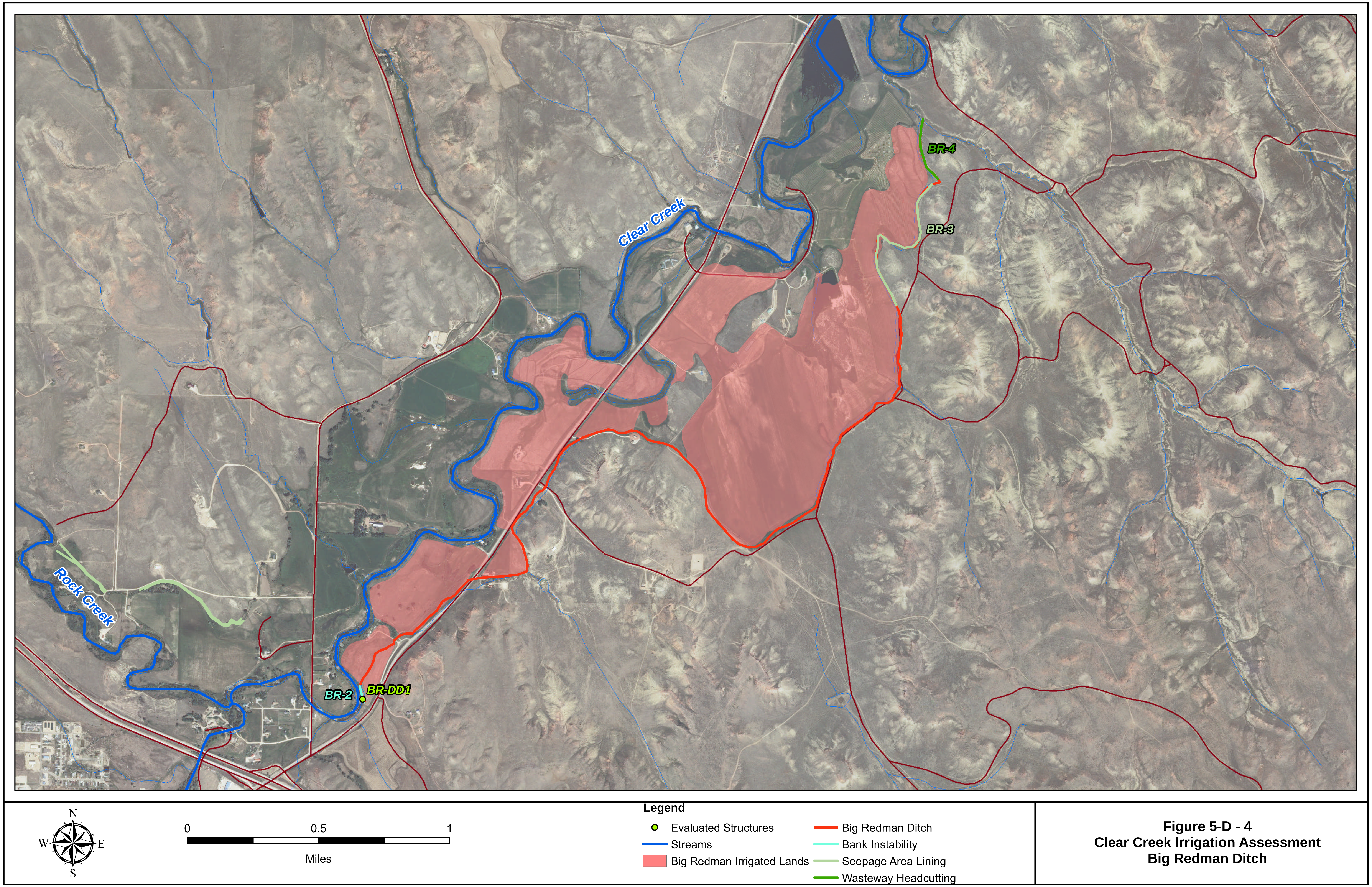


Figure 5-D - 4
Clear Creek Irrigation Assessment
Big Redman Ditch

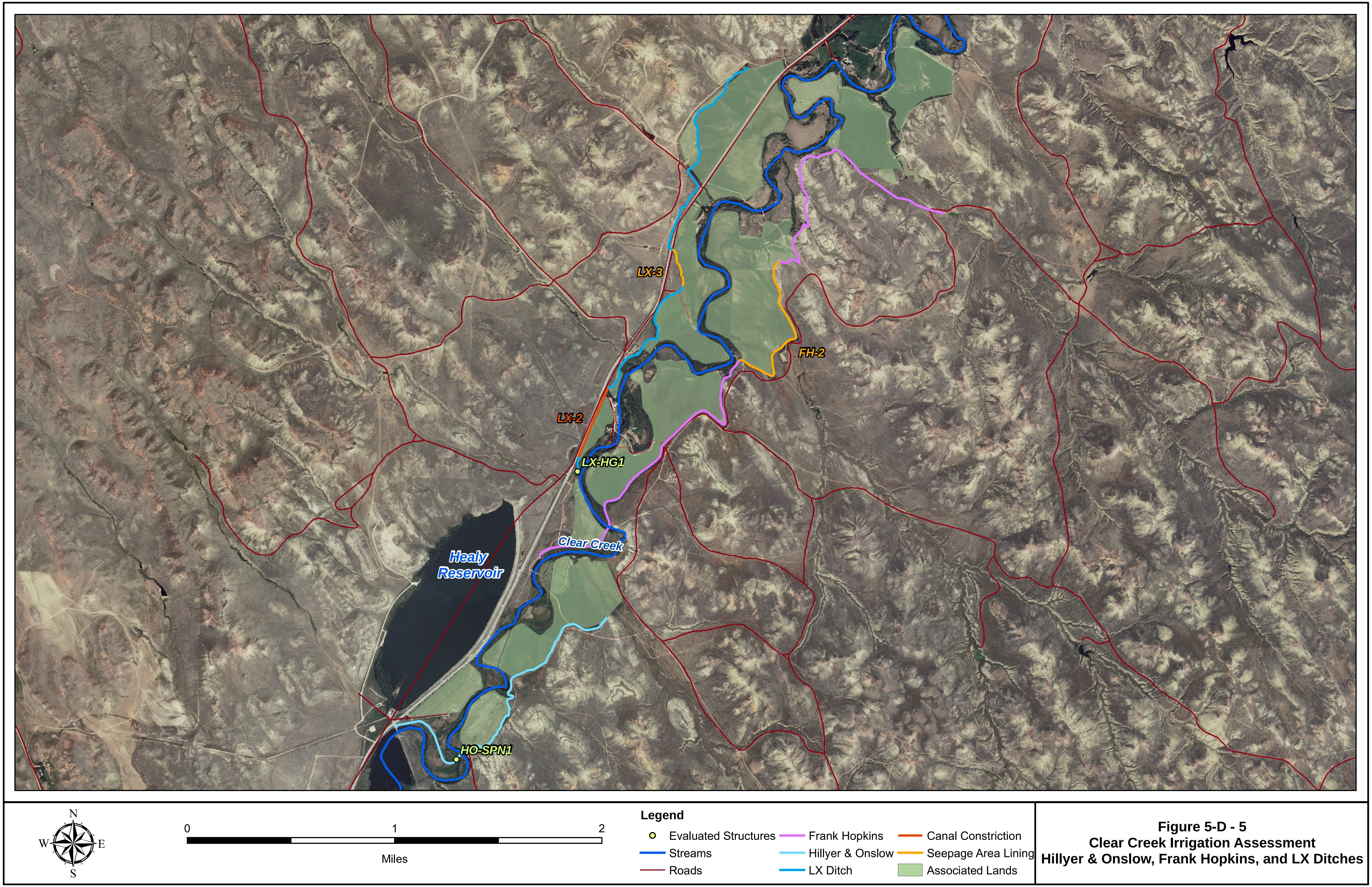
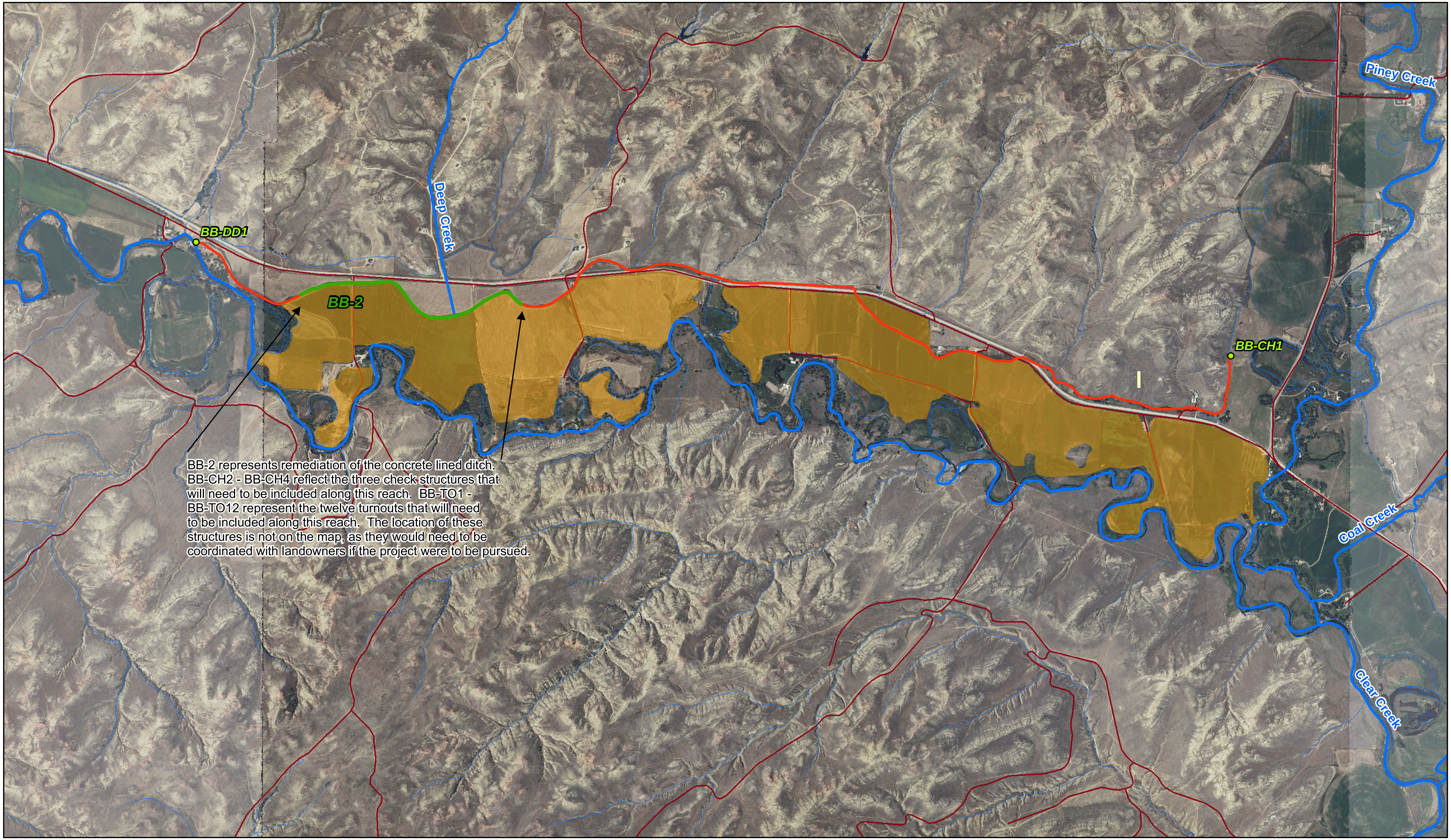


Figure 5-D - 5
Clear Creek Irrigation Assessment
Hillyer & Onslow, Frank Hopkins, and LX Ditches



BB-2 represents remediation of the concrete lined ditch. BB-CH2 - BB-CH4 reflect the three check structures that will need to be included along this reach. BB-TO1 - BB-TO12 represent the twelve turnouts that will need to be included along this reach. The location of these structures is not on the map, as they would need to be coordinated with landowners if the project were to be pursued.

Legend

- ● Evaluated Structures
- Canal Liner Rehabilitation
- Streams
- Roads
- Big Bonanza Ditch
- 🟧 Big Bonanza Irrigated Lands

Figure 5-D - 6
Clear Creek Irrigation Assessment
Big Bonanza Ditch

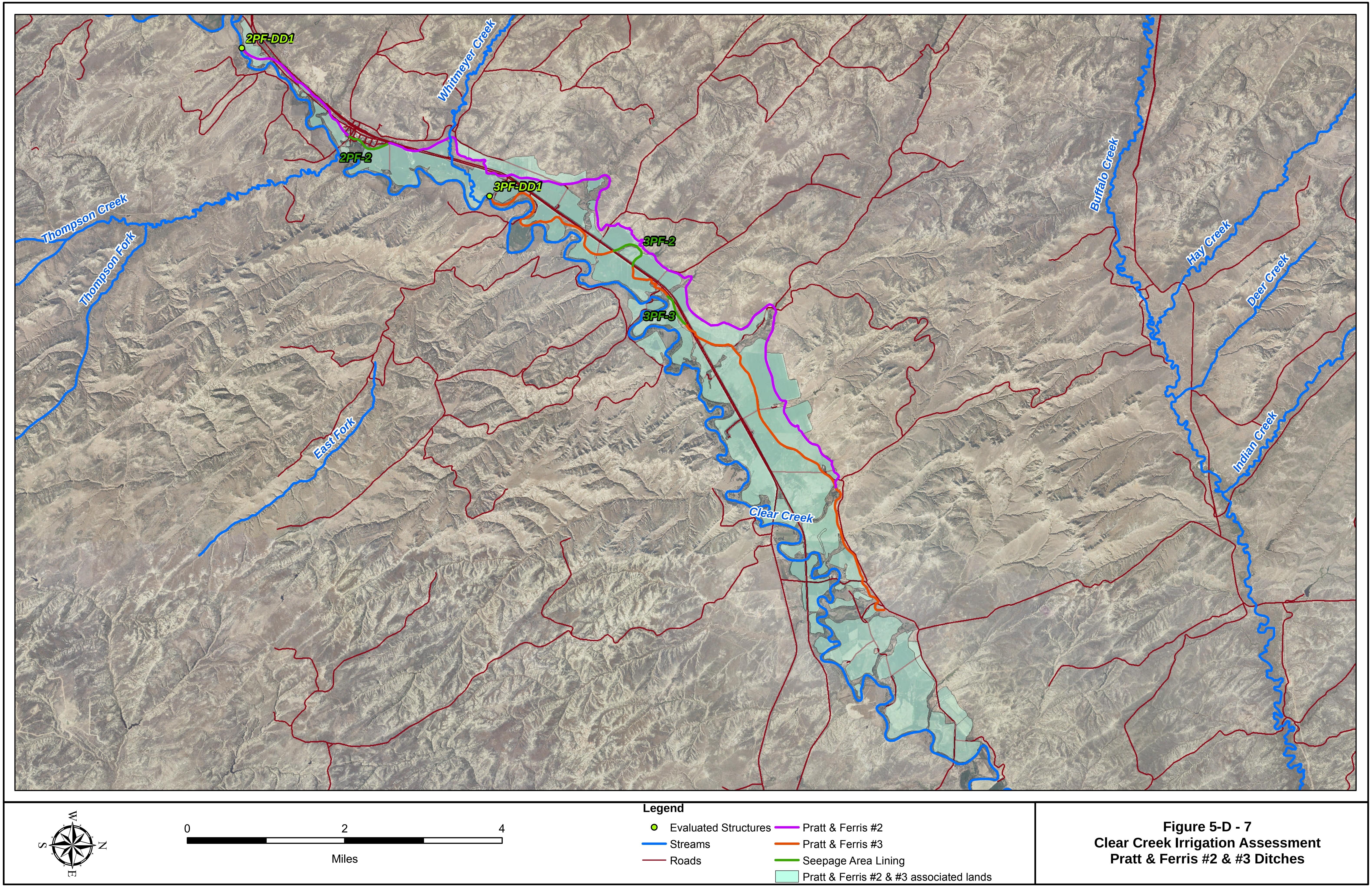
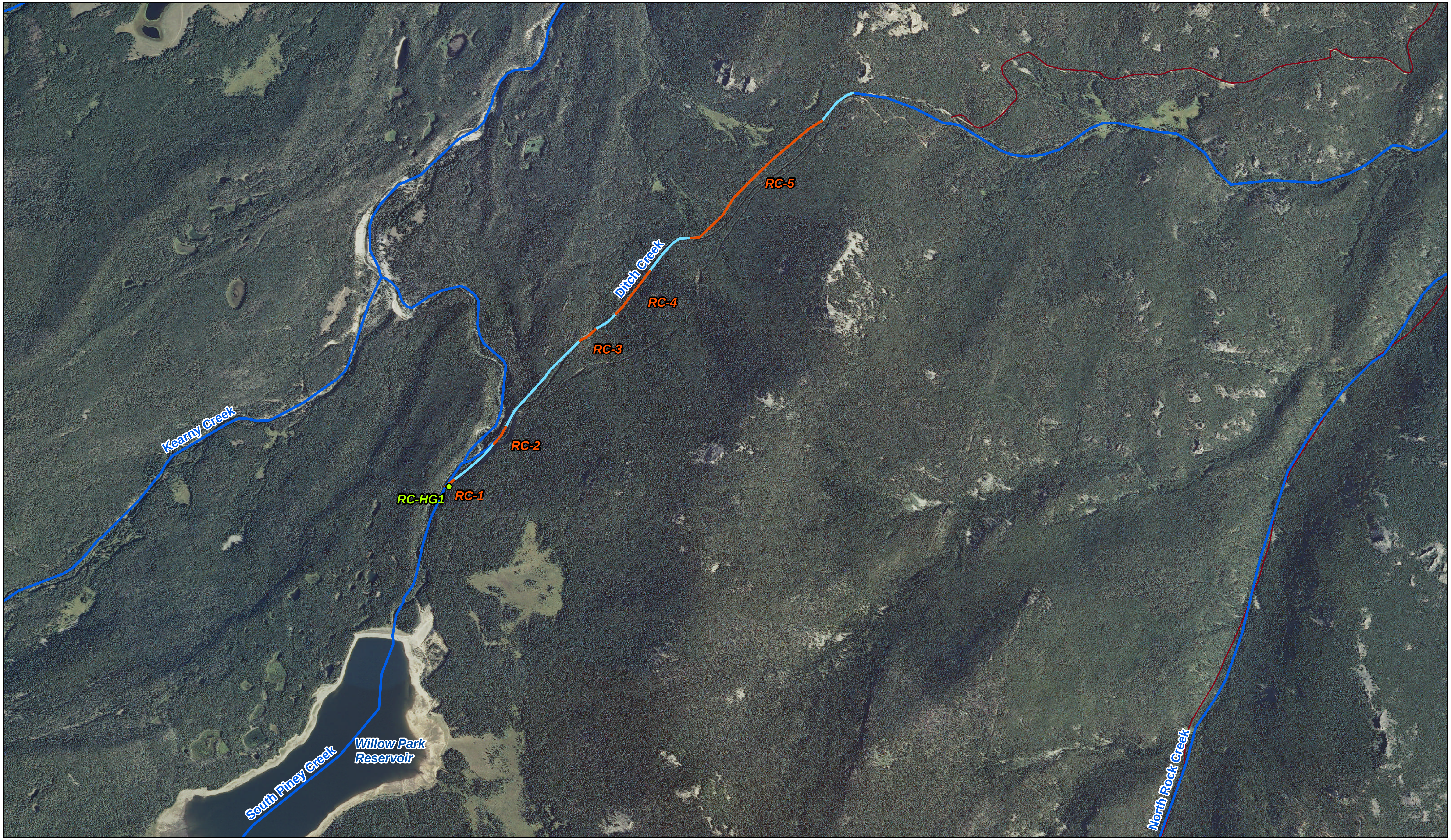


Figure 5-D - 7
Clear Creek Irrigation Assessment
Pratt & Ferris #2 & #3 Ditches

Piney Creek Systems



Legend

- ● Evaluated Structures
- Seepage Area Lining
- Rock Creek & South Piney Ditch
- Streams
- Roads

Figure 5-D - 8
Clear Creek Irrigation Assessment
Rock Creek & South Piney Ditch

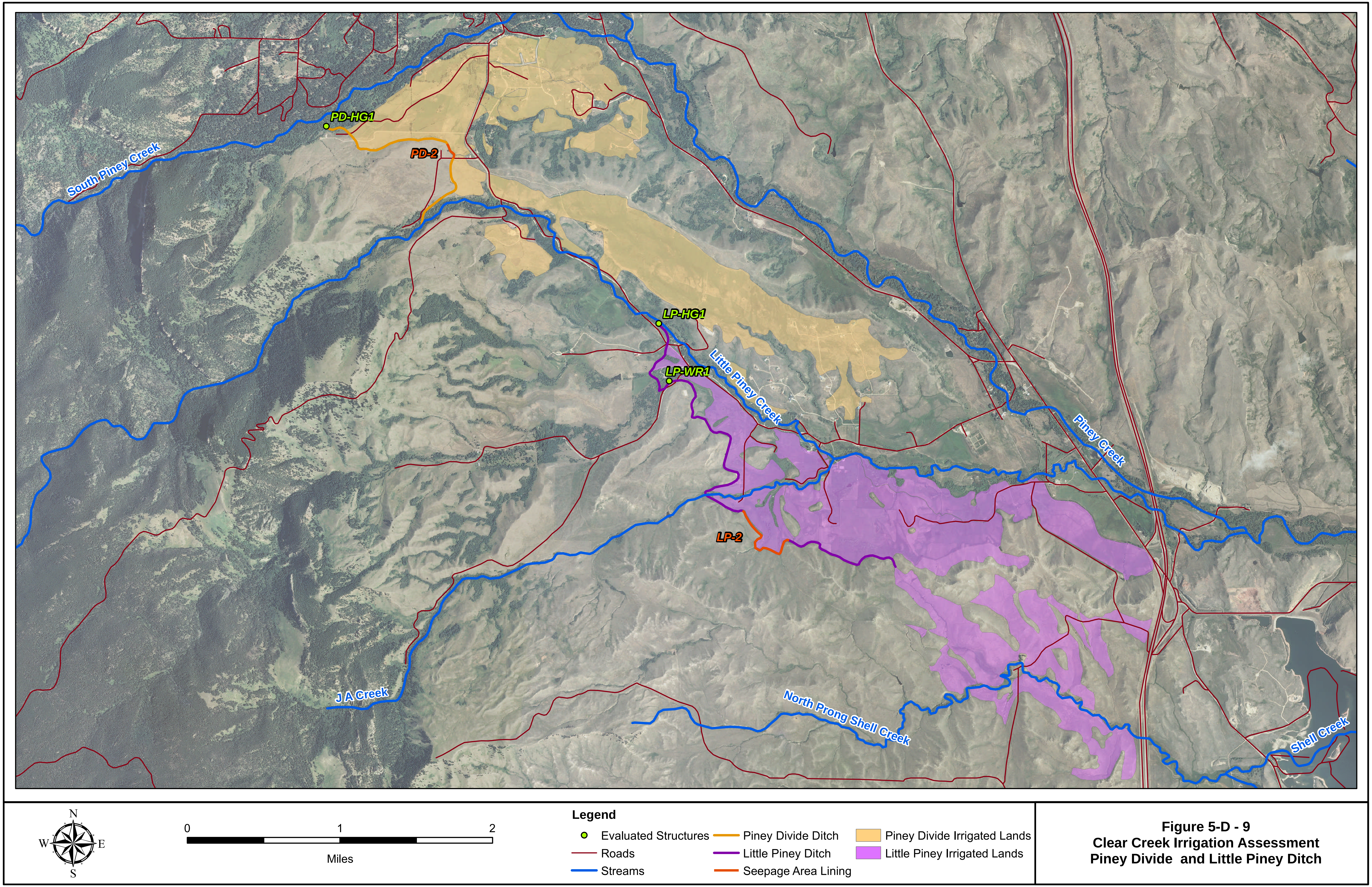


Figure 5-D - 9
Clear Creek Irrigation Assessment
Piney Divide and Little Piney Ditch

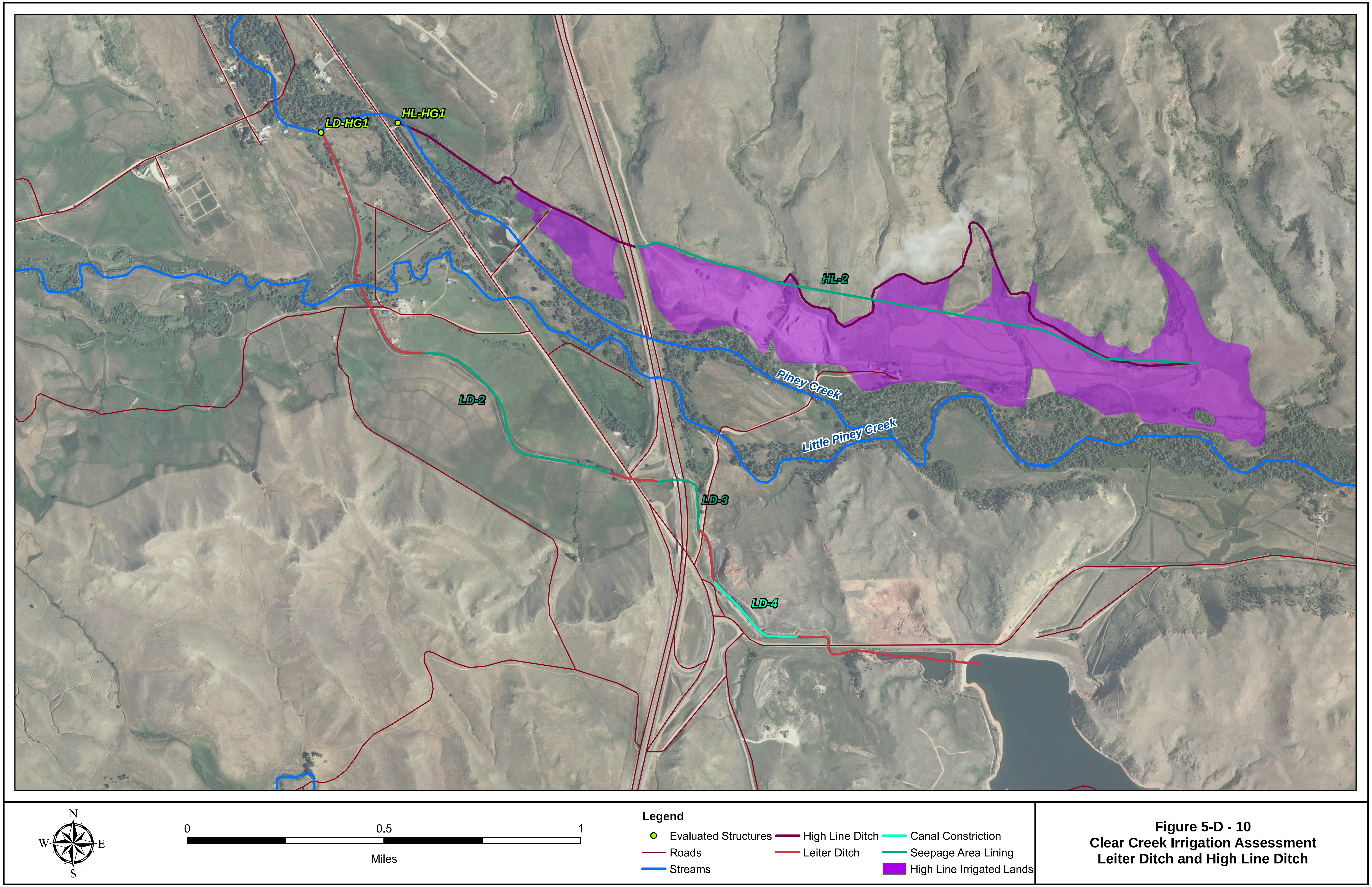
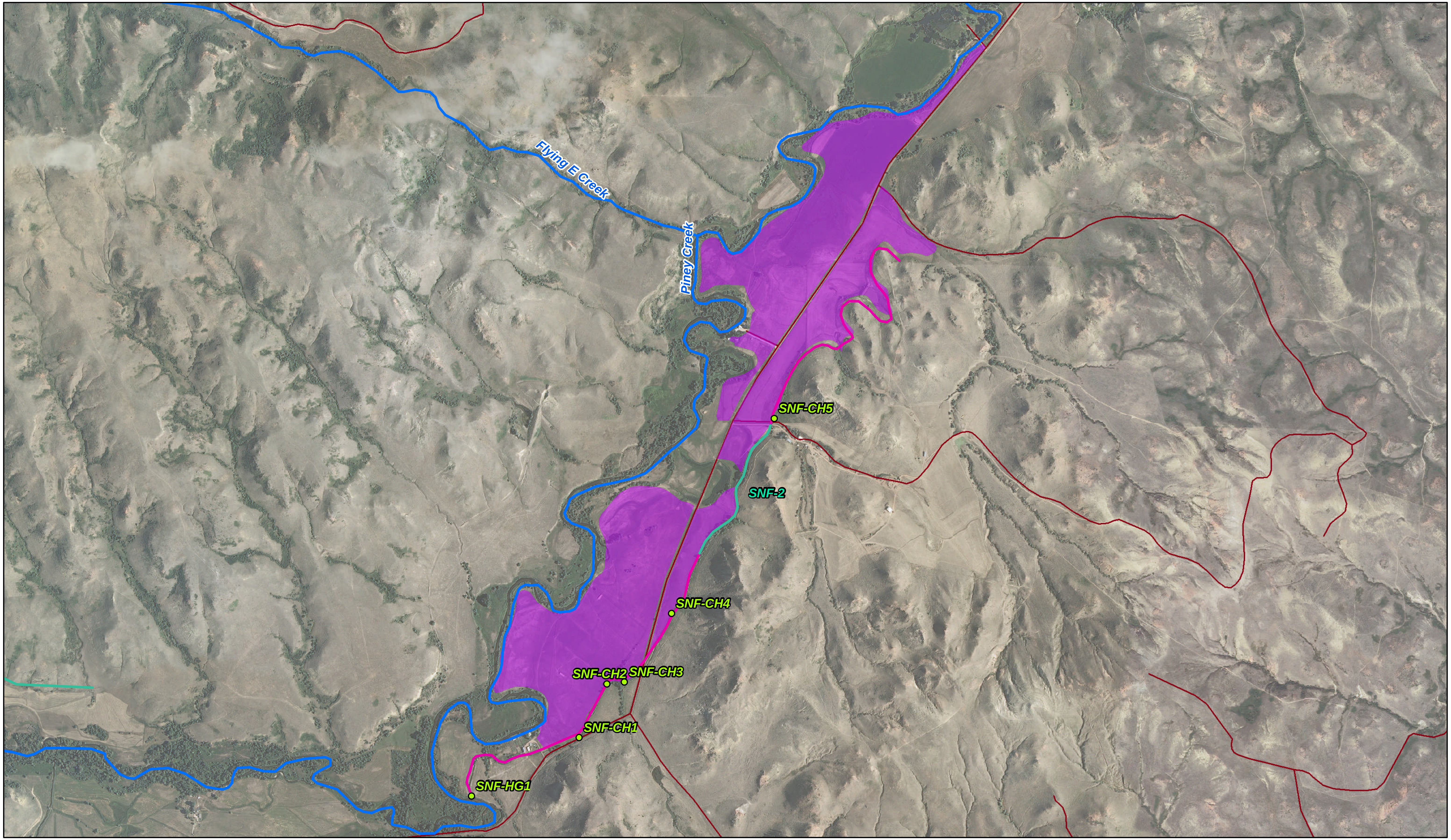


Figure 5-D - 10
Clear Creek Irrigation Assessment
Leiter Ditch and High Line Ditch



Legend

- ● Evaluated Structures
- Streams
- Roads
- Seepage Area Lining
- Senff Irrigated Lands

Figure 5-D - 11
Clear Creek Irrigation Assessment
Senff Ditch

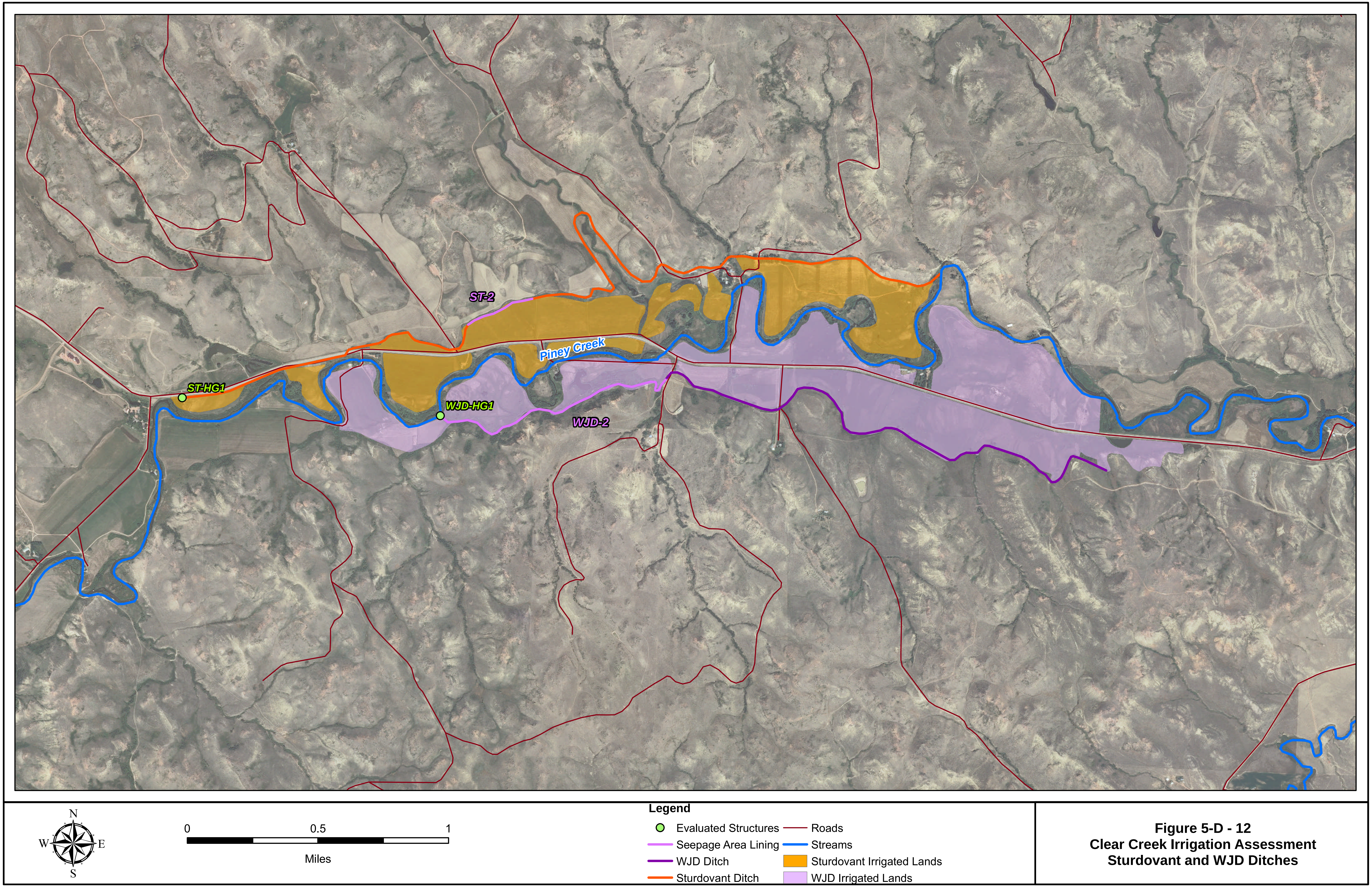


Figure 5-D - 12
Clear Creek Irrigation Assessment
Sturdovant and WJD Ditches

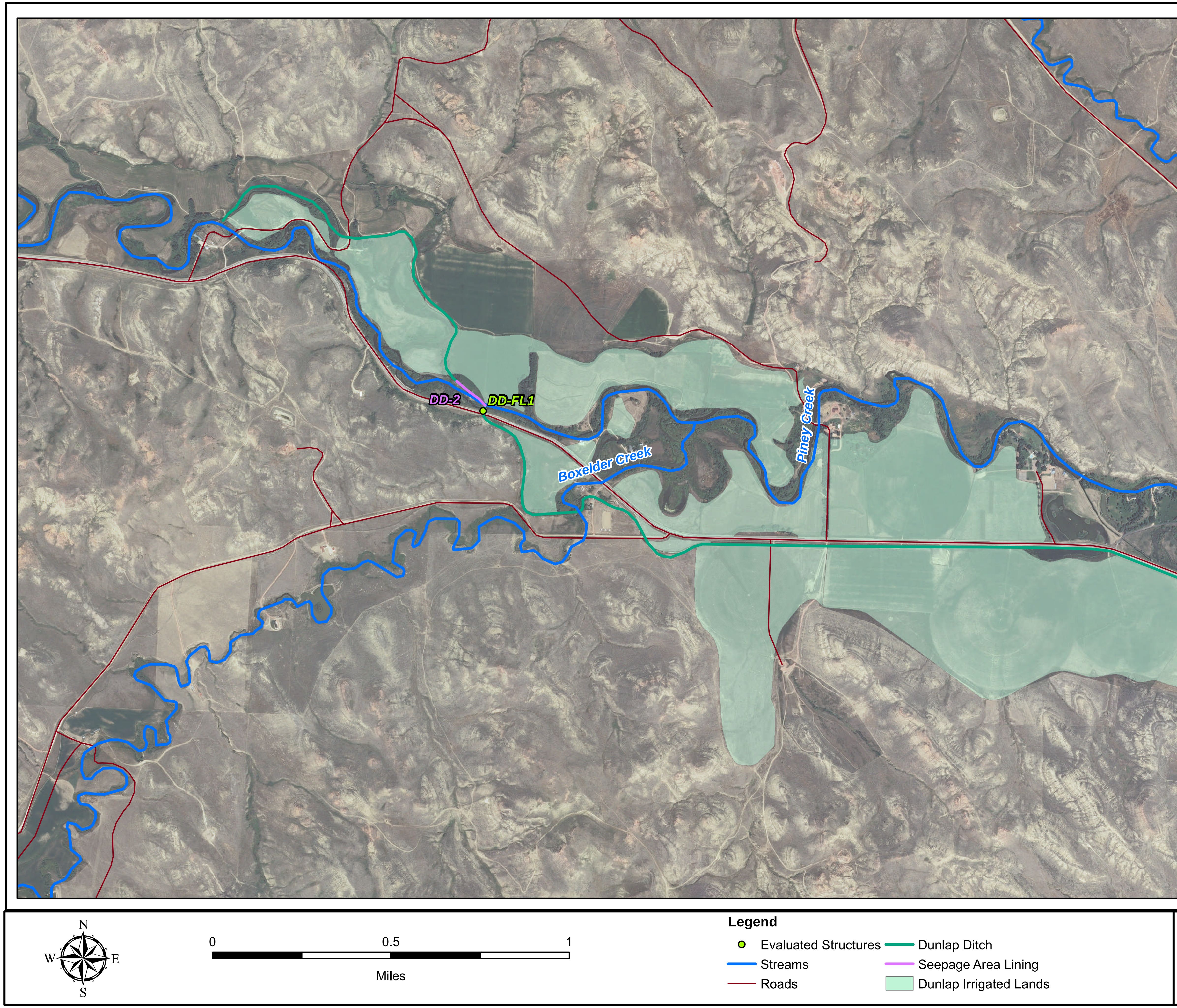


Figure 5-D - 13
Clear Creek Irrigation Assessment
Dunlap Ditch

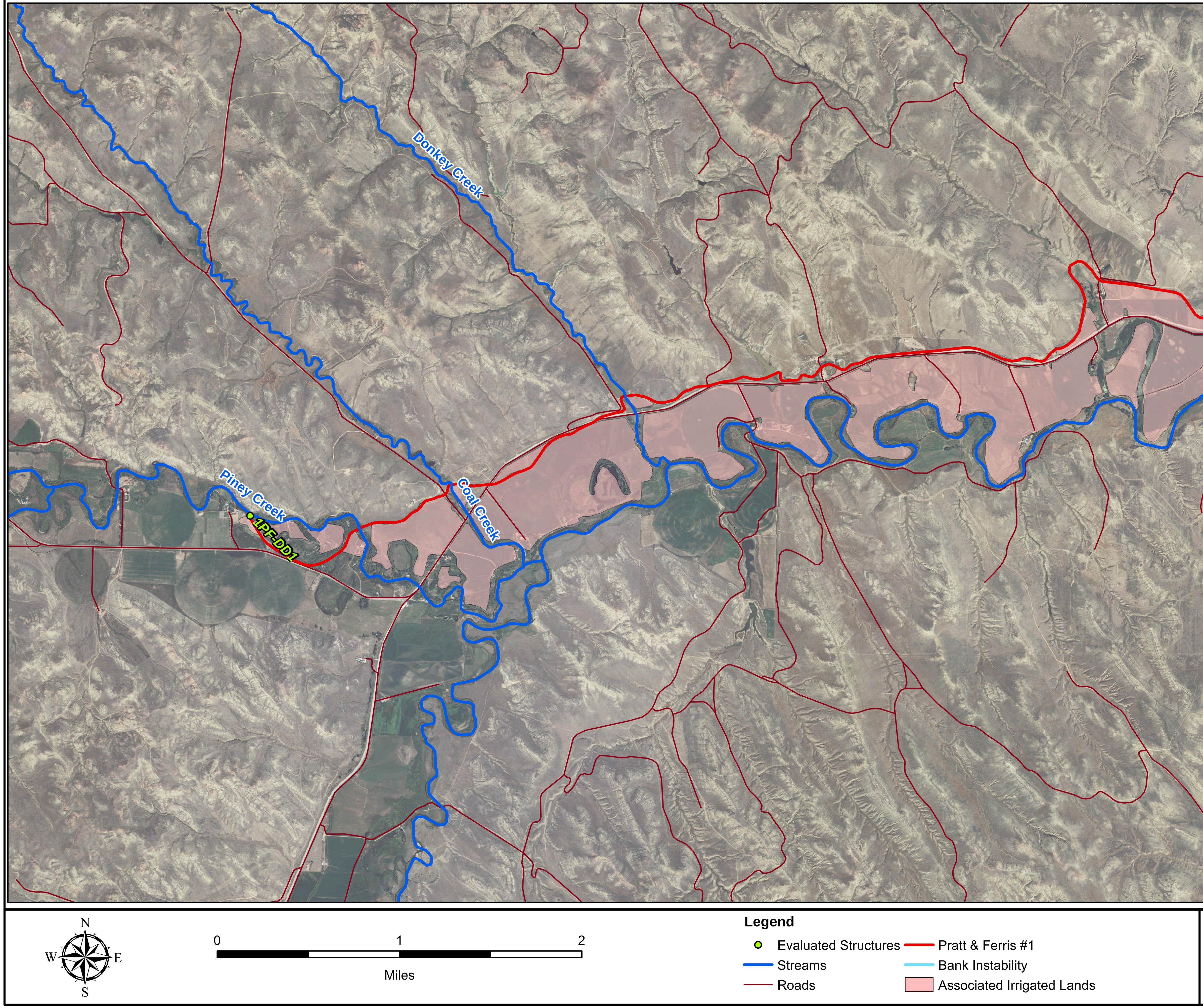
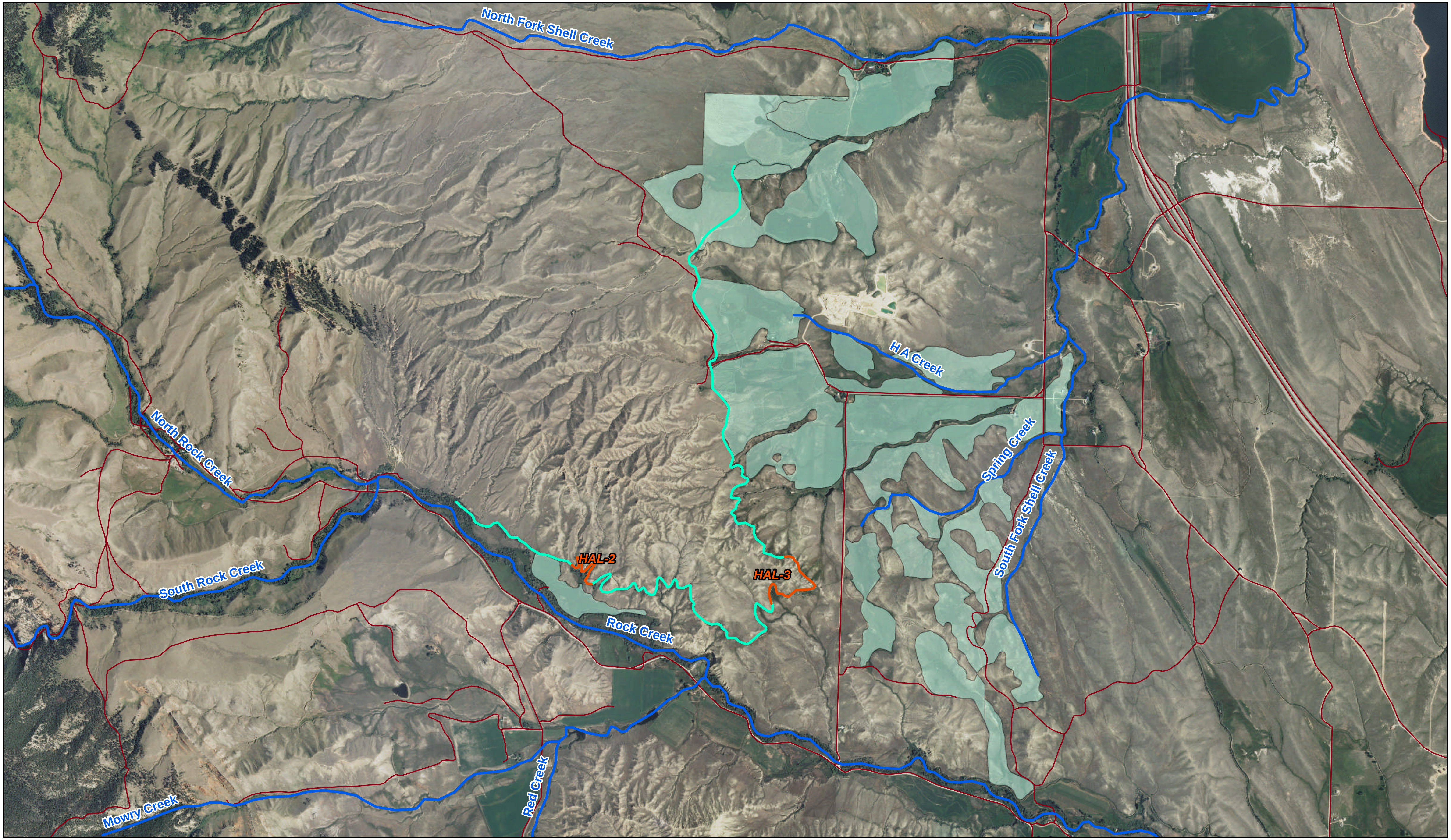


Figure 5-D - 14
Clear Creek Irrigation Assessment
Pratt & Ferris #1 Ditch

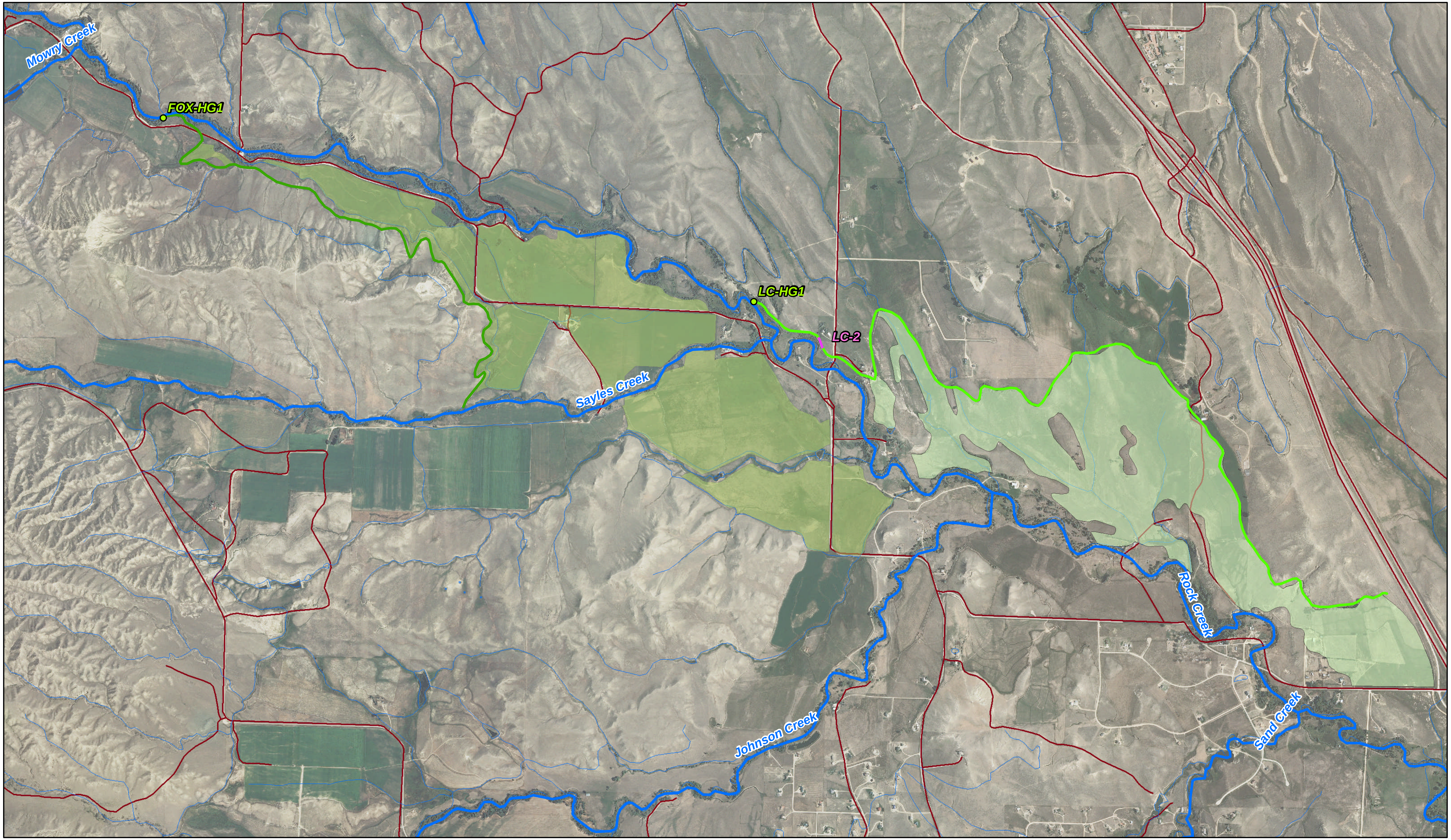
Rock Creek Systems



Legend

- Streams
- Roads
- Hallie Ditch
- Seepage Area Lining
- Associated Irrigated Lands

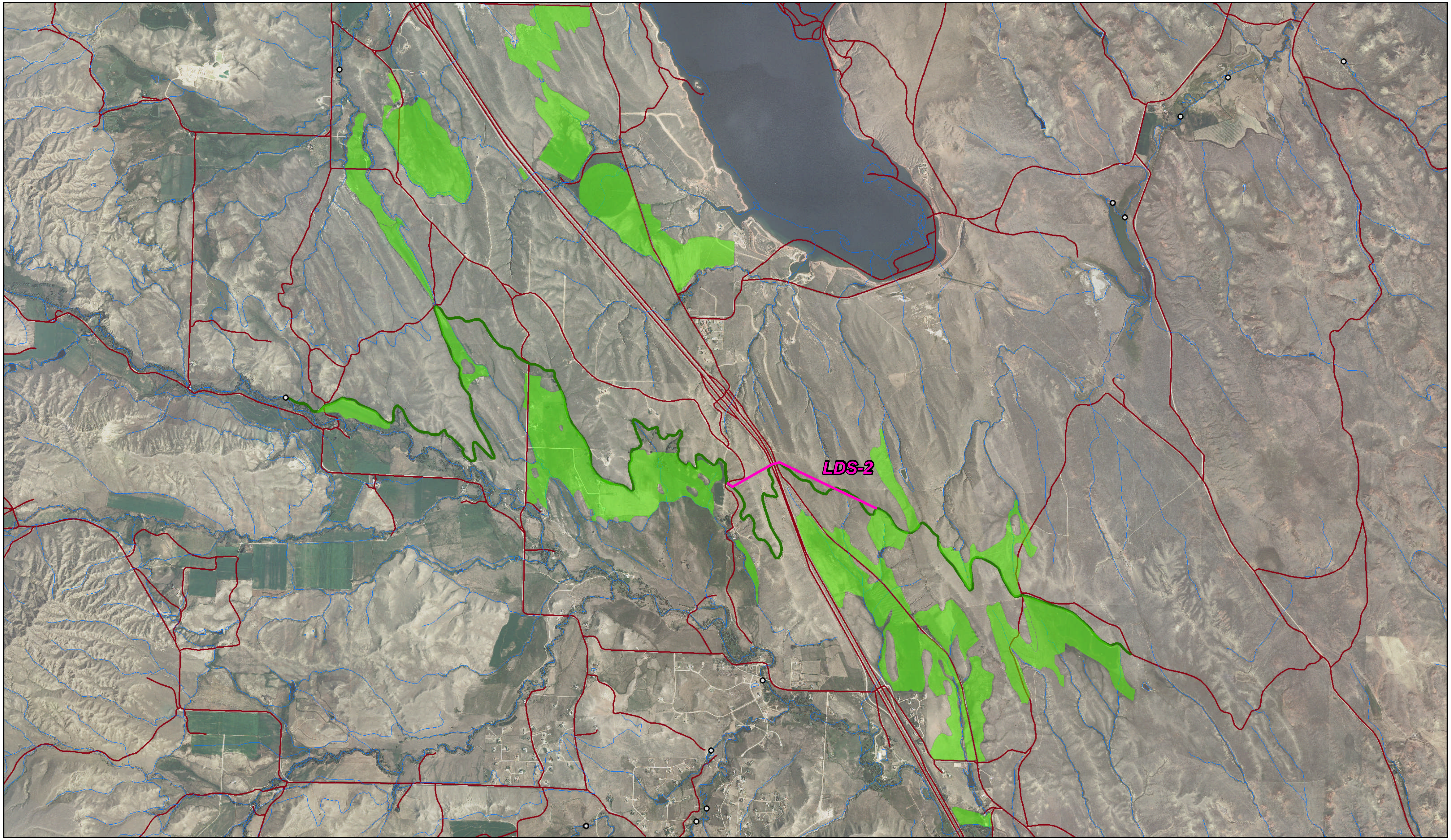
Figure 5-D - 15
Clear Creek Irrigation Assessment
Hallie Ditch



Legend

- ● Evaluated Structures
- Roads
- Streams
- Bank Instability
- Fox Ditch
- Last Chance Ditch
- 🟩 Fox Ditch Irrigated Lands
- 🟩 Last Chance Irrigated Lands

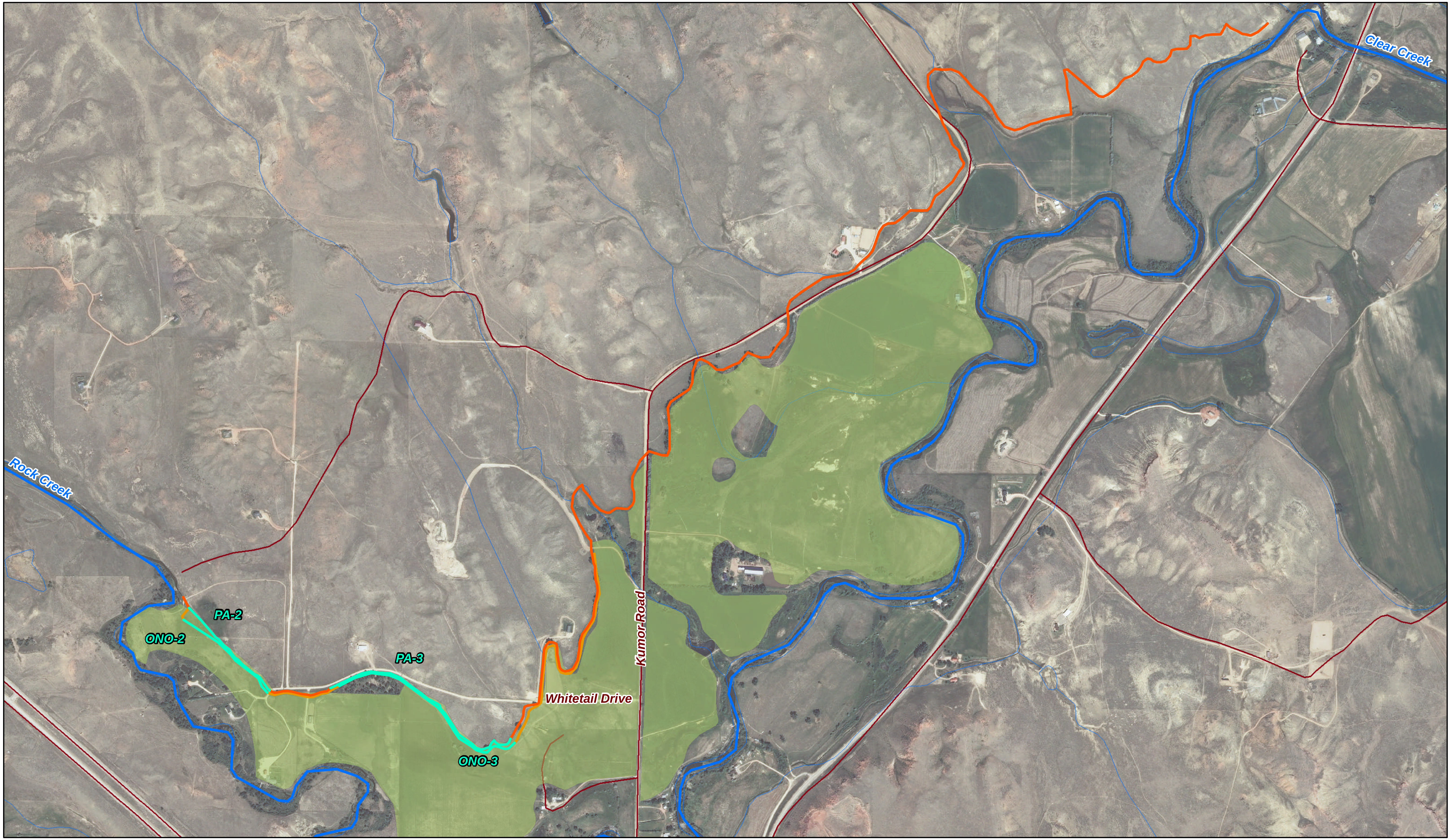
Figure 5-D - 16
Clear Creek Irrigation Assessment
Fox Ditch and Last Chance Ditch



Legend

🟩 Associated Irrigated Lands
Lake Desmet (M&M) Ditch
Seepage Area Lining
Streams
Roads

Figure 5-D - 17
Clear Creek Irrigation Assessment
Lake Desmet Ditch

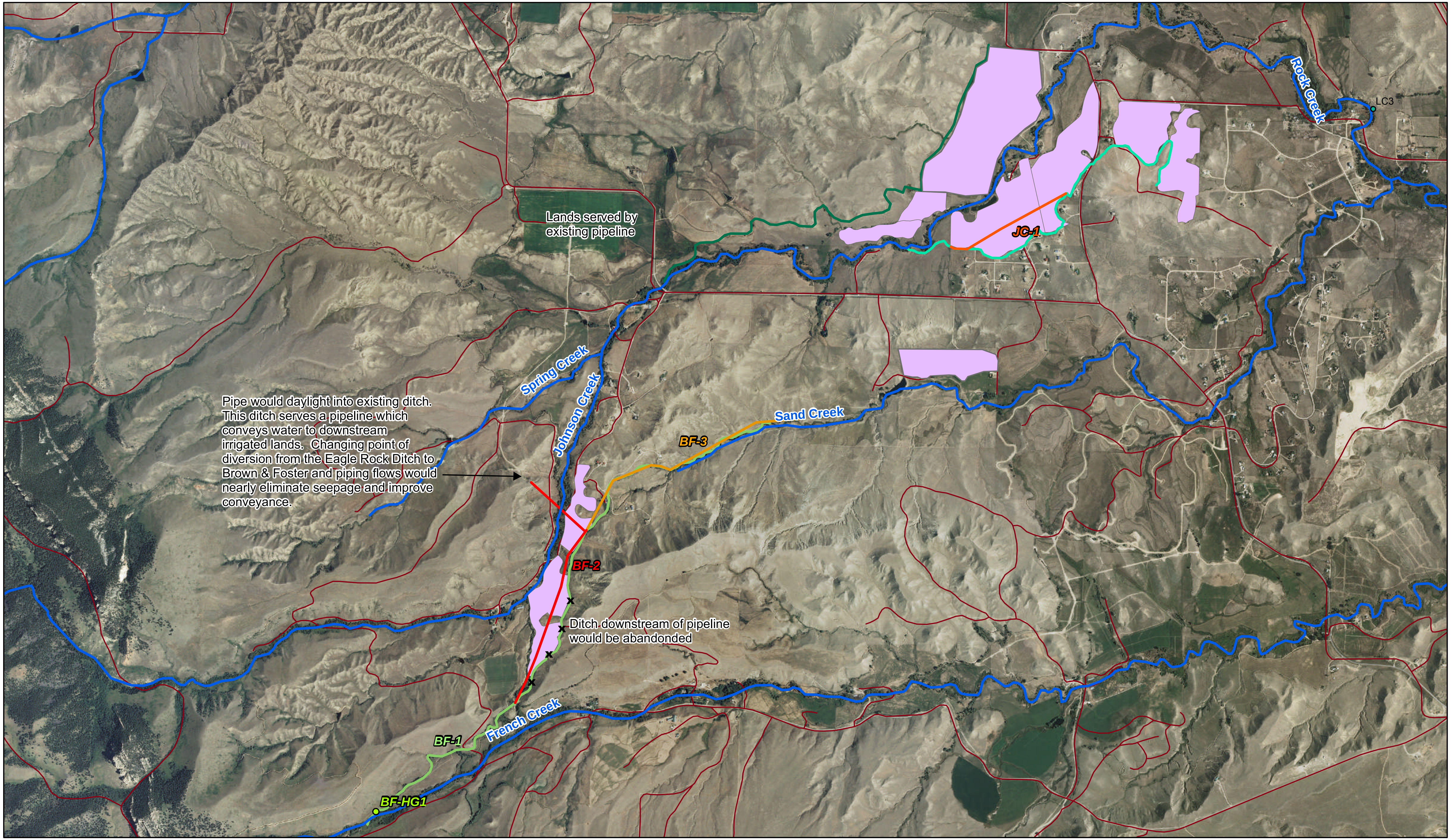


Legend

- Streams
- Roads
- 🟩 Associated Irrigated Lands
- Ono Ditch
- Prince Albert
- Seepage Area Lining

Figure 5-D - 18
Clear Creek Irrigation Assessment
Prince Albert and Ono Ditches

French Creek Systems



Lands served by existing pipeline

Pipe would daylight into existing ditch. This ditch serves a pipeline which conveys water to downstream irrigated lands. Changing point of diversion from the Eagle Rock Ditch to Brown & Foster and piping flows would nearly eliminate seepage and improve conveyance.

Ditch downstream of pipeline would be abandoned

Figure 5-D - 19
Clear Creek Irrigation Assessment
Johnson Creek, Johnson #2
and Brown & Foster Ditches

Appendix 5E
Remediation Reports

Deficiency Category and Ranking Description

Deficiency Categories and Ratings

The deficiencies for each structure are ranked by selection of one of the following United States Department of the Interior categories. These have been adopted for previous irrigation assessments and have proven to be a useful tool in categorizing deficiencies. The definitions provided are the official DOI definitions. Categories are listed below from highest to lowest priority. All structures have a deficiency category ranking unless the rating is “none”.

Critical Health and Safety Deferred Maintenance (CHSdm). A facility deferred maintenance need that poses a significant threat to public or employee safety or health.

Critical Health and Safety Capital Improvement (CHSci). A condition that poses a significant threat to public or employee safety or health and can only be reasonably abated by the construction of some capital improvement.

Critical Resource Protection Deferred Maintenance (CRPdm). A facility deferred maintenance need that poses a serious threat to natural or cultural resources.

Critical Resource Protection Capital Improvement (CRPci). A condition that poses a serious threat to natural or cultural resources.

Critical Mission Deferred Maintenance (CMDM). A facility deferred maintenance need that poses a serious threat to irrigator’s ability to carry out its assigned mission (Improving the management of land and natural resource assets by ensuring the reliability of water facilities).

Compliance and Other Deferred Maintenance (C&ODM). A facility deferred maintenance need that will improve public or employee safety, health, or accessibility; compliance with codes, standards, laws, complete unmet programmatic needs and mandated programs; protection of natural or cultural resources or to irrigator’s ability to carry out its assigned mission.

In those cases where several categories are applicable to a given structure, the highest priority category is selected. The difference between deferred maintenance and a capital improvement is based on whether the purpose associated with the deficiency has historically been provided by the structure, or if remediating the deficiency would require an additional feature. For example, replacing a handrail which is broken or missing would fall under deferred maintenance, while adding the handrail to a structure where there has historically never been a handrail would be a capital improvement.

In addition to giving each structure a deficiency ranking category, they are also assigned a work severity rating of critical, serious or minor. The "none" rating should be used if there are no deficiencies, or if removal of the structure is recommended. The highest applicable rating should be selected. Definitions of the ratings are as follows:

Critical – A critical deficiency exists if any one of the following criteria is met:

- There is a threat to the health and/or safety of the user which may occur within two years.
- There is advanced deterioration which has resulted in the failure of the feature or will result in the failure of the feature if not corrected within two years.
- There is accelerated deterioration of adjacent or related materials as a result of the feature's deficiency.
- There is failure to meet a legislated requirement.

Serious – A serious deficiency exists if any one of the following criteria is met:

- A threat to the health and/or safety of the user may occur within 2 – 5 years if the deterioration is not corrected.
- There is deterioration which, if not corrected within 2 – 5 years, will result in the failure of the feature.
- There is deterioration of adjacent or related materials and/or system as a result of the feature's deficiency.

Minor – A Minor deficiency exists if any one of the following criteria is met:

- Standard preventative maintenance practices and conservation methods have not been followed.
- There is a reduced life expectancy of affected or related materials and/or systems.
- There is a condition with long-term impact beyond five years.

As mentioned previously, the deficiencies for each structure are ranked by selection of one of the following United States Department of the Interior categories. These have been adopted for previous irrigation assessments and have proven to be a useful tool in categorizing deficiencies. The rankings are not a used as an end-all priority ranking, but they do help identify structures that may be in more immediate need of rehabilitation.

Remediation Priority Ranking

DOWL HKM has previously worked closely with the Department of Interior (DOI), and in particular, staff of BIA's Irrigation, Power, and Safety of Dams (IPSOD) program, to develop a priority ranking system for rehabilitation of irrigation structures. This system has been developed to allow ranking of structures based on several different criteria, such as: Current structure condition, importance of structure type, and the significance of structure to the irrigation project. The cumulative result of these criteria is termed the Remediation Priority Index (RPI). The RPI is based upon two additional indices, the Facilities Condition Index (FCI) and the Asset Priority Index (API).

The FCI, on a 0 – 1 scale, is the ratio of the Total Rehabilitation Cost to the Current Replacement Value. A high FCI corresponds to a larger degree of deterioration (the rehabilitation cost is a high percentage of the replacement cost).

The API, on a 1 – 100 scale, is composed of two separate parameters, weighted equally; the structure function and significance. The structure function ranks the structures based on importance by structure type over a range from 1 to 50. The second parameter, structure significance, ranks the structures by their significance to the irrigation project over a range of 1 to 50, as determined by the canal capacity. Canal capacities were determined by reviewing Project reports and files as well as through the account of project personnel. A complete list of canal flows is included in Appendix 5-C. API rating criteria for the Clear Creek Watershed irrigation assessment are summarized as follows. API Significance ratings are established to provide API distribution ratings over the full range from 1 to 50. A high API corresponds to a higher priority structure.

Example: The API ranking of a 45 cfs diversion dam would be 50 (Function) + 50 (Significance) = 100. The FCI, the ratio of the total cost of rehabilitation to the Current Replacement Value, for this structure has been estimated at 0.68. The resulting RPI is then 100 x 0.68 = 68.

Further details of the Remediation Priority Index (RPI) calculations, including the API and FCI are summarized on the following page.

Asset Priority Index (API) Rating

Rating	Function	Structure Types
50	Primary Diversion	Diversion Dams, Headworks
40	Conveyance	Siphon, Flume, Pump, Drop, Chute
30	Regulation / Fish Protection	Check, Wasteway, Fish Ladder, Fish Screen
20	Lateral Diversion / Flow Measurement	Headgate, Weir
10	Delivery	Turnout

API Significance Rating

Rating	Flow Range (cfs)	
	Minimum	Maximum
50	40	100
40	25	39
30	17	24
20	6	16
10	0	5

Calculation of Remediation Priority Index (RPI)

- Remediation Priority Index **(RPI)**
    - RPI = API x FCI

- Facilities Condition Index **(FCI)**
    - Scale (0 - 1)
    - FCI = (Repair Cost)/(Replacement Cost), unless;
        - Repair Cost > Replacement Cost: FCI = 1
        - Structure Removal Recommended: FCI=0.01
        - Structure Replacement Recommended: FCI = 1

- Asset Priority Index **(API)**
    - Scale (1 – 100)
    - Based on two parameters weighted equally;
        - Significance: Rated by irrigated acres, as determined by canal capacity. (Scale of 1 – 50)
        - Function: Rated by importance of structure type. (Scale of 0 – 50)
            - Structure Removal Recommended: Function = 0

Remediation Priority Index (RPI) Description

Remediation Priority Index (RPI) Ranking

The results of the inventory, rehabilitation, costs and priority rankings are submitted in the following tables. The tables are organized into structure and canal overall rankings. Additional tables summarize the structure and canal costs per system. The rankings are based on the RPI values which were discussed in Section 5.2.1.9. The higher a given structure or canal is ranked, the more immediate the need for improving or replacing the structure. The tables provide a replacement cost as well as a rehabilitation cost. No rehab is provided if the structure was identified as needing to be replaced. This is because the structure was in too poor of condition to be able to improve it without replacing it. The Remediation Cost at the end of the tables reflects the recommended cost associated with the structure. This is either the Rehab. Cost, or the Replacement Cost (CRV) if the structure is recommended for replacement.

In the Division Remediation Cost Summary table, the estimated structure and canal costs required to rehabilitate each given system are summarized and presented as a total. This could be a useful tool to identify system-wide remediation costs.

The Division Structure Remediation Cost Summary table identifies each structure within a given system that was identified and evaluated. It summarizes structure remediation costs for each system. The Division Canal Remediation Cost Summary table provides the same function, but for canal reaches within each system. Detailed remediation reports for each evaluated structure and canal reach can be found in Appendix 5-E. These sheets provide a detailed description, photos, and cost estimate for each structure and canal reach that was evaluated.

Remediation Priority Index (RPI)

Structure Ranking

(ranked by RPI value)

Clear Creek Unit / Division Structure Remediation Priority Ranking Summary

HKM ID	BIA ID	Canal	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category / Rating		Remediation Cost	Pg #
2PF-DD1		Pratt & Ferris #2	Diversion Dam (NT)	Replace	$0.00	$398,977.97	1.00	90	90	CHSci	Critical	$398,977.97	
3PF-DD1		Pratt & Ferris #3	Diversion Dam (NT)		$411,747.44	$484,704.13	0.85	100	85	CHSdm	Critical	$411,747.44	
FOX-HG1		Fox Ditch	Headgate (NT)		$143,454.92	$166,613.36	0.86	90	77	CMDM	Serious	$143,454.92	
RC-HG1		Rock Creek & South Piney	Headgate (NT)		$99,966.75	$120,835.13	0.83	90	75	CHSci	Critical	$99,966.75	
JH-SPN1		Johnson Holt	Siphon (NT)	Replace	$0.00	$53,196.99	1.00	70	70	CMDM	Critical	$53,196.99	
1PF-DD1		Pratt & Ferris #1	Diversion Dam (NT)		$221,844.28	$264,338.02	0.84	80	67	CHSci	Serious	$221,844.28	
LP-HG1		Little Piney Ditch	Headgate (NT)		$69,441.91	$86,716.13	0.8	80	64	CMDM	Critical	$69,441.91	
LD-HG1		Leiter Ditch	Headgate (NT)		$96,335.31	$157,081.99	0.61	100	61	CMDM	Minor	$96,335.31	
BB-CH1		Big Bonanza	Wasteway (NT)	Replace	$0.00	$72,209.58	1.00	60	60	CRPci	Critical	$72,209.58	
BF-HG1		Brown & Foster	Headgate (NT)	Replace	$0.00	$22,563.97	1.00	60	60	CMDM	Serious	$22,563.97	
BB-CH2		Big Bonanza	Check (NT)	Replace	$0.00	$8,477.26	1.00	60	60	CMDM	Serious	$8,477.26	
BB-CH3		Big Bonanza	Check (NT)	Replace	$0.00	$8,477.26	1.00	60	60	CMDM	Serious	$8,477.26	
BB-CH4		Big Bonanza	Check (NT)	Replace	$0.00	$8,477.26	1.00	60	60	CMDM	Serious	$8,477.26	
CD-CH2		Crown Ditch	Check (NT)	Replace	$0.00	$8,124.04	1.00	60	60	CMDM	Serious	$8,124.04	
CD-CH1		Crown Ditch	Check (NT)	Replace	$0.00	$8,124.04	1.00	60	60	CMDM	Serious	$8,124.04	
6M-HG1		Six Mile	Headgate (NT)		$154,386.65	$255,652.22	0.6	90	54	CHSci	Serious	$154,386.65	
LX-HG1		LX Ditch	Headgate (NT)		$147,438.80	$170,602.04	0.86	60	52	CMDM	Serious	$147,438.80	
MK-HG1		Fort McKinney Ditch	Headgate (NT)		$44,027.29	$51,122.37	0.86	60	52	CMDM	Minor	$44,027.29	
ST-HG1		Sturdovant Ditch	Headgate (NT)		$140,293.27	$176,415.35	0.8	60	48	CMDM	Serious	$140,293.27	
BR-DD1		Big Redman	Diversion Dam (NT)		$157,790.69	$273,848.95	0.58	80	46	CHSci	Serious	$157,790.69	
HO-SPN		Hillyer & Onslow	Siphon (NT)		$86,508.93	$99,412.03	0.87	50	44	CMDM	Critical	$86,508.93	
6M-SPN2		Six Mile	Siphon (NT)		$72,592.09	$131,412.81	0.55	80	44	CMDM	Serious	$72,592.09	
PD-HG1		Piney Divide	Headgate (NT)		$41,597.95	$98,545.07	0.42	100	42	CMDM	Critical	$41,597.95	
SNF-CH4		Senff Ditch	Check (NT)	Replace	$0.00	$13,691.63	1.00	40	40	CMDM	Serious	$13,691.63	
SNF-CH3		Senff Ditch	Check (NT)	Replace	$0.00	$13,691.63	1.00	40	40	CMDM	Serious	$13,691.63	
SNF-CH2		Senff Ditch	Check (NT)	Replace	$0.00	$13,691.63	1.00	40	40	CMDM	Serious	$13,691.63	
SNF-CH1		Senff Ditch	Check (NT)	Replace	$0.00	$13,691.63	1.00	40	40	CMDM	Serious	$13,691.63	
SNF-CH5		Senff Ditch	Check (NT)	Replace	$0.00	$8,395.64	1.00	40	40	CMDM	Serious	$8,395.64	
BB-TO1		Big Bonanza	Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO12		Big Bonanza	Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO11		Big Bonanza	Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	

Clear Creek Unit / Division Structure Remediation Priority Ranking Summary

HKM ID	BIA ID	Canal	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category / Rating		Remediation Cost	Pg #
BB-TO2		Big Bonanza	Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO3		Big Bonanza	Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO9		Big Bonanza	Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO10		Big Bonanza	Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO7		Big Bonanza	Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO8		Big Bonanza	Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO4		Big Bonanza	Turnout (NT)	Replace	$0.00	$5,651.68	1.00	40	40	CMDM	Serious	$5,651.68	
BB-TO6		Big Bonanza	Turnout (NT)	Replace	$0.00	$5,651.68	1.00	40	40	CMDM	Serious	$5,651.68	
BB-TO5		Big Bonanza	Turnout (NT)	Replace	$0.00	$5,651.68	1.00	40	40	CMDM	Serious	$5,651.68	
JH-HG1		Johnson Holt	Headgate (NT)		$133,546.49	$297,959.59	0.45	80	36	CRPdm	Serious	$133,546.49	
SNF-HG1		Senff Ditch	Headgate (NT)		$75,217.03	$131,934.73	0.57	60	34	CMDM	Serious	$75,217.03	
WJD-HG		WJD Ditch	Headgate (NT)		$69,419.13	$122,307.21	0.57	60	34	C&ODM	Minor	$69,419.13	
LC-HG1		Last Chance	Headgate (NT)		$61,852.03	$126,773.67	0.49	70	34	CMDM	Minor	$61,852.03	
LP-WR1		Little Piney Ditch	Weir (NT)		$5,491.73	$11,227.29	0.49	60	29	C&ODM	Serious	$5,491.73	
LADD-H		Ladd Ditch	Headgate (NT)		$53,813.14	$129,341.85	0.42	60	25	CMDM	Critical	$53,813.14	
LADD-C		Ladd Ditch	Check (NT)		$8,261.71	$13,856.62	0.6	40	24	CMDM	Serious	$8,261.71	
DD-FL1		Dunlap Ditch	Flume (NT)		$29,180.80	$81,401.57	0.36	60	22	CMDM	Serious	$29,180.80	
BB-DD1		Big Bonanza	Diversion Dam (NT)		$124,846.58	$452,425.94	0.28	80	22	CHSci	Critical	$124,846.58	
HL-HG1		High Line Ditch	Headgate (NT)		$52,206.98	$177,739.50	0.29	60	17	CMDM	Serious	$52,206.98	
				Total for Project		***$4,806,722.52***						***$3,225,716.87***	

Remediation Priority Index (RPI)

Canal Ranking

(ranked by RPI value)

Clear Creek Unit / Division Canal Remediation Priority Ranking Summary

HKM ID	Canal	Section Type	Length	Rehabilitation Cost		FCI	API	RPI	Deficiency		Remediation	Pg #
				Total	$/FT				Category / Rating		Cost	
LD-4	Leiter Ditch	Canal Constriction	1,400 ft	$750,768.09	$536.26	1	100	100	CMDM	Serious	$750,768.09	
LD-2	Leiter Ditch	Seepage Area Lining	3,250 ft	$526,683.30	$162.06	1	100	100	CMDM	Serious	$526,683.30	
3PF-2	Pratt & Ferris #3	Seepage Area Lining	3,300 ft	$440,728.82	$133.55	1	100	100	CMDM	Minor	$440,728.82	
3PF-3	Pratt & Ferris #3	Seepage Area Lining	2,250 ft	$303,003.94	$134.67	1	100	100	CMDM	Serious	$303,003.94	
LDS-2	Lake Desmet Ditch	Seepage Area Lining	6,500 ft	$258,618.32	$39.79	1	100	100	CMDM	Minor	$258,618.32	
LD-3	Leiter Ditch	Seepage Area Lining	1,100 ft	$178,262.04	$162.06	1	100	100	CMDM	Serious	$178,262.04	
LDS-1	Lake Desmet Ditch	Cleaning/Reshaping	69,300 ft	$116,281.00	$1.68	1	100	100	C&ODM	Minor	$116,281.00	
3PF-1	Pratt & Ferris #3	Cleaning/Reshaping	49,400 ft	$66,017.60	$1.34	1	100	100	C&ODM	Minor	$66,017.60	
PD-2	Piney Divide	Seepage Area Lining	600 ft	$54,491.01	$90.82	1	100	100	CMDM	Serious	$54,491.01	
LD-1	Leiter Ditch	Cleaning/Reshaping	7,000 ft	$11,703.12	$1.67	1	100	100	C&ODM	Minor	$11,703.12	
PD-1	Piney Divide	Cleaning/Reshaping	8,250 ft	$9,002.40	$1.09	1	100	100	C&ODM	Minor	$9,002.40	
RC-5	Rock Creek & South Piney	Seepage Area Lining	2,900 ft	$405,256.50	$139.74	1	80	80	CMDM	Critical	$405,256.50	
2PF-2	Pratt & Ferris #2	Seepage Area Lining	2,950 ft	$270,486.84	$91.69	1	80	80	CRPci	Serious	$270,486.84	
HAL-3	Hallie Ditch	Seepage Area Lining	3,200 ft	$216,336.21	$67.61	1	80	80	CMDM	Serious	$216,336.21	
HAL-2	Hallie Ditch	Seepage Area Lining	2,100 ft	$142,850.49	$68.02	1	80	80	CMDM	Serious	$142,850.49	
RC-4	Rock Creek & South Piney	Seepage Area Lining	900 ft	$128,104.02	$142.34	1	80	80	CMDM	Critical	$128,104.02	
2PF-1	Pratt & Ferris #2	Cleaning/Reshaping	66,750 ft	$78,020.80	$1.17	1	80	80	C&ODM	Minor	$78,020.80	
6M-1	Six Mile	Cleaning/Reshaping	55,200 ft	$64,517.20	$1.17	1	80	80	C&ODM	Minor	$64,517.20	
RC-2	Rock Creek & South Piney	Seepage Area Lining	330 ft	$46,749.78	$141.67	1	80	80	CMDM	Critical	$46,749.78	
RC-3	Rock Creek & South Piney	Seepage Area Lining	325 ft	$46,749.78	$143.85	1	80	80	CMDM	Critical	$46,749.78	
HAL-1	Hallie Ditch	Cleaning/Reshaping	32,340 ft	$32,408.64	$1.00	1	80	80	C&ODM	Minor	$32,408.64	
RC-1	Rock Creek & South Piney	Seepage Area Lining	175 ft	$24,163.92	$138.08	1	80	80	CMDM	Critical	$24,163.92	
FOX-1	Fox Ditch	Cleaning/Reshaping	13,680 ft	$12,565.85	$0.92	1	80	80	C&ODM	Minor	$12,565.85	
BB-2	Big Bonanza	Canal Liner Rehabilitation	5,700 ft	$243,967.68	$42.80	1	60	60	CMDM	Serious	$243,967.68	
LP-2	Little Piney Ditch	Seepage Area Lining	3,200 ft	$217,903.54	$68.09	1	60	60	CMDM	Serious	$217,903.54	
BR-3	Big Redman	Seepage Area Lining	3,700 ft	$188,072.24	$50.83	1	60	60	CMDM	Serious	$188,072.24	
JH-2	Johnson Holt	Sediment Deposition	1,250 ft	$69,985.57	$55.99	1	60	60	CMDM	Serious	$69,985.57	
JH-1	Johnson Holt	Cleaning/Reshaping	43,630 ft	$43,661.64	$1.00	1	60	60	C&ODM	Minor	$43,661.64	
1PF-1	Pratt & Ferris #1	Cleaning/Reshaping	36,760 ft	$42,911.44	$1.17	1	60	60	C&ODM	Minor	$42,911.44	
BB-1	Big Bonanza	Cleaning/Reshaping	28,190 ft	$28,507.60	$1.01	1	60	60	C&ODM	Minor	$28,507.60	
BR-1	Big Redman	Cleaning/Reshaping	24,500 ft	$20,480.46	$0.84	1	60	60	C&ODM	Minor	$20,480.46	
LP-1	Little Piney Ditch	Cleaning/Reshaping	15,700 ft	$17,029.54	$1.08	1	60	60	C&ODM	Minor	$17,029.54	
BR-4	Big Redman	Wasteway Headcutting	1,300 ft	$16,374.60	$12.60	1	60	60	CMDM	Serious	$16,374.60	
BR-2	Big Redman	Bank Instability	300 ft	$9,551.52	$31.84	1	60	60	CMDM	Serious	$9,551.52	
FH-2	Frank Hopkins	Seepage Area Lining	4,400 ft	$225,545.68	$51.26	1	40	40	CMDM	Serious	$225,545.68	
PA-3	Prince Albert	Seepage Area Lining	1,600 ft	$82,653.08	$51.66	1	40	40	CMDM	Serious	$82,653.08	
PA-2	Prince Albert	Seepage Area Lining	1,320 ft	$68,597.19	$51.97	1	40	40	CMDM	Serious	$68,597.19	
DD-2	Dunlap Ditch	Seepage Area Lining	550 ft	$29,943.50	$54.44	1	40	40	CMDM	Critical	$29,943.50	
PA-1	Prince Albert	Cleaning/Reshaping	22,500 ft	$22,506.00	$1.00	1	40	40	C&ODM	Minor	$22,506.00	

Clear Creek Unit / Division Canal Remediation Priority Ranking Summary

HKM ID	Canal	Section Type	Length	Rehabilitation Cost Total	$/FT	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
FH-1	Frank Hopkins	Cleaning/Reshaping	21,000 ft	$17,629.70	$0.84	1	40	40	C&ODM	Minor	$17,629.70	
LC-1	Last Chance	Cleaning/Reshaping	22,000 ft	$16,504.40	$0.75	1	40	40	C&ODM	Minor	$16,504.40	
LC-2	Last Chance	Bank Instability	215 ft	$15,780.73	$73.40	1	40	40	CMDM	Serious	$15,780.73	
DD-1	Dunlap Ditch	Cleaning/Reshaping	11,740 ft	$9,827.62	$0.84	1	40	40	C&ODM	Minor	$9,827.62	
WJD-2	WJD Ditch	Seepage Area Lining	5,200 ft	$441,417.24	$84.89	1	20	20	CMDM	Critical	$441,417.24	
BF-2	Brown & Foster	Pipeline Rehabilitation	6,900 ft	$289,761.69	$41.99	1	20	20	CMDM	Minor	$289,761.69	
BF-3	Brown & Foster	Bank Instability	7,580 ft	$177,280.75	$23.39	1	20	20	CRPci	Serious	$177,280.75	
HL-2	High Line Ditch	Seepage Area Lining	7,800 ft	$172,026.29	$22.05	1	20	20	CRPci	Critical	$172,026.29	
JC-1	Johnson Creek	Pipeline Rehabilitation	3,480 ft	$102,845.52	$29.55	1	20	20	CMDM	Minor	$102,845.52	
ST-2	Sturdovant Ditch	Seepage Area Lining	1,400 ft	$96,086.85	$68.63	1	20	20	CMDM	Serious	$96,086.85	
SNF-2	Senff Ditch	Seepage Area Lining	2,500 ft	$74,431.70	$29.77	1	20	20	CMDM	Serious	$74,431.70	
ONO-3	Ono Ditch	Seepage Area Lining	2,400 ft	$71,807.96	$29.92	1	20	20	CMDM	Serious	$71,807.96	
LX-2	LX Ditch	Canal Constriction	1,950 ft	$61,115.26	$31.34	1	20	20	CMDM	Serious	$61,115.26	
ONO-2	Ono Ditch	Seepage Area Lining	1,300 ft	$39,965.60	$30.74	1	20	20	CMDM	Serious	$39,965.60	
LX-3	LX Ditch	Seepage Area Lining	1,000 ft	$33,615.04	$33.62	1	20	20	CMDM	Serious	$33,615.04	
MK-1	Fort McKinney Ditch	Pipeline Rehabilitation	600 ft	$17,368.56	$28.95	1	20	20	CMDM	Serious	$17,368.56	
ST-1	Sturdovant Ditch	Cleaning/Reshaping	20,100 ft	$16,804.48	$0.84	1	20	20	C&ODM	Minor	$16,804.48	
WJD-1	WJD Ditch	Cleaning/Reshaping	16,100 ft	$13,503.60	$0.84	1	20	20	C&ODM	Minor	$13,503.60	
LX-1	LX Ditch	Cleaning/Reshaping	13,000 ft	$8,702.32	$0.67	1	20	20	C&ODM	Minor	$8,702.32	
LADD-1	Ladd Ditch	Cleaning/Reshaping	9,200 ft	$7,689.55	$0.84	1	20	20	C&ODM	Minor	$7,689.55	
ONO-1	Ono Ditch	Cleaning/Reshaping	8,000 ft	$6,676.78	$0.83	1	20	20	C&ODM	Minor	$6,676.78	
BF-1	Brown & Foster	Cleaning/Reshaping	5,600 ft	$6,001.60	$1.07	1	20	20	C&ODM	Minor	$6,001.60	
HO-1	Hillyer & Onslow	Cleaning/Reshaping	8,700 ft	$5,776.54	$0.66	1	20	20	C&ODM	Minor	$5,776.54	
JC-2	Johnson Creek	Cleaning/Reshaping	6,900 ft	$3,450.92	$0.50	1	20	20	C&ODM	Minor	$3,450.92	
SNF-1	Senff Ditch	Cleaning/Reshaping	4,280 ft	$2,888.27	$0.67	1	20	20	C&ODM	Minor	$2,888.27	
HL-1	High Line Ditch	Cleaning/Reshaping	3,500 ft	$2,625.70	$0.75	1	20	20	C&ODM	Minor	$2,625.70	
1PF-2	Pratt & Ferris #1	Bank Instability	500 ft	$0.00	$0.00					None	$0.00	
			Total for Unit / Division	***$7,223,045.65***							***$7,223,045.65***	

Assessment Cost Summary by Irrigation System

Clear Creek Unit / Division Remediation Cost Summary

Big Bonanza [BB-1]

Structure Cost: $295,152.38

Canal Cost: $272,475.28

Total Cost: ***$567,627.66***

Big Redman [BR-1]

Structure Cost: $157,790.69

Canal Cost: $234,478.82

Total Cost: ***$392,269.51***

Brown & Foster [BF-1]

Structure Cost: $22,563.97

Canal Cost: $473,044.04

Total Cost: ***$495,608.01***

Crown Ditch [CR-1]

Structure Cost: $16,248.08

Canal Cost: $0.00

Total Cost: ***$16,248.08***

Dunlap Ditch [DUN-1]

Structure Cost: $29,180.80

Canal Cost: $39,771.12

Total Cost: ***$68,951.92***

Fort McKinney Ditch [MK-1]

Structure Cost: $44,027.29

Canal Cost: $17,368.56

Total Cost: ***$61,395.85***

Fox Ditch [FOX-1]

Structure Cost: $143,454.92

Canal Cost: $12,565.85

Total Cost: ***$156,020.77***

Frank Hopkins [FH-1]

Structure Cost: $0.00

Canal Cost: $243,175.38

Total Cost: ***$243,175.38***

Hallie Ditch [HAL-1]

Structure Cost: $0.00

Canal Cost: $391,595.35

Total Cost: ***$391,595.35***

High Line Ditch [HL-1]

Structure Cost: $52,206.98

Canal Cost: $174,651.99

Total Cost: ***$226,858.98***

Hillyer & Onslow [HO-1]

Structure Cost: $86,508.93

Canal Cost: $5,776.54

Total Cost: ***$92,285.47***

Clear Creek Unit / Division Remediation Cost Summary

Johnson Creek [JC-1]

Structure Cost:	$0.00
Canal Cost:	$106,296.44
Total Cost:	***$106,296.44***

Johnson Holt [JH-1]

Structure Cost:	$186,743.48
Canal Cost:	$113,647.21
Total Cost:	***$300,390.69***

Ladd Ditch [LADD-1]

Structure Cost:	$62,074.85
Canal Cost:	$7,689.55
Total Cost:	***$69,764.40***

Lake Desmet Ditch [LDS-1]

Structure Cost:	$0.00
Canal Cost:	$374,899.32
Total Cost:	***$374,899.32***

Last Chance [LC-1]

Structure Cost:	$61,852.03
Canal Cost:	$32,285.13
Total Cost:	***$94,137.16***

Leiter Ditch [LD-1]

Structure Cost:	$96,335.31
Canal Cost:	$1,467,416.55
Total Cost:	***$1,563,751.86***

Little Piney Ditch [LP-1]

Structure Cost:	$74,933.65
Canal Cost:	$234,933.08
Total Cost:	***$309,866.73***

LX Ditch [LX-1]

Structure Cost:	$147,438.80
Canal Cost:	$103,432.62
Total Cost:	***$250,871.42***

Ono Ditch [ONO-1]

Structure Cost:	$0.00
Canal Cost:	$118,450.34
Total Cost:	***$118,450.34***

Piney Divide [PD-1]

Structure Cost:	$41,597.95
Canal Cost:	$63,493.41
Total Cost:	***$105,091.36***

Pratt & Ferris #1 [PF-1]

Structure Cost:	$221,844.28
Canal Cost:	$42,911.44
Total Cost:	***$264,755.72***

Clear Creek Unit / Division Remediation Cost Summary

Pratt & Ferris #2 [PF-2]

Structure Cost:	$398,977.97
Canal Cost:	$348,507.64
Total Cost:	***$747,485.60***

Pratt & Ferris #3 [PF-3]

Structure Cost:	$411,747.44
Canal Cost:	$809,750.36
Total Cost:	***$1,221,497.80***

Prince Albert [PA-1]

Structure Cost:	$0.00
Canal Cost:	$173,756.27
Total Cost:	***$173,756.27***

Rock Creek & South Piney Ditch [RC-1]

Structure Cost:	$99,966.75
Canal Cost:	$651,024.00
Total Cost:	***$750,990.75***

Senff Ditch [SEN-1]

Structure Cost:	$138,379.18
Canal Cost:	$77,319.97
Total Cost:	***$215,699.15***

Six Mile [6M-1]

Structure Cost:	$226,978.75
Canal Cost:	$64,517.20
Total Cost:	***$291,495.95***

Sturdovant Ditch [ST-1]

Structure Cost:	$140,293.27
Canal Cost:	$112,891.33
Total Cost:	***$253,184.61***

WJD Ditch [WJD-1]

Structure Cost:	$69,419.13
Canal Cost:	$454,920.84
Total Cost:	***$524,339.98***

Grand Total ***$10,448,762.52***

Structure Remediation Cost Summary by Irrigation System

Clear Creek Unit / Division Structure Remediation Cost Summary

Big Bonanza [BB-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category /	Rating	Remediation Cost	Pg #
BB-CH1		Wasteway (NT)	Replace	$0.00	$72,209.58	1.00	60	60	CRPci	Critical	$72,209.58	
BB-CH3		Check (NT)	Replace	$0.00	$8,477.26	1.00	60	60	CMDM	Serious	$8,477.26	
BB-CH2		Check (NT)	Replace	$0.00	$8,477.26	1.00	60	60	CMDM	Serious	$8,477.26	
BB-CH4		Check (NT)	Replace	$0.00	$8,477.26	1.00	60	60	CMDM	Serious	$8,477.26	
BB-TO2		Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO12		Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO11		Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO10		Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO3		Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO8		Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO7		Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO1		Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO9		Turnout (NT)	Replace	$0.00	$6,189.93	1.00	40	40	CMDM	Serious	$6,189.93	
BB-TO4		Turnout (NT)	Replace	$0.00	$5,651.68	1.00	40	40	CMDM	Serious	$5,651.68	
BB-TO5		Turnout (NT)	Replace	$0.00	$5,651.68	1.00	40	40	CMDM	Serious	$5,651.68	
BB-TO6		Turnout (NT)	Replace	$0.00	$5,651.68	1.00	40	40	CMDM	Serious	$5,651.68	
BB-DD1		Diversion Dam (NT)		$124,846.58	$452,425.94	0.28	80	22	CHSci	Critical	$124,846.58	
			Total for Canal		***$622,731.74***						***$295,152.38***	

Big Redman [BR-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category /	Rating	Remediation Cost	Pg #
BR-DD1		Diversion Dam (NT)		$157,790.69	$273,848.95	0.58	80	46	CHSci	Serious	$157,790.69	
			Total for Canal		***$273,848.95***						***$157,790.69***	

Brown & Foster [BF-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category /	Rating	Remediation Cost	Pg #
BF-HG1		Headgate (NT)	Replace	$0.00	$22,563.97	1.00	60	60	CMDM	Serious	$22,563.97	
			Total for Canal		***$22,563.97***						***$22,563.97***	

Crown Ditch [CR-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category /	Rating	Remediation Cost	Pg #
CD-CH1		Check (NT)	Replace	$0.00	$8,124.04	1.00	60	60	CMDM	Serious	$8,124.04	
CD-CH2		Check (NT)	Replace	$0.00	$8,124.04	1.00	60	60	CMDM	Serious	$8,124.04	
			Total for Canal		***$16,248.08***						***$16,248.08***	

Clear Creek Unit / Division Structure Remediation Cost Summary

Dunlap Ditch [DUN-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
DD-FL1		Flume (NT)		$29,180.80	$81,401.57	0.36	60	22	CMDM	Serious	$29,180.80	
			Total for Canal		***$81,401.57***						***$29,180.80***	

Fort McKinney Ditch [MK-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
MK-HG1		Headgate (NT)		$44,027.29	$51,122.37	0.86	60	52	CMDM	Minor	$44,027.29	
			Total for Canal		***$51,122.37***						***$44,027.29***	

Fox Ditch [FOX-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
FOX-HG1		Headgate (NT)		$143,454.92	$166,613.36	0.86	90	77	CMDM	Serious	$143,454.92	
			Total for Canal		***$166,613.36***						***$143,454.92***	

High Line Ditch [HL-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
HL-HG1		Headgate (NT)		$52,206.98	$177,739.50	0.29	60	17	CMDM	Serious	$52,206.98	
			Total for Canal		***$177,739.50***						***$52,206.98***	

Hillyer & Onslow [HO-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
HO-SPN		Siphon (NT)		$86,508.93	$99,412.03	0.87	50	44	CMDM	Critical	$86,508.93	
			Total for Canal		***$99,412.03***						***$86,508.93***	

Johnson Holt [JH-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
JH-SPN1		Siphon (NT)	Replace	$0.00	$53,196.99	1.00	70	70	CMDM	Critical	$53,196.99	
JH-HG1		Headgate (NT)		$133,546.49	$297,959.59	0.45	80	36	CRPdm	Serious	$133,546.49	
			Total for Canal		***$351,156.58***						***$186,743.48***	

Clear Creek Unit / Division Structure Remediation Cost Summary

Ladd Ditch [LADD-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
LADD-H		Headgate (NT)		$53,813.14	$129,341.85	0.42	60	25	CMDM	Critical	$53,813.14	
LADD-C		Check (NT)		$8,261.71	$13,856.62	0.6	40	24	CMDM	Serious	$8,261.71	
			Total for Canal		***$143,198.47***						***$62,074.85***	

Last Chance [LC-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
LC-HG1		Headgate (NT)		$61,852.03	$126,773.67	0.49	70	34	CMDM	Minor	$61,852.03	
			Total for Canal		***$126,773.67***						***$61,852.03***	

Leiter Ditch [LD-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
LD-HG1		Headgate (NT)		$96,335.31	$157,081.99	0.61	100	61	CMDM	Minor	$96,335.31	
			Total for Canal		***$157,081.99***						***$96,335.31***	

Little Piney Ditch [LP-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
LP-HG1		Headgate (NT)		$69,441.91	$86,716.13	0.8	80	64	CMDM	Critical	$69,441.91	
LP-WR1		Weir (NT)		$5,491.73	$11,227.29	0.49	60	29	C&ODM	Serious	$5,491.73	
			Total for Canal		***$97,943.42***						***$74,933.65***	

LX Ditch [LX-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
LX-HG1		Headgate (NT)		$147,438.80	$170,602.04	0.86	60	52	CMDM	Serious	$147,438.80	
			Total for Canal		***$170,602.04***						***$147,438.80***	

Piney Divide [PD-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
PD-HG1		Headgate (NT)		$41,597.95	$98,545.07	0.42	100	42	CMDM	Critical	$41,597.95	
			Total for Canal		***$98,545.07***						***$41,597.95***	

Clear Creek Unit / Division Structure Remediation Cost Summary

Pratt & Ferris #1 [PF-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category /	Rating	Remediation Cost	Pg #
1PF-DD1		Diversion Dam (NT)		$221,844.28	$264,338.02	0.84	80	67	CHSci	Serious	$221,844.28	
			Total for Canal		*$264,338.02*						*$221,844.28*	

Pratt & Ferris #2 [PF-2]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category /	Rating	Remediation Cost	Pg #
2PF-DD1		Diversion Dam (NT)	Replace	$0.00	$398,977.97	1.00	90	90	CHSci	Critical	$398,977.97	
			Total for Canal		*$398,977.97*						*$398,977.97*	

Pratt & Ferris #3 [PF-3]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category /	Rating	Remediation Cost	Pg #
3PF-DD1		Diversion Dam (NT)		$411,747.44	$484,704.13	0.85	100	85	CHSdm	Critical	$411,747.44	
			Total for Canal		*$484,704.13*						*$411,747.44*	

Rock Creek & South Piney Ditch [RC-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category /	Rating	Remediation Cost	Pg #
RC-HG1		Headgate (NT)		$99,966.75	$120,835.13	0.83	90	75	CHSci	Critical	$99,966.75	
			Total for Canal		*$120,835.13*						*$99,966.75*	

Senff Ditch [SEN-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category /	Rating	Remediation Cost	Pg #
SNF-CH1		Check (NT)	Replace	$0.00	$13,691.63	1.00	40	40	CMDM	Serious	$13,691.63	
SNF-CH2		Check (NT)	Replace	$0.00	$13,691.63	1.00	40	40	CMDM	Serious	$13,691.63	
SNF-CH3		Check (NT)	Replace	$0.00	$13,691.63	1.00	40	40	CMDM	Serious	$13,691.63	
SNF-CH4		Check (NT)	Replace	$0.00	$13,691.63	1.00	40	40	CMDM	Serious	$13,691.63	
SNF-CH5		Check (NT)	Replace	$0.00	$8,395.64	1.00	40	40	CMDM	Serious	$8,395.64	
SNF-HG1		Headgate (NT)		$75,217.03	$131,934.73	0.57	60	34	CMDM	Serious	$75,217.03	
			Total for Canal		*$195,096.87*						*$138,379.18*	

Six Mile [6M-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category /	Rating	Remediation Cost	Pg #
6M-HG1		Headgate (NT)		$154,386.65	$255,652.22	0.6	90	54	CHSci	Serious	$154,386.65	
6M-SPN2		Siphon (NT)		$72,592.09	$131,412.81	0.55	80	44	CMDM	Serious	$72,592.09	
			Total for Canal		*$387,065.03*						*$226,978.75*	

Clear Creek Unit / Division Structure Remediation Cost Summary

Sturdovant Ditch [ST-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
ST-HG1		Headgate (NT)		$140,293.27	$176,415.35	0.8	60	48	CMDM	Serious	$140,293.27	
			Total for Canal		***$176,415.35***						***$140,293.27***	

WJD Ditch [WJD-1]

HKM ID	BIA ID	Structure Type	Action	Rehab. Cost	CRV	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
WJD-HG		Headgate (NT)		$69,419.13	$122,307.21	0.57	60	34	C&ODM	Minor	$69,419.13	
			Total for Canal		***$122,307.21***						***$69,419.13***	
			Total for Unit / Division		***$4,806,722.52***						***$3,225,716.87***	

Canal Remediation Cost Summary by Irrigation System

Clear Creek Unit / Division Canal Remediation Cost Summary

Big Bonanza [BB-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
BB-2	Canal Liner Rehabilitation	5,700 ft	$243,967.68	$42.80	$0.00	1	60	60	CMDM	Serious	$243,967.68	
BB-1	Cleaning/Reshaping	28,190 ft	$28,507.60	$1.01	$0.00	1	60	60	C&ODM	Minor	$28,507.60	
			Total for Canal	***$272,475.28***							***$272,475.28***	

Big Redman [BR-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
BR-3	Seepage Area Lining	3,700 ft	$188,072.24	$50.83	$0.00	1	60	60	CMDM	Serious	$188,072.24	
BR-1	Cleaning/Reshaping	24,500 ft	$20,480.46	$0.84	$0.00	1	60	60	C&ODM	Minor	$20,480.46	
BR-4	Wasteway Headcutting	1,300 ft	$16,374.60	$12.60	$0.00	1	60	60	CMDM	Serious	$16,374.60	
BR-2	Bank Instability	300 ft	$9,551.52	$31.84	$0.00	1	60	60	CMDM	Serious	$9,551.52	
			Total for Canal	***$234,478.82***							***$234,478.82***	

Brown & Foster [BF-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
BF-2	Pipeline Rehabilitation	6,900 ft	$289,761.69	$41.99	$0.00	1	20	20	CMDM	Minor	$289,761.69	
BF-3	Bank Instability	7,580 ft	$177,280.75	$23.39	$0.00	1	20	20	CRPci	Serious	$177,280.75	
BF-1	Cleaning/Reshaping	5,600 ft	$6,001.60	$1.07	$0.00	1	20	20	C&ODM	Minor	$6,001.60	
			Total for Canal	***$473,044.04***							***$473,044.04***	

Dunlap Ditch [DUN-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
DD-2	Seepage Area Lining	550 ft	$29,943.50	$54.44	$0.00	1	40	40	CMDM	Critical	$29,943.50	
DD-1	Cleaning/Reshaping	11,740 ft	$9,827.62	$0.84	$0.00	1	40	40	C&ODM	Minor	$9,827.62	
			Total for Canal	***$39,771.12***							***$39,771.12***	

Fort McKinney Ditch [MK-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
MK-1	Pipeline Rehabilitation	600 ft	$17,368.56	$28.95	$0.00	1	20	20	CMDM	Serious	$17,368.56	
			Total for Canal	***$17,368.56***							***$17,368.56***	

Fox Ditch [FOX-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
FOX-1	Cleaning/Reshaping	13,680 ft	$12,565.85	$0.92	$0.00	1	80	80	C&ODM	Minor	$12,565.85	
			Total for Canal	***$12,565.85***							***$12,565.85***	

Clear Creek Unit / Division Canal Remediation Cost Summary

Frank Hopkins [FH-1]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category /	Rating	Cost	Pg #
FH-2	Seepage Area Lining	4,400 ft	$225,545.68	$51.26	$0.00	1	40	40	CMDM	Serious	$225,545.68	
FH-1	Cleaning/Reshaping	21,000 ft	$17,629.70	$0.84	$0.00	1	40	40	C&ODM	Minor	$17,629.70	
			Total for Canal	***$243,175.38***							***$243,175.38***	

Hallie Ditch [HAL-1]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category /	Rating	Cost	Pg #
HAL-3	Seepage Area Lining	3,200 ft	$216,336.21	$67.61	$0.00	1	80	80	CMDM	Serious	$216,336.21	
HAL-2	Seepage Area Lining	2,100 ft	$142,850.49	$68.02	$0.00	1	80	80	CMDM	Serious	$142,850.49	
HAL-1	Cleaning/Reshaping	32,340 ft	$32,408.64	$1.00	$0.00	1	80	80	C&ODM	Minor	$32,408.64	
			Total for Canal	***$391,595.35***							***$391,595.35***	

High Line Ditch [HL-1]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category /	Rating	Cost	Pg #
HL-2	Seepage Area Lining	7,800 ft	$172,026.29	$22.05	$0.00	1	20	20	CRPci	Critical	$172,026.29	
HL-1	Cleaning/Reshaping	3,500 ft	$2,625.70	$0.75	$0.00	1	20	20	C&ODM	Minor	$2,625.70	
			Total for Canal	***$174,651.99***							***$174,651.99***	

Hillyer & Onslow [HO-1]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category /	Rating	Cost	Pg #
HO-1	Cleaning/Reshaping	8,700 ft	$5,776.54	$0.66	$0.00	1	20	20	C&ODM	Minor	$5,776.54	
			Total for Canal	***$5,776.54***							***$5,776.54***	

Johnson Creek [JC-1]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category /	Rating	Cost	Pg #
JC-1	Pipeline Rehabilitation	3,480 ft	$102,845.52	$29.55	$0.00	1	20	20	CMDM	Minor	$102,845.52	
JC-2	Cleaning/Reshaping	6,900 ft	$3,450.92	$0.50	$0.00	1	20	20	C&ODM	Minor	$3,450.92	
			Total for Canal	***$106,296.44***							***$106,296.44***	

Johnson Holt [JH-1]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category /	Rating	Cost	Pg #
JH-2	Sediment Deposition	1,250 ft	$69,985.57	$55.99	$0.00	1	60	60	CMDM	Serious	$69,985.57	
JH-1	Cleaning/Reshaping	43,630 ft	$43,661.64	$1.00	$0.00	1	60	60	C&ODM	Minor	$43,661.64	
			Total for Canal	***$113,647.21***							***$113,647.21***	

Clear Creek Unit / Division Canal Remediation Cost Summary

Ladd Ditch [LADD-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category /**	**Rating**	**Cost**	**Pg #**
LADD-1	Cleaning/Reshaping	9,200 ft	$7,689.55	$0.84	$0.00	1	20	20	C&ODM	Minor	$7,689.55	
			Total for Canal	***$7,689.55***							***$7,689.55***	

Lake Desmet Ditch [LDS-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category /**	**Rating**	**Cost**	**Pg #**
LDS-2	Seepage Area Lining	6,500 ft	$258,618.32	$39.79	$0.00	1	100	100	CMDM	Minor	$258,618.32	
LDS-1	Cleaning/Reshaping	69,300 ft	$116,281.00	$1.68	$0.00	1	100	100	C&ODM	Minor	$116,281.00	
			Total for Canal	***$374,899.32***							***$374,899.32***	

Last Chance [LC-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category /**	**Rating**	**Cost**	**Pg #**
LC-1	Cleaning/Reshaping	22,000 ft	$16,504.40	$0.75	$0.00	1	40	40	C&ODM	Minor	$16,504.40	
LC-2	Bank Instability	215 ft	$15,780.73	$73.40	$0.00	1	40	40	CMDM	Serious	$15,780.73	
			Total for Canal	***$32,285.13***							***$32,285.13***	

Leiter Ditch [LD-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category /**	**Rating**	**Cost**	**Pg #**
LD-4	Canal Constriction	1,400 ft	$750,768.09	$536.26	$0.00	1	100	100	CMDM	Serious	$750,768.09	
LD-2	Seepage Area Lining	3,250 ft	$526,683.30	$162.06	$0.00	1	100	100	CMDM	Serious	$526,683.30	
LD-3	Seepage Area Lining	1,100 ft	$178,262.04	$162.06	$0.00	1	100	100	CMDM	Serious	$178,262.04	
LD-1	Cleaning/Reshaping	7,000 ft	$11,703.12	$1.67	$0.00	1	100	100	C&ODM	Minor	$11,703.12	
			Total for Canal	***$1,467,416.55***							***$1,467,416.55***	

Little Piney Ditch [LP-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category /**	**Rating**	**Cost**	**Pg #**
LP-2	Seepage Area Lining	3,200 ft	$217,903.54	$68.09	$0.00	1	60	60	CMDM	Serious	$217,903.54	
LP-1	Cleaning/Reshaping	15,700 ft	$17,029.54	$1.08	$0.00	1	60	60	C&ODM	Minor	$17,029.54	
			Total for Canal	***$234,933.08***							***$234,933.08***	

LX Ditch [LX-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category /**	**Rating**	**Cost**	**Pg #**
LX-2	Canal Constriction	1,950 ft	$61,115.26	$31.34	$0.00	1	20	20	CMDM	Serious	$61,115.26	
LX-3	Seepage Area Lining	1,000 ft	$33,615.04	$33.62	$0.00	1	20	20	CMDM	Serious	$33,615.04	
LX-1	Cleaning/Reshaping	13,000 ft	$8,702.32	$0.67	$0.00	1	20	20	C&ODM	Minor	$8,702.32	
			Total for Canal	***$103,432.62***							***$103,432.62***	

Clear Creek Unit / Division Canal Remediation Cost Summary

Ono Ditch [ONO-1]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category	/ Rating	Cost	Pg #
ONO-3	Seepage Area Lining	2,400 ft	$71,807.96	$29.92	$0.00	1	20	20	CMDM	Serious	$71,807.96	
ONO-2	Seepage Area Lining	1,300 ft	$39,965.60	$30.74	$0.00	1	20	20	CMDM	Serious	$39,965.60	
ONO-1	Cleaning/Reshaping	8,000 ft	$6,676.78	$0.83	$0.00	1	20	20	C&ODM	Minor	$6,676.78	
			Total for Canal	***$118,450.34***							***$118,450.34***	

Piney Divide [PD-1]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category	/ Rating	Cost	Pg #
PD-2	Seepage Area Lining	600 ft	$54,491.01	$90.82	$0.00	1	100	100	CMDM	Serious	$54,491.01	
PD-1	Cleaning/Reshaping	8,250 ft	$9,002.40	$1.09	$0.00	1	100	100	C&ODM	Minor	$9,002.40	
			Total for Canal	***$63,493.41***							***$63,493.41***	

Pratt & Ferris #1 [PF-1]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category	/ Rating	Cost	Pg #
1PF-1	Cleaning/Reshaping	36,760 ft	$42,911.44	$1.17	$0.00	1	60	60	C&ODM	Minor	$42,911.44	
1PF-2	Bank Instability	500 ft	$0.00	$0.00						None	$0.00	
			Total for Canal	***$42,911.44***							***$42,911.44***	

Pratt & Ferris #2 [PF-2]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category	/ Rating	Cost	Pg #
2PF-2	Seepage Area Lining	2,950 ft	$270,486.84	$91.69	$0.00	1	80	80	CRPci	Serious	$270,486.84	
2PF-1	Cleaning/Reshaping	66,750 ft	$78,020.80	$1.17	$0.00	1	80	80	C&ODM	Minor	$78,020.80	
			Total for Canal	***$348,507.64***							***$348,507.64***	

Pratt & Ferris #3 [PF-3]

									Deficiency		Remediation	
HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Category	/ Rating	Cost	Pg #
3PF-2	Seepage Area Lining	3,300 ft	$440,728.82	$133.55	$0.00	1	100	100	CMDM	Minor	$440,728.82	
3PF-3	Seepage Area Lining	2,250 ft	$303,003.94	$134.67	$0.00	1	100	100	CMDM	Serious	$303,003.94	
3PF-1	Cleaning/Reshaping	49,400 ft	$66,017.60	$1.34	$0.00	1	100	100	C&ODM	Minor	$66,017.60	
			Total for Canal	***$809,750.36***							***$809,750.36***	

Clear Creek Unit / Division Canal Remediation Cost Summary

Prince Albert [PA-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
PA-3	Seepage Area Lining	1,600 ft	$82,653.08	$51.66	$0.00	1	40	40	CMDM	Serious	$82,653.08	
PA-2	Seepage Area Lining	1,320 ft	$68,597.19	$51.97	$0.00	1	40	40	CMDM	Serious	$68,597.19	
PA-1	Cleaning/Reshaping	22,500 ft	$22,506.00	$1.00	$0.00	1	40	40	C&ODM	Minor	$22,506.00	
			Total for Canal	*$173,756.27*							*$173,756.27*	

Rock Creek & South Piney Ditch [RC-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
RC-5	Seepage Area Lining	2,900 ft	$405,256.50	$139.74	$0.00	1	80	80	CMDM	Critical	$405,256.50	
RC-4	Seepage Area Lining	900 ft	$128,104.02	$142.34	$0.00	1	80	80	CMDM	Critical	$128,104.02	
RC-2	Seepage Area Lining	330 ft	$46,749.78	$141.67	$0.00	1	80	80	CMDM	Critical	$46,749.78	
RC-3	Seepage Area Lining	325 ft	$46,749.78	$143.85	$0.00	1	80	80	CMDM	Critical	$46,749.78	
RC-1	Seepage Area Lining	175 ft	$24,163.92	$138.08	$0.00	1	80	80	CMDM	Critical	$24,163.92	
			Total for Canal	*$651,024.00*							*$651,024.00*	

Senff Ditch [SEN-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
SNF-2	Seepage Area Lining	2,500 ft	$74,431.70	$29.77	$0.00	1	20	20	CMDM	Serious	$74,431.70	
SNF-1	Cleaning/Reshaping	4,280 ft	$2,888.27	$0.67	$0.00	1	20	20	C&ODM	Minor	$2,888.27	
			Total for Canal	*$77,319.97*							*$77,319.97*	

Six Mile [6M-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
6M-1	Cleaning/Reshaping	55,200 ft	$64,517.20	$1.17	$0.00	1	80	80	C&ODM	Minor	$64,517.20	
			Total for Canal	*$64,517.20*							*$64,517.20*	

Sturdovant Ditch [ST-1]

									Deficiency		Remediation	
HKM ID	**Section Type**	**Length**	**Rehab. Cost**	**$/FT**	**$/FT**	**FCI**	**API**	**RPI**	**Category**	**/ Rating**	**Cost**	**Pg #**
ST-2	Seepage Area Lining	1,400 ft	$96,086.85	$68.63	$0.00	1	20	20	CMDM	Serious	$96,086.85	
ST-1	Cleaning/Reshaping	20,100 ft	$16,804.48	$0.84	$0.00	1	20	20	C&ODM	Minor	$16,804.48	
			Total for Canal	*$112,891.33*							*$112,891.33*	

Clear Creek Unit / Division Canal Remediation Cost Summary

WJD Ditch [WJD-1]

HKM ID	Section Type	Length	Rehab. Cost	$/FT	$/FT	FCI	API	RPI	Deficiency Category	/ Rating	Remediation Cost	Pg #
WJD-2	Seepage Area Lining	5,200 ft	$441,417.24	$84.89	$0.00	1	20	20	CMDM	Critical	$441,417.24	
WJD-1	Cleaning/Reshaping	16,100 ft	$13,503.60	$0.84	$0.00	1	20	20	C&ODM	Minor	$13,503.60	
			Total for Canal	***$454,920.84***							***$454,920.84***	
			Total for Unit / Division	***$7,223,045.65***							***$7,223,045.65***	

Structure Reports

Local Name: Sonny's Washout

HKM ID: **BB-CH1** ***BIA ID:*** ***Division:*** **Clear Creek**
Canal Name: **Big Bonanza** ***Structure Type:*** **Wasteway**
UTM Zone: **13** ***Coordinates:*** **377001.8, 4934787.3** ***Total # of Photos:*** **5**

Notes: This site is at the end of the Big Bonanza ditch. It appears that the ditch bank has broken down; allowing return flows to travel overland down to an old Piney Creek oxbow. This has created a head cut that started at the oxbow and is continuing back toward the ditch. This also disconnected the ditch so the land owner can no longer irrigate downstream of this location. A concrete check structure is recommended at this location which would allow water to spill into a 24" RCP pipe to the outfall, or continue down the ditch to irrigate downstream of the site. This site has been approved for remediation through the NRC and repairs are scheduled. Consequently, this site will not need to be remediated.

Remediation Assessment

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
RCP 24" D	450.0	FT	$89.40	$40,230.00
USBR Baffled Pipe Outlet: No. 3	1.0	Each	$7,546.95	$7,546.95
CIP Concrete	3.0	CY	$1,135.47	$3,406.41
Structural Fill	10.0	CY	$36.65	$366.50
Trash Rack	9.0	SF	$34.22	$307.98
Check Guides: Replace	12.0	FT	$19.87	$238.44
Structural Excavation	10.0	CY	$22.95	$229.50

Total Field Cost:		$52,325.78
Contingencies:	15%	$7,848.87
Subtotal:		$60,174.65
Engineering:	10%	$6,017.46
Mobilization:	10%	$6,017.46

Current Replacement Value (CRV): **$72,209.58**

Facilities Condition Index (FCI): 1.00
Asset Priority Index (API): 60
Remediation Priority Index (RPI): 60

Deficiency
Category: CRPci
Rating: Critical

HKM ID:	BB-CH2	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza			**Structure Type:**	Check
UTM Zone:	13	**Coordinates:**	0.0, 0.0	**Total # of Photos:**	0

Notes: This structure is the first conceptual check structure for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. It is recommended that a concrete check be installed to improve regulation. The actual location of the check would depend on landowner coordination during design.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
			Total Field Cost:	$6,142.94
		Contingencies:	15%	$921.44
			Subtotal:	$7,064.38
		Engineering:	10%	$706.44
		Mobilization:	10%	$706.44
			Current Replacement Value (CRV):	**$8,477.26**

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 60

Remediation Priority Index (RPI): 60

HKM ID:	BB-CH3	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza	**Structure Type:**	Check		
UTM Zone:	13	**Coordinates:**	376662.1, 4929796.6	**Total # of Photos:**	0

Notes: This structure is the first conceptual check structure for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. It is recommended that a concrete check be installed to improve regulation. The actual location of the check would depend on landowner coordination during design.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
			Total Field Cost:	$6,142.94
		Contingencies:	15%	$921.44
			Subtotal:	$7,064.38
		Engineering:	10%	$706.44
		Mobilization:	10%	$706.44

Current Replacement Value (CRV): **$8,477.26**

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 60

Remediation Priority Index (RPI): 60

HKM ID:	BB-CH4	***BIA ID:***		***Division:***	Clear Creek
Canal Name:	Big Bonanza			***Structure Type:***	Check
UTM Zone:	13	***Coordinates:***	0.0, 0.0	***Total # of Photos:***	0

Notes: This structure is the first conceptual check structure for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. It is recommended that a concrete check be installed to improve regulation. The actual location of the check would depend on landowner coordination during design.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
			Total Field Cost:	$6,142.94
		Contingencies:	15%	$921.44
			Subtotal:	$7,064.38
		Engineering:	10%	$706.44
		Mobilization:	10%	$706.44

Current Replacement Value (CRV): **$8,477.26**

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 60

Remediation Priority Index (RPI): 60

Local Name: Big Bonanza Diversion

HKM ID:	BB-DD1	***BIA ID:***		***Division:***	Clear Creek
Canal Name:	Big Bonanza	***Structure Type:***	Diversion Dam		
UTM Zone:	13	***Coordinates:***	376228.7, 4927504.2	***Total # of Photos:***	8

Notes: The Big Bonanza Ditch diverts out of Clear Creek approximately 5 miles upstream of the confluence with Piney Creek. The ditch has an appropriation of 22.2 cfs and irrigates approximately 1,550 acres. The head gate consists of a single 4 x 6-foot rectangular steel gate operated with a Waterman-type screw. The gate is mounted on a concrete headwall with flared wing walls. There is no trash rack or fish screen associated with the head gate. The diversion consists of three check bays and has recently been retrofitted to incorporate a fish ladder. Rehabilitation recommendations include a trash rack at the headgate, and installation of walkway and handrail across the check/diversion wall. Replacement assumes an overshot gate with new headgate. The overshot gate is included as landowners indicated that they didn't feel that the rock vane diversion would be appropriate at this site. Handrail is recommended at the inlet and outlet of the headgate pipe. Riprap bank stabilization is recommended along the left bank upstream of the headgate. Miscellaneous costs reflect a fish screen structure.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	81,000.0	$	$1.03	$83,430.00
Handrail	50.0	FT	$50.71	$2,535.50
Walkway (Expanded Steel)	75.0	SF	$17.95	$1,346.25
Trash Rack	36.0	SF	$34.22	$1,231.92
			Total Field Cost:	$88,543.67
		Active Dewatering:	7.5%	$6,640.78
		Contingencies:	10%	$8,854.37
			Subtotal:	$104,038.81
		Engineering:	10%	$10,403.88
		Mobilization:	10%	$10,403.88
			Total Rehabilitation Cost:	**$124,846.58**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Overshot Gate	300.0	SF	$510.96	$153,288.00
Miscellaneous	81,000.0	$	$1.03	$83,430.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
Overshot Gate: Compressor & Control	1.0	Each	$18,735.29	$18,735.29
CIP Concrete	15.0	CY	$1,135.47	$17,032.05
4-ft x 4-ft Slide Gate	1.0	Each	$6,460.84	$6,460.84
RCP 48" D	25.0	FT	$256.97	$6,424.25
Structural Fill	70.0	CY	$36.65	$2,565.50
Handrail	50.0	FT	$50.71	$2,535.50
Structural Excavation	70.0	CY	$22.95	$1,606.50
Trash Rack	36.0	SF	$34.22	$1,231.92
			Total Field Cost:	$320,869.46
		Active Dewatering:	7.5%	$24,065.21
		Contingencies:	10%	$32,086.95
			Subtotal:	$377,021.62
		Engineering:	10%	$37,702.16
		Mobilization:	10%	$37,702.16
			Current Replacement Value (CRV):	**$452,425.94**

Facilities Condition Index (FCI):	0.28
Asset Priority Index (API):	80
Remediation Priority Index (RPI):	22

Deficiency

Category: CHSci

Rating: Critical

HKM ID:	BB-TO1	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza			**Structure Type:**	Turnout
UTM Zone:	13	**Coordinates:**	376594.6, 4928244.3	**Total # of Photos:**	1

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
		Contingencies:	15%	$702.07
			Subtotal:	$5,382.55
		Engineering:	5%	$269.13
		Mobilization:	10%	$538.26

Current Replacement Value (CRV): **$6,189.93**

Deficiency

Category: CMDM

Rating: Serious

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	40

HKM ID:	BB-TO10	***BIA ID:***		***Division:***	Clear Creek
Canal Name:	Big Bonanza			***Structure Type:***	Turnout
UTM Zone:	13	***Coordinates:***	0.0, 0.0	***Total # of Photos:***	0

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
		Contingencies:	15%	$702.07
			Subtotal:	$5,382.55
		Engineering:	5%	$269.13
		Mobilization:	10%	$538.26
			Current Replacement Value (CRV):	**$6,189.93**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	40

HKM ID:	**BB-TO11**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Big Bonanza**			***Structure Type:***	**Turnout**
UTM Zone:	**13**	***Coordinates:***	**0.0, 0.0**	***Total # of Photos:***	**0**

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
		Contingencies:	15%	$702.07
			Subtotal:	$5,382.55
		Engineering:	5%	$269.13
		Mobilization:	10%	$538.26

Current Replacement Value (CRV): **$6,189.93**

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 40

Remediation Priority Index (RPI): 40

HKM ID:	BB-TO12	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza	**Structure Type:**	Turnout		
UTM Zone:	13	**Coordinates:**	0.0, 0.0	**Total # of Photos:**	0

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
	Contingencies:		15%	$702.07
			Subtotal:	$5,382.55
	Engineering:		5%	$269.13
	Mobilization:		10%	$538.26
	Current Replacement Value (CRV):			**$6,189.93**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	40

HKM ID:	BB-TO2	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza	**Structure Type:**	Turnout		
UTM Zone:	13	**Coordinates:**	376507.6, 4928623.0	**Total # of Photos:**	1

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
		Contingencies:	15%	$702.07
			Subtotal:	$5,382.55
		Engineering:	5%	$269.13
		Mobilization:	10%	$538.26

Current Replacement Value (CRV): **$6,189.93**

Deficiency

Category: CMDM

Rating: Serious

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 40

Remediation Priority Index (RPI): 40

HKM ID:	BB-TO3	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza	**Structure Type:**	Turnout		
UTM Zone:	13	**Coordinates:**	376517.8, 4928905.6	**Total # of Photos:**	0

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Remediation Assessment

Deficiency

Category: CMDM

Rating: Serious

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
		Contingencies:	15%	$702.07
			Subtotal:	$5,382.55
		Engineering:	5%	$269.13
		Mobilization:	10%	$538.26

Current Replacement Value (CRV): **$6,189.93**

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 40

Remediation Priority Index (RPI): 40

HKM ID:	BB-TO4	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza			**Structure Type:**	Turnout
UTM Zone:	13	**Coordinates:**	376706.9, 4929061.7	**Total # of Photos:**	0

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Remediation Assessment

Deficiency

Category: CMDM

Rating: Serious

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
		Contingencies:	15%	$702.07
			Subtotal:	$5,382.55
		Engineering:	5%	$269.13
		Mobilization:	0%	$0.00
			Current Replacement Value (CRV):	**$5,651.68**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	40

HKM ID:	BB-TO5	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza	**Structure Type:**	Turnout		
UTM Zone:	13	**Coordinates:**	376687.0, 4929470.0	**Total # of Photos:**	0

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
		Contingencies:	15%	$702.07
			Subtotal:	$5,382.55
		Engineering:	5%	$269.13
		Mobilization:	0%	$0.00

Current Replacement Value (CRV): **$5,651.68**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	40

HKM ID:	**BB-TO6**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Big Bonanza**	***Structure Type:***	**Turnout**		
UTM Zone:	**13**	***Coordinates:***	**376570.3, 4929696.1**	***Total # of Photos:***	**0**

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
		Contingencies:	15%	$702.07
			Subtotal:	$5,382.55
		Engineering:	5%	$269.13
		Mobilization:	0%	$0.00

Current Replacement Value (CRV): **$5,651.68**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	40

HKM ID:	BB-TO7	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza			**Structure Type:**	Turnout
UTM Zone:	13	**Coordinates:**	0.0, 0.0	**Total # of Photos:**	0

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
	Contingencies:		15%	$702.07
			Subtotal:	$5,382.55
	Engineering:		5%	$269.13
	Mobilization:		10%	$538.26

Current Replacement Value (CRV): **$6,189.93**

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 40

Remediation Priority Index (RPI): 40

HKM ID:	BB-TO8	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza	**Structure Type:**	Turnout		
UTM Zone:	13	**Coordinates:**	0.0, 0.0	**Total # of Photos:**	0

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
		Contingencies:	15%	$702.07
			Subtotal:	$5,382.55
		Engineering:	5%	$269.13
		Mobilization:	10%	$538.26
			Current Replacement Value (CRV):	**$6,189.93**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	40

HKM ID:	BB-TO9	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Big Bonanza			**Structure Type:**	Turnout
UTM Zone:	13	**Coordinates:**	0.0, 0.0	**Total # of Photos:**	0

Notes: This structure is a conceptual turnout for the reach of concrete lined ditch on the Big Bonanza Ditch. Recommended improvements to the canal reach is to remove the concrete liner, and reshaping/regrading the ditch. Landowner interviews indicated that there are currently 12 siphon pipes serving water to the fields from the concrete lined ditch. Twelve standard turnouts are recommended for the remediation of this reach.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$4,680.48
		Contingencies:	15%	$702.07
			Subtotal:	$5,382.55
		Engineering:	5%	$269.13
		Mobilization:	10%	$538.26

Current Replacement Value (CRV): **$6,189.93**

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 40

Remediation Priority Index (RPI): 40

Local Name: Big Redman Diversion

HKM ID: **BR-DD1**
BIA ID:
Division: **Clear Creek**
Canal Name: **Big Redman**
Structure Type: **Diversion Dam**
UTM Zone: **13**
Coordinates: **368535.5, 4913300.3**
Total # of Photos: **6**

Notes: The Big Redman Ditch diverts from Clear Creek approximately 0.5 miles east of the Interstate 90 overpass off of US Highway 16 East. The ditch flows approximately 4.5 miles. It has a direct flow water right of 17.4 cfs which can serve approximately 1200 acres. The diversion structure is composed of large concrete wing walls and headwall with a large slide gate that controls flows through a 6' x 4' CMP arch pipe. The concrete footer below the pipe is broken which causes leakage and piping around the arch pipe and actually lead to a complete washout of the pipe. Sediment accumulation at the headgate is an issue. There is no sluice gate that would allow for diverted water to return to the creek during non-irrigation times. The CMP pipe is showing corrosion and should be replaced. Rehabilitation costs reflect the installation of a 36" sluice gate on the left headwall, and replacement and repair of the pipe and footer. Handrail should also be added to the headwall structure and downstream cutoff wall. A rock vane diversion has been installed recently and is in good condition. However, replacement costs include a rock vane diversion. This is to represent the most complete replacement cost if the structure and diversion were to be completely demolished and replaced. Miscellaneous costs reflect a fish screen structure.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	66,000.0	$	$1.03	$67,980.00
RCP 5' D	18.0	FT	$395.74	$7,123.32
Stream Control (Small)	1.0	Each	$6,812.78	$6,812.78
CIP Concrete	5.0	CY	$1,135.47	$5,677.35
36" Diameter Canal Gate	1.0	Each	$5,314.01	$5,314.01
RCP 36" D	40.0	FT	$132.48	$5,299.20
Trash Rack	150.0	SF	$34.22	$5,133.00
Handrail	60.0	FT	$50.71	$3,042.60
Concrete Demo. & Disposal	5.0	CY	$209.94	$1,049.70

Total Field Cost:		$107,431.96
Active Dewatering:	7.5%	$8,057.40
Contingencies:	10%	$10,743.20
Subtotal:		$126,232.55
Engineering:	15%	$18,934.88
Mobilization:	10%	$12,623.26
Total Rehabilitation Cost:		**$157,790.69**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	66,000.0	$	$1.03	$67,980.00
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
CIP Concrete	24.0	CY	$1,135.47	$27,251.28
5-ft x 5-ft Slide Gate	1.0	Each	$8,847.60	$8,847.60
Structural Fill	230.0	CY	$36.65	$8,429.50
RCP 5' D	18.0	FT	$395.74	$7,123.32
Stream Control (Small)	1.0	Each	$6,812.78	$6,812.78
36" Diameter Canal Gate	1.0	Each	$5,314.01	$5,314.01
RCP 36" D	40.0	FT	$132.48	$5,299.20
Structural Excavation	230.0	CY	$22.95	$5,278.50
Trash Rack	150.0	SF	$34.22	$5,133.00
Concrete Demo. & Disposal	24.0	CY	$209.94	$5,038.56
Handrail	60.0	FT	$50.71	$3,042.60

Total Field Cost:		$186,450.35
Active Dewatering:	7.5%	$13,983.78
Contingencies:	10%	$18,645.04
Subtotal:		$219,079.16
Engineering:	15%	$32,861.88
Mobilization:	10%	$21,907.92
Current Replacement Value (CRV):		**$273,848.95**

Facilities Condition Index (FCI): 0.58
Asset Priority Index (API): 80
Remediation Priority Index (RPI): 46

Deficiency

Category: CHSci
Rating: Serious

Local Name: Brown & Foster Headgate

HKM ID:	BF-HG1	***BIA ID:***		***Division:***	Clear Creek
Canal Name:	Brown & Foster			***Structure Type:***	Headgate
UTM Zone:	13	***Coordinates:***	353126.2, 4912731.2	***Total # of Photos:***	3

Notes: This structure is the headgate to the Brown and Foster Ditch. The headgate is an 18" screw-type headgate on a concrete headwall. The concrete is broken up and cracked. It is recommended that the headgate be replaced. A recommendation for the canal is to incorporate the Eaglerock Ditch diversion into the Brown & Foster Ditch. The new headgate should be upsized to accommodate the approximate 7 cfs that is appropriated to the Eaglerock Ditch.

Remediation Assessment

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Stream Control (Small)	1.0	Each	$6,812.78	$6,812.78
CIP Concrete	3.0	CY	$1,135.47	$3,406.41
2.5-ft x 2.5-ft Slide Gate	1.0	Each	$3,072.83	$3,072.83
RCP 30" D	20.0	FT	$99.93	$1,998.60
Concrete Demo. & Disposal	2.0	CY	$209.94	$419.88
Trash Rack	10.0	SF	$34.22	$342.20
Structural Fill	5.0	CY	$36.65	$183.25
Structural Excavation	5.0	CY	$22.95	$114.75

Total Field Cost:		$16,350.70
Contingencies:	15%	$2,452.61
Subtotal:		$18,803.31
Engineering:	10%	$1,880.33
Mobilization:	10%	$1,880.33
Current Replacement Value (CRV):		**$22,563.97**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	60
Remediation Priority Index (RPI):	60

Deficiency

Category: CMDM

Rating: Serious

Local Name: Kirven Check

HKM ID:	**CD-CH1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Crown Ditch**	***Structure Type:***	**Check**		
UTM Zone:	**13**	***Coordinates:***	**363156.0, 4909268.4**	***Total # of Photos:***	**0**

Notes: This site was identified by interviews. It was indicated that the turnout for the fields is a significant height above the bottom of the ditch. It is very difficult to get water high enough to serve the turnout. The ditch section has gotten deep and is fairly wide at this location. Installation of a check structure could aid in the regulation of the ditch, and ease of operation of the turnout. A typical NRCS concrete check is recommended.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
			Total Field Cost:	$6,142.94
		Contingencies:	15%	$921.44
			Subtotal:	$7,064.38
		Engineering:	5%	$353.22
		Mobilization:	10%	$706.44
			Current Replacement Value (CRV):	**$8,124.04**

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 60

Remediation Priority Index (RPI): 60

Local Name: Driscoll Check

HKM ID:	CD-CH2	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Crown Ditch	**Structure Type:**	Check		
UTM Zone:	13	**Coordinates:**	365404.4, 4908682.3	**Total # of Photos:**	0

Notes: This site was identified during interviews. The landowner has difficulty regulating flows when he is irrigating, and when downstream landowners need water. Installation of a check would allow the landowner to establish water surface that can serve his turnout, and still allow for passive overflow down the ditch. A typical NRCS concrete check is recommended.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
			Total Field Cost:	$6,142.94
		Contingencies:	15%	$921.44
			Subtotal:	$7,064.38
		Engineering:	5%	$353.22
		Mobilization:	10%	$706.44
			Current Replacement Value (CRV):	**$8,124.04**

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 60

Remediation Priority Index (RPI): 60

Local Name: Dunlap Ditch Flume

HKM ID:	**DD-FL1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Dunlap Ditch**	***Structure Type:***	**Flume**		
UTM Zone:	**13**	***Coordinates:***	**373622.7, 4936105.4**	***Total # of Photos:***	**12**

Notes: This structure is a flume that conveys ditch flows across Piney Creek. The flume is made of half of a 48" CMP pipe. There is a pipe serving the flume, and a pipe that takes flows from the flume, across the road, and to the ditch. Both of these pipes are 36" CMP. It appears that the current 48" CMP half pipe was installed over a failed steel half pipe. The current configuration shows significant corrosion which allows for significant losses through the bottom of the flume. Field investigation indicated that the support structure is in fairly good condition, but the CMP portion of the flume needs to be replaced or lined. Because the support structure is in good condition, the rehabilitation costs assumes removing the existing CMP material, adding additional support strapping, and installing lightweight HDPE pipe to flume across the creek. Miscellaneous costs reflect removal of CMP material and installation of additional pipe support. Replacement assumes installation of a 36" RCP siphon which would tie into the existing inlet and outlet pipes. Miscellaneous costs reflect estimated cost to remove existing flume structure.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	15,000.0	$	$1.03	$15,450.00
HDPE 36" Pipe	80.0	FT	$65.57	$5,245.60
			Total Field Cost:	$20,695.60
		Active Dewatering:	7.5%	$1,552.17
		Contingencies:	10%	$2,069.56
			Subtotal:	$24,317.33
		Engineering:	10%	$2,431.73
		Mobilization:	10%	$2,431.73
			Total Rehabilitation Cost:	**$29,180.80**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
RCP 36" D	150.0	FT	$132.48	$19,872.00
Miscellaneous	10,000.0	$	$1.03	$10,300.00
			Total Field Cost:	$57,731.61
		Active Dewatering:	7.5%	$4,329.87
		Contingencies:	10%	$5,773.16
			Subtotal:	$67,834.64
		Engineering:	10%	$6,783.46
		Mobilization:	10%	$6,783.46
			Current Replacement Value (CRV):	**$81,401.57**

Facilities Condition Index (FCI):	0.36
Asset Priority Index (API):	60
Remediation Priority Index (RPI):	22

Deficiency

Category: CMDM

Rating: Serious

Local Name: Fort McKinney Headgate

HKM ID:	**MK-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Fort McKinney Ditch**	***Structure Type:***	**Headgate**		
UTM Zone:	**13**	***Coordinates:***	**360011.8, 4910504.1**	***Total # of Photos:***	**4**

Notes: This structure is the headgate for the Fort McKinney ditch headgate consists of a concrete throat structure with a spillway notch, and 24” steel slide gate. The headgate does not seal well, and the irrigator indicated that he has to use canvas or plastic to seal off the gate. The ditch section immediately downstream of the headgate is very wide and deep compared to the flow that it conveys. This has resulted in this section being choked with cattails. This ditch section is discussed in the canal evaluation. Remediation for the headgate includes a new gate as well as a trash rack. Replacement assumes a 'replace-in-kind' scenario.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	27,000.0	$	$1.03	$27,810.00
2.5-ft x 2.5-ft Slide Gate	1.0	Each	$3,072.83	$3,072.83
Trash Rack	10.0	SF	$34.22	$342.20
		Total Field Cost:		$31,225.03
		Active Dewatering:	7.5%	$2,341.88
		Contingencies:	10%	$3,122.50
		Subtotal:		$36,689.41
		Engineering:	10%	$3,668.94
		Mobilization:	10%	$3,668.94

Total Rehabilitation Cost: **$44,027.29**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	27,000.0	$	$1.03	$27,810.00
CIP Concrete	3.0	CY	$1,135.47	$3,406.41
2.5-ft x 2.5-ft Slide Gate	1.0	Each	$3,072.83	$3,072.83
Concrete Demo. & Disposal	3.0	CY	$209.94	$629.82
RCP 30" D	4.0	FT	$99.93	$399.72
Trash Rack	10.0	SF	$34.22	$342.20
Structural Fill	8.0	CY	$36.65	$293.20
Structural Excavation	8.0	CY	$22.95	$183.60
Check Guides: Replace	6.0	FT	$19.87	$119.22
		Total Field Cost:		$36,257.00
		Active Dewatering:	7.5%	$2,719.28
		Contingencies:	10%	$3,625.70
		Subtotal:		$42,601.98
		Engineering:	10%	$4,260.20
		Mobilization:	10%	$4,260.20

Current Replacement Value (CRV): **$51,122.37**

Facilities Condition Index (FCI):	0.86
Asset Priority Index (API):	60
Remediation Priority Index (RPI):	52

Deficiency

Category: CMDM

Rating: Minor

Local Name: Fox Ditch Headgate

HKM ID:	**FOX-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Fox Ditch**	***Structure Type:***	**Headgate**		
UTM Zone:	**13**	***Coordinates:***	**353851.1, 4921935.6**	***Total # of Photos:***	**2**

Notes: This structure is the headgate for the Fox Ditch. The ditch usually diverts between 15 and 30 cfs. It currently supplies water to three ranches. The headgate has leakage issues, which need to be addressed each irrigation season. In addition, the culvert has corroded through. Interviews indicated that irrigators have filled the voids within the culvert with rocks, and then tried to seal it with concrete. Rehabilitation assumes replacement of the culvert, and installation of a rock vane diversion and sluice gate. A trash rack needs to be installed to prevent plugging of the headgate. Replacement assumes a new rock vane diversion, with new 36" gate and pipe on a concrete headwall with flared wing walls. A sluice gate is recommended in the left flared wing wall to remediate sedimentation at the headgate during the non-irrigation season. Miscellaneous costs reflect a fish screen structure.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	60,000.0	$	$1.03	$61,800.00
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
RCP 36" D	20.0	FT	$132.48	$2,649.60
Trash Rack	50.0	SF	$34.22	$1,711.00

Total Field Cost: $101,741.08

Active Dewatering: 7.5% $7,630.58

Contingencies: 10% $10,174.11

Subtotal: $119,545.77

Engineering: 10% $11,954.58

Mobilization: 10% $11,954.58

Total Rehabilitation Cost: **$143,454.92**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	60,000.0	$	$1.03	$61,800.00
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Small)	1.0	Each	$6,812.78	$6,812.78
CIP Concrete	5.0	CY	$1,135.47	$5,677.35
36" Diameter Canal Gate	1.0	Each	$5,314.01	$5,314.01
RCP 36" D	20.0	FT	$132.48	$2,649.60
18" Diameter Canal Gate	1.0	Each	$1,964.36	$1,964.36
RCP 18" D	20.0	FT	$77.87	$1,557.40
Structural Fill	25.0	CY	$36.65	$916.25
Structural Excavation	25.0	CY	$22.95	$573.75

Total Field Cost: $118,165.50

Active Dewatering: 7.5% $8,862.41

Contingencies: 10% $11,816.55

Subtotal: $138,844.46

Engineering: 10% $13,884.45

Mobilization: 10% $13,884.45

Current Replacement Value (CRV): **$166,613.36**

Deficiency

Category: CMDM

Rating: Serious

Facilities Condition Index (FCI): 0.86

Asset Priority Index (API): 90

Remediation Priority Index (RPI): 77

Local Name: High Line Headgate

HKM ID:	**HL-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**High Line Ditch**			***Structure Type:***	**Headgate**
UTM Zone:	**13**	***Coordinates:***	**355773.1, 4932710.0**	***Total # of Photos:***	**6**

Notes: The High Line Headgate diverts out of Piney Creek upstream of the large Piney Creek Diversion. The High Line ditch serves approximately 230 acres. The headgate appears to be fairly new. The concrete is in good condition, and the gate is operable. Landowner interviews indicated that the headgate operates well, but there are issues with debris and rocks plugging the gate opening and not allowing the gate to close. No trash rack is present on the diversion headgate. There are two sluice gate bays that do not have gates. They are currently checked up with no means of operation. Rehabilitation costs reflect the installation of trash rack to prevent these issues on both the diversion gate and sluice gates. In addition, slide gates are recommended for the two sluice gate bays. The High Line ditch has issues downstream of the headgate which are addressed in the Canal section.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	24,000.0	$	$1.03	$24,720.00
3-ft x 3-ft Slide Gate	2.0	Each	$3,728.89	$7,457.78
Trash Rack	75.0	SF	$34.22	$2,566.50
Handrail	45.0	FT	$50.71	$2,281.95
			Total Field Cost:	$37,026.23
		Active Dewatering:	7.5%	$2,776.97
		Contingencies:	10%	$3,702.62
			Subtotal:	$43,505.82
		Engineering:	10%	$4,350.58
		Mobilization:	10%	$4,350.58
			Total Rehabilitation Cost:	**$52,206.98**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
Miscellaneous	24,000.0	$	$1.03	$24,720.00
CIP Concrete	13.0	CY	$1,135.47	$14,761.11
RCP 24" D	100.0	FT	$89.40	$8,940.00
3-ft x 3-ft Slide Gate	2.0	Each	$3,728.89	$7,457.78
Concrete Demo. & Disposal	20.0	CY	$209.94	$4,198.80
2-ft x 2-ft Slide Gate	1.0	Each	$2,670.63	$2,670.63
Trash Rack	75.0	SF	$34.22	$2,566.50
Handrail	45.0	FT	$50.71	$2,281.95
			Total Field Cost:	$126,056.38
		Active Dewatering:	7.5%	$9,454.23
		Contingencies:	10%	$12,605.64
			Subtotal:	$148,116.25
		Engineering:	10%	$14,811.62
		Mobilization:	10%	$14,811.62
			Current Replacement Value (CRV):	**$177,739.50**

Facilities Condition Index (FCI): 0.29

Asset Priority Index (API): 60

Remediation Priority Index (RPI): 17

Deficiency

Category: CMDM

Rating: Serious

Local Name: Hillyer & Onslow Siphon

HKM ID:	**HO-SPN1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Hillyer & Onslow**			***Structure Type:***	**Siphon**
UTM Zone:	**13**	***Coordinates:***	**371896.7, 4917298.5**	***Total # of Photos:***	**4**

Notes: This siphon is located approximately 0.4 miles downstream of the diversion. It has significant leakage, as identified by the operator. The siphon is a 24" steel siphon that conveys flows under Clear Creek to serve lands east of the creek. It was identified that the siphon leaks and that silt plumes can be seen in the creek resulting from water flowing out of the pipe. The inlet and outlet structures appear to be in good condition, but the pipe needs to be replaced. Replacement assumes a concrete inlet and outlet structure with trash rack.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
RCP 24" D	350.0	FT	$89.40	$31,290.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
			Total Field Cost:	$58,849.61
			Active Dewatering: 7.5%	$4,413.72
			Contingencies: 15%	$8,827.44
			Subtotal:	$72,090.77
			Engineering: 10%	$7,209.08
			Mobilization: 10%	$7,209.08
			Total Rehabilitation Cost:	**$86,508.93**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
RCP 24" D	350.0	FT	$89.40	$31,290.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
CIP Concrete	6.0	CY	$1,135.47	$6,812.82
Trash Rack	40.0	SF	$34.22	$1,368.80
Structural Fill	10.0	CY	$36.65	$366.50
Structural Excavation	10.0	CY	$22.95	$229.50
			Total Field Cost:	$67,627.23
			Active Dewatering: 7.5%	$5,072.04
			Contingencies: 15%	$10,144.08
			Subtotal:	$82,843.36
			Engineering: 10%	$8,284.34
			Mobilization: 10%	$8,284.34
			Current Replacement Value (CRV):	**$99,412.03**

Facilities Condition Index (FCI):	0.87
Asset Priority Index (API):	50
Remediation Priority Index (RPI):	44

Deficiency

Category: CMDM

Rating: Critical

Local Name: Johnson Holt Headgate

HKM ID:	**JH-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Johnson Holt**	***Structure Type:***	**Headgate**		
UTM Zone:	**13**	***Coordinates:***	**359818.3, 4909762.4**	***Total # of Photos:***	**5**

Notes: This structure is the Johnson Holt headgate. The head gate consists of a single 4.2 x 2.6-foot rectangular steel gate operated with Waterman-type screw, mounted to a concrete headwall. This is adjacent to a rock dam. Field visits indicated that the headgate is served by a side channel of the creek. Interviews indicated that the channel upstream of the headgate has to be cleaned every few years due to sediment accumulation. Relocating the headgate upstream to the main channel of the creek would be beneficial by an operational/maintenance stand point. Remediation costs assume that the headgate will stay in the same location. Installation of a sluice gate that will return flow from the side channel to the creek is recommended to help eliminate the sediment accumulation. This will be mounted on a cast in place concrete head wall. In addition, a trash rack needs to be added to the headgate. Replacement assumes that the headgate is relocated approximately 300 feet upstream and installed with a rock vane diversion. The ditch flows would then be piped to the existing ditch. Miscellaneous replacement costs reflect a fish screen structure.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	81,000.0	$	$1.03	$83,430.00
24" Diameter Canal Gate	1.0	Each	$2,868.20	$2,868.20
RCP 24" D	25.0	FT	$89.40	$2,235.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	30.0	SF	$34.22	$1,026.60
Riprap Bank Protection	2.0	CY	$55.40	$110.80
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$90,925.27
Active Dewatering:	7.5%	$6,819.40
Contingencies:	10%	$9,092.53
Subtotal:		$106,837.19
Engineering:	15%	$16,025.58
Mobilization:	10%	$10,683.72
Total Rehabilitation Cost:		**$133,546.49**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	81,000.0	$	$1.03	$83,430.00
RCP 36" D	320.0	FT	$132.48	$42,393.60
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
3-ft x 3-ft Slide Gate	2.0	Each	$3,728.89	$7,457.78
CIP Concrete	5.0	CY	$1,135.47	$5,677.35
Trash Rack	80.0	SF	$34.22	$2,737.60
Structural Fill	30.0	CY	$36.65	$1,099.50
Handrail	16.0	FT	$50.71	$811.36
Structural Excavation	30.0	CY	$22.95	$688.50
Riprap Bank Protection	2.0	CY	$55.40	$110.80

Total Field Cost:		$202,866.10
Active Dewatering:	7.5%	$15,214.96
Contingencies:	10%	$20,286.61
Subtotal:		$238,367.67
Engineering:	15%	$35,755.15
Mobilization:	10%	$23,836.77
Current Replacement Value (CRV):		**$297,959.59**

Facilities Condition Index (FCI):	0.45
Asset Priority Index (API):	80
Remediation Priority Index (RPI):	36

Deficiency

Category: CRPdm

Rating: Serious

Local Name: Sand Draw Crossing

HKM ID:	**JH-SPN1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Johnson Holt**			***Structure Type:***	**Siphon**
UTM Zone:	**13**	***Coordinates:***	**360876.8, 4908221.0**	***Total # of Photos:***	**3**

Notes: This location on the Johnson Holt ditch is a site where the ditch crosses a drainage, referred to locally as 'Sand Draw'. There is no flume for the ditch or under drain for the drainage, so the ditch intercepts the storm runoff. This water carries significant sediment loads. This is conveyed directly into the ditch which can cause restriction points and significant sediment in the ditch. The ditch should be put in a siphon to eliminate these sediment loads into the ditch.

Remediation Assessment

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
RCP 36" D	250.0	FT	$132.48	$33,120.00
CIP Concrete	5.0	CY	$1,135.47	$5,677.35
Trash Rack	30.0	SF	$34.22	$1,026.60
Structural Fill	8.0	CY	$36.65	$293.20
Structural Excavation	8.0	CY	$22.95	$183.60
			Total Field Cost:	$40,300.75
		Contingencies:	10%	$4,030.08
			Subtotal:	$44,330.83
		Engineering:	10%	$4,433.08
		Mobilization:	10%	$4,433.08

Current Replacement Value (CRV): **$53,196.99**

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 70

Remediation Priority Index (RPI): 70

Deficiency

Category: CMDM

Rating: Critical

Local Name: Ladd Siphon

HKM ID:	LADD-CH1	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Ladd Ditch	**Structure Type:**	Check		
UTM Zone:	13	**Coordinates:**	363210.6, 4909776.6	**Total # of Photos:**	4

Notes: This structure on the Ladd Ditch is a concrete structure that should regulate flow to in a siphon under the Cemetery Ditch to irrigate lands north of the ditch. It also conveys flows past the siphon to continue flowing down the ditch. The siphon is in good condition, but the structure that is supposed to regulate flow to the siphon or down the ditch is in very poor condition. The concrete is cracked and allows significant leakage. In addition, controlling flows to the siphon is difficult, as the gate leading to the siphon cannot be sealed off. The structure should be narrowed to aid in the operation of the structure. Costs reflect demo of the right wall and floor, and replacement with a new wall and floor. In addition, a screw gate is recommended to control flow to the siphon. Replacement assumes a standard concrete check with a headgate to serve the siphon.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
CIP Concrete	3.0	CY	$1,135.47	$3,406.41
18" Diameter Canal Gate	1.0	Each	$1,964.36	$1,964.36
Concrete Demo. & Disposal	3.0	CY	$209.94	$629.82
Structural Fill	3.0	CY	$36.65	$109.95
Check Guides: Replace	4.0	FT	$19.87	$79.48
Structural Excavation	3.0	CY	$22.95	$68.85

Total Field Cost:		$6,258.87
Contingencies:	10%	$625.89
Subtotal:		$6,884.76
Engineering:	10%	$688.48
Mobilization:	10%	$688.48
Total Rehabilitation Cost:		**$8,261.71**

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
CIP Concrete	2.0	CY	$1,135.47	$2,270.94
18" Diameter Canal Gate	1.0	Each	$1,964.36	$1,964.36
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$10,497.44
Contingencies:	10%	$1,049.74
Subtotal:		$11,547.18
Engineering:	10%	$1,154.72
Mobilization:	10%	$1,154.72
Current Replacement Value (CRV):		**$13,856.62**

Facilities Condition Index (FCI):	0.6
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	24

Deficiency

Category: CMDM

Rating: Serious

Local Name: Ladd Diversion

HKM ID:	**LADD-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Ladd Ditch**			***Structure Type:***	**Headgate**
UTM Zone:	**13**	***Coordinates:***	**361793.1, 4909042.2**	***Total # of Photos:***	**5**

Notes: This structure is the headgate to the Ladd Ditch, which diverts out of Clear Creek and conveys flows in an unlined earthen ditch for approximately 0.2 miles where it flows into Sand Creek. The creek flooded a few years ago and disconnected the ox bow on which the headgate is located. Landowners had to create a rock diversion berm to route flows back to the existing headgate. This headgate is a 30" steel slide gate mounted on a concrete headwall. The gate is very leaky, and could not be sealed this winter. This caused water to flow in the ditch and created an ice problem at a downstream crossing. The county had to excavate a notch in the berm to allow flows to return to the creek. The excavated material was placed in front of the headgate to seal off the gate. The headgate needs to be replaced, and a sluice gate needs to be installed to allow flows to return to the creek if the existing location is kept. Replacement assumes relocating the headgate upstream and piping flows to the existing ditch. It also assumes a new rock vane diversion.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	27,000.0	$	$1.03	$27,810.00
2.5-ft x 2.5-ft Slide Gate	2.0	Each	$3,072.83	$6,145.66
CIP Concrete	2.0	CY	$1,135.47	$2,270.94
RCP 30" D	10.0	FT	$99.93	$999.30
Handrail	15.0	FT	$50.71	$760.65
Structural Fill	3.0	CY	$36.65	$109.95
Structural Excavation	3.0	CY	$22.95	$68.85

Total Field Cost:		$38,165.35
Active Dewatering:	7.5%	$2,862.40
Contingencies:	10%	$3,816.54
Subtotal:		$44,844.29
Engineering:	10%	$4,484.43
Mobilization:	10%	$4,484.43
Total Rehabilitation Cost:		**$53,813.14**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Miscellaneous	27,000.0	$	$1.03	$27,810.00
RCP 30" D	160.0	FT	$99.93	$15,988.80
2.5-ft x 2.5-ft Slide Gate	2.0	Each	$3,072.83	$6,145.66
CIP Concrete	5.0	CY	$1,135.47	$5,677.35
Trash Rack	100.0	SF	$34.22	$3,422.00
Structural Fill	30.0	CY	$36.65	$1,099.50
Structural Excavation	30.0	CY	$22.95	$688.50

Total Field Cost:		$91,731.81
Active Dewatering:	7.5%	$6,879.89
Contingencies:	10%	$9,173.18
Subtotal:		$107,784.88
Engineering:	10%	$10,778.49
Mobilization:	10%	$10,778.49
Current Replacement Value (CRV):		**$129,341.85**

Facilities Condition Index (FCI):	0.42
Asset Priority Index (API):	60
Remediation Priority Index (RPI):	25

Deficiency

Category: CMDM

Rating: Critical

Local Name: Last Chance Headgate

HKM ID:	LC-HG1	***BIA ID:***		***Division:***	Clear Creek
Canal Name:	Last Chance	***Structure Type:***	Headgate		
UTM Zone:	13	***Coordinates:***	357817.8, 4920703.7	***Total # of Photos:***	2

Notes: This structure is the headgate for the Last Chance canal. This ditch has an appropriation of approximately 9 cfs, according to a landowner. The majority of the concern is regarding reaches of the ditch. The downstream landowner would like to change his point of diversion from this site, to a site on his land. From there, he would pump his appropriation up to his ditch. For this headgate, there is no trash rack or hand rail, which are recommended. Miscellaneous costs reflect a fish screen structure. During the winter (2010) it was discovered that the culvert from the headgate was nearly completely rusted through. Replacement of this culvert is recommended. The landowner has concerns regarding the ability to get an excavator to the culvert, but feels a tracked vehicle would be the best option.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	42,000.0	$	$1.03	$43,260.00
RCP 24" D	25.0	FT	$89.40	$2,235.00
Trash Rack	25.0	SF	$34.22	$855.50
Handrail	10.0	FT	$50.71	$507.10
			Total Field Cost:	$46,857.60
		Contingencies:	10%	$4,685.76
			Subtotal:	$51,543.36
		Engineering:	10%	$5,154.34
		Mobilization:	10%	$5,154.34
			Total Rehabilitation Cost:	**$61,852.03**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	42,000.0	$	$1.03	$43,260.00
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Small)	1.0	Each	$6,812.78	$6,812.78
24" Diameter Canal Gate	2.0	Each	$2,868.20	$5,736.40
CIP Concrete	4.0	CY	$1,135.47	$4,541.88
RCP 24" D	25.0	FT	$89.40	$2,235.00
Trash Rack	25.0	SF	$34.22	$855.50
Structural Fill	20.0	CY	$36.65	$733.00
Handrail	10.0	FT	$50.71	$507.10
Structural Excavation	20.0	CY	$22.95	$459.00
			Total Field Cost:	$96,040.66
		Contingencies:	10%	$9,604.07
			Subtotal:	$105,644.73
		Engineering:	10%	$10,564.47
		Mobilization:	10%	$10,564.47
			Current Replacement Value (CRV):	**$126,773.67**

Deficiency

Category: CMDM

Rating: Minor

Facilities Condition Index (FCI):	0.49
Asset Priority Index (API):	70
Remediation Priority Index (RPI):	34

Local Name: Leiter Ditch Headgate

HKM ID:	**LD-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Leiter Ditch**			***Structure Type:***	**Headgate**
UTM Zone:	**13**	***Coordinates:***	**355460.0, 4932670.9**	***Total # of Photos:***	**6**

Notes: This structure is the headgate for the Leiter Ditch. It is recessed off of Piney Creek. This diversion is a concrete headwall and wing walls with dual 4x4 slide gates. There is minor spalling on the concrete headwall. The diversion has sediment and debris issues. Irrigation personnel indicated that they typically have to pull logs and branches out from under the gates following operation. The diversion could use safety features, a trash rack, and potentially a sweeper log setup to divert large debris and allow it to continue flowing down Piney Creek. This sweeper log is reflected in the miscellaneous costs. In addition, a sluice gate needs to be installed to remediate sediment issues at the headgate during the non-irrigation season. This is reflected by structure ex/fill and CIP concrete for a new headwall, with 24" RCP and slide gate. Replacement assumes that the structure is relocated to the right bank of the channel and will receive flow from a new rock vane diversion. Replacement assumes a 'replace in kind' structure which incorporates a sluice gate for the non-irrigation season. One of the gates was eliminated. This is because it was noted that the safe operation of the ditch is currently approximately 40 cfs. A single 4' RCP could convey approximately 100 cfs, or 2.5 times greater than the safe operating flow currently observed.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
4-ft x 4-ft Slide Gate	2.0	Each	$6,460.84	$12,921.68
RCP 24" D	60.0	FT	$89.40	$5,364.00
Miscellaneous	5,000.0	$	$1.03	$5,150.00
CIP Concrete	4.0	CY	$1,135.47	$4,541.88
Trash Rack	120.0	SF	$34.22	$4,106.40
2-ft x 2-ft Slide Gate	1.0	Each	$2,670.63	$2,670.63
Handrail	40.0	FT	$50.71	$2,028.40
Structural Fill	20.0	CY	$36.65	$733.00
Structural Excavation	20.0	CY	$22.95	$459.00
Riprap Bank Protection	1.0	CY	$55.40	$55.40

Total Field Cost:		$65,590.00
Active Dewatering:	7.5%	$4,919.25
Contingencies:	10%	$6,559.00
Subtotal:		$77,068.25
Engineering:	15%	$11,560.24
Mobilization:	10%	$7,706.83
Total Rehabilitation Cost:		**$96,335.31**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
CIP Concrete	12.0	CY	$1,135.47	$13,625.64
RCP 48" D	30.0	FT	$256.97	$7,709.10
4-ft x 4-ft Slide Gate	1.0	Each	$6,460.84	$6,460.84
Trash Rack	120.0	SF	$34.22	$4,106.40
Structural Fill	100.0	CY	$36.65	$3,665.00
RCP 24" D	40.0	FT	$89.40	$3,576.00
2-ft x 2-ft Slide Gate	1.0	Each	$2,670.63	$2,670.63
Handrail	50.0	FT	$50.71	$2,535.50
Structural Excavation	100.0	CY	$22.95	$2,295.00
Concrete Demo. & Disposal	8.0	CY	$209.94	$1,679.52
Riprap Bank Protection	3.0	CY	$55.40	$166.20

Total Field Cost:		$106,949.44
Active Dewatering:	7.5%	$8,021.21
Contingencies:	10%	$10,694.94
Subtotal:		$125,665.59
Engineering:	15%	$18,849.84
Mobilization:	10%	$12,566.56
Current Replacement Value (CRV):		**$157,081.99**

Facilities Condition Index (FCI):	0.61
Asset Priority Index (API):	100
Remediation Priority Index (RPI):	61

Deficiency

Category: CMDM

Rating: Minor

Local Name: Little Piney Diversion

HKM ID:	LP-HG1	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Little Piney Ditch			**Structure Type:**	Headgate
UTM Zone:	13	**Coordinates:**	351595.4, 4933626.8	**Total # of Photos:**	6

Notes: This structure is the diversion on Little Piney Creek. The diversion is just a rock pile which needs to be reconfigured every year after high water. There is right stream bank instability in the channel which was identified by a large slump section. A wooden flume used to convey water from the rock diversion to the headgate. The flume has been destroyed, and the left bank of this section is eroding. There is a large bush on this bank, which appears to be the only thing keeping the bank from washing away. The headgate is a 5'x5' steel slide gate on a concrete headwall. There is some corrosion, but the headgate is generally in good condition. A trash rack is recommended. In addition, the diversion needs to be replaced. A sluice gate is recommended to convey water from the headgate to the creek during the non-irrigation season. Riprap is recommended to stabilize the right stream bank just upstream of the diversion.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Small)	1.0	Each	$6,812.78	$6,812.78
2-ft x 2-ft Slide Gate	1.0	Each	$2,670.63	$2,670.63
Trash Rack	75.0	SF	$34.22	$2,566.50
CIP Concrete	2.0	CY	$1,135.47	$2,270.94
Riprap Bank Protection	20.0	CY	$55.40	$1,108.00
HDPE 24" Pipe	25.0	FT	$38.03	$950.75
			Total Field Cost:	$47,279.60
		Active Dewatering:	7.5%	$3,545.97
		Contingencies:	10%	$4,727.96
			Subtotal:	$55,553.53
		Engineering:	15%	$8,333.03
		Mobilization:	10%	$5,555.35
			Total Rehabilitation Cost:	**$69,441.91**

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
5-ft x 5-ft Slide Gate	1.0	Each	$8,847.60	$8,847.60
Stream Control (Small)	1.0	Each	$6,812.78	$6,812.78
CIP Concrete	5.0	CY	$1,135.47	$5,677.35
2-ft x 2-ft Slide Gate	1.0	Each	$2,670.63	$2,670.63
Trash Rack	75.0	SF	$34.22	$2,566.50
Riprap Bank Protection	20.0	CY	$55.40	$1,108.00
Concrete Demo. & Disposal	2.0	CY	$209.94	$419.88
HDPE 24" Pipe	1.0	FT	$38.03	$38.03
			Total Field Cost:	$59,040.77
		Active Dewatering:	7.5%	$4,428.06
		Contingencies:	10%	$5,904.08
			Subtotal:	$69,372.91
		Engineering:	15%	$10,405.94
		Mobilization:	10%	$6,937.29
			Current Replacement Value (CRV):	**$86,716.13**

Facilities Condition Index (FCI):	0.8
Asset Priority Index (API):	80
Remediation Priority Index (RPI):	64

Deficiency

Category: CMDM

Rating: Critical

Local Name: Little Piney Weir

HKM ID:	**LP-WR1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Little Piney Ditch**	***Structure Type:***	**Weir**		
UTM Zone:	**13**	***Coordinates:***	**351705.2, 4933021.2**	***Total # of Photos:***	**4**

Notes: The Little Piney Ditch weir is located just downstream of the Bear Creek diversion. Water is diverted out of Little Piney Creek and flows to Bear Creek. Irrigation water is then diverted out of Bear Creek and continues down the Little Piney Ditch. Just downstream of this diversion is the weir for the Little Piney Ditch. This weir was identified by the state as being out of level. In addition, water can be seen piping around the headwall and not flowing through the weir throat. The state has asked the ditch company to address these issues. In addition, there is debate as to whether the weir should be relocated to directly below the Little Piney Ditch diversion and headgate. It seems that the current location is appropriate, as it is accounting for the diverted irrigation water that serves vast majority of irrigated lands from the Little Piney Ditch. Re-forming the cutoff walls, leveling, and re-calibrating the weir is recommended. The leveling and recalibration is identified as the miscellaneous cost.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
CIP Concrete	3.0	CY	$1,135.47	$3,406.41
Miscellaneous	500.0	$	$1.03	$515.00
Concrete Demo. & Disposal	2.0	CY	$209.94	$419.88
			Total Field Cost:	$4,341.29
		Contingencies:	10%	$434.13
			Subtotal:	$4,775.42
		Engineering:	5%	$238.77
		Mobilization:	10%	$477.54
			Total Rehabilitation Cost:	**$5,491.73**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Parshall Flume (35 cfs)	1.0	Each	$4,534.04	$4,534.04
CIP Concrete	3.0	CY	$1,135.47	$3,406.41
Miscellaneous	500.0	$	$1.03	$515.00
Concrete Demo. & Disposal	2.0	CY	$209.94	$419.88
			Total Field Cost:	$8,875.33
		Contingencies:	10%	$887.53
			Subtotal:	$9,762.86
		Engineering:	5%	$488.14
		Mobilization:	10%	$976.29
			Current Replacement Value (CRV):	**$11,227.29**

Facilities Condition Index (FCI):	0.49
Asset Priority Index (API):	60
Remediation Priority Index (RPI):	29

Deficiency

Category: C&ODM

Rating: Serious

Local Name: LX Diversion and Headgate

HKM ID:	**LX-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**LX Ditch**	***Structure Type:***	**Headgate**		
UTM Zone:	**12**	***Coordinates:***	**372838.1, 4919529.2**	***Total # of Photos:***	**7**

Notes: This structure represents the headgate and diversion structure for the LX Ditch. The diversion is approximately 300 feet downstream of the headgate, which has made the regulation difficult. In addition, the diversion is not stable, and has to be re-worked every year. The headgate is a 36" slide gate leaks around the headgate and along the pipe. Efforts have been made to seal the leak around the headgate, including pouring concrete at the outlet. Relocating the diversion upstream would be beneficial as it could better regulate the water surface at the headgate. In addition, the gate needs to be reset. Remediation assumes a rock vane diversion and new headgate. Miscellaneous costs reflect removal of the existing diversion dam and retrofitting a fish screening structure. Replacement assumes a rock vane with new headgate and culvert. In addition, it assumes a sluice gate to prevent sedimentation during non-irrigation flows. Miscellaneous replacement costs reflect a fish screen structure, as well as removal of the existing diversion.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	37,000.0	$	$1.03	$38,110.00
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
3-ft x 3-ft Slide Gate	1.0	Each	$3,728.89	$3,728.89

Total Field Cost: $100,298.50

Active Dewatering: 7.5% $7,522.39

Contingencies: 15% $15,044.78

Subtotal: $122,865.66

Engineering: 10% $12,286.57

Mobilization: 10% $12,286.57

Total Rehabilitation Cost: **$147,438.80**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	37,000.0	$	$1.03	$38,110.00
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
RCP 36" D	60.0	FT	$132.48	$7,948.80
CIP Concrete	4.0	CY	$1,135.47	$4,541.88
3-ft x 3-ft Slide Gate	1.0	Each	$3,728.89	$3,728.89
2-ft x 2-ft Slide Gate	1.0	Each	$2,670.63	$2,670.63
Structural Fill	10.0	CY	$36.65	$366.50
Structural Excavation	10.0	CY	$22.95	$229.50

Total Field Cost: $116,055.81

Active Dewatering: 7.5% $8,704.19

Contingencies: 15% $17,408.37

Subtotal: $142,168.37

Engineering: 10% $14,216.84

Mobilization: 10% $14,216.84

Current Replacement Value (CRV): **$170,602.04**

Facilities Condition Index (FCI): 0.86

Asset Priority Index (API): 60

Remediation Priority Index (RPI): 52

Deficiency

Category: CMDM

Rating: Serious

Local Name: Piney Divide Headgate

HKM ID:	**PD-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Piney Divide**			***Structure Type:***	**Headgate**
UTM Zone:	**13**	***Coordinates:***	**348089.9, 4935702.5**	***Total # of Photos:***	**4**

Notes: This structure is the headgate and diversion wall for the Piney Divide ditch, located on the South Fork of Piney Creek. The ditch is the first segment of a diversion that takes water from the South Fork of Piney Creek to Bear Creek. The direct flow appropriation for this ditch is 43.9 cfs; however, they typically run around 20 cfs. The headgate is a two bay concrete structure with two 4'x3' slide gates. The left slide gate is undermined, which allows diverted flows to quickly return to the creek. The gates do not seal. Landowners indicated that the diversion wall is in good condition and operates well. The concrete is showing significant cracking on the left wall, probably a result of the undermining. It is recommended that the left wall of the head works portion of the structure be replaced. In addition, the gates should be replaced as well. Safety features need to be added to the structure. Replacement assumes a rock vane diversion.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
4-ft x 4-ft Slide Gate	2.0	Each	$6,460.84	$12,921.68
Stream Control (Small)	1.0	Each	$6,812.78	$6,812.78
CIP Concrete	4.0	CY	$1,135.47	$4,541.88
Handrail	40.0	FT	$50.71	$2,028.40
Trash Rack	50.0	SF	$34.22	$1,711.00
Walkway (Expanded Steel)	33.0	SF	$17.95	$592.35
Structural Fill	15.0	CY	$36.65	$549.75
Structural Excavation	15.0	CY	$22.95	$344.25

Total Field Cost:		$29,502.09
Active Dewatering:	7.5%	$2,212.66
Contingencies:	10%	$2,950.21
Subtotal:		$34,664.96
Engineering:	10%	$3,466.50
Mobilization:	10%	$3,466.50
Total Rehabilitation Cost:		**$41,597.95**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
4-ft x 4-ft Slide Gate	2.0	Each	$6,460.84	$12,921.68
CIP Concrete	8.0	CY	$1,135.47	$9,083.76
Stream Control (Small)	1.0	Each	$6,812.78	$6,812.78
2-ft x 2-ft Slide Gate	1.0	Each	$2,670.63	$2,670.63
Handrail	40.0	FT	$50.71	$2,028.40
Trash Rack	50.0	SF	$34.22	$1,711.00
Concrete Demo. & Disposal	8.0	CY	$209.94	$1,679.52
Structural Fill	25.0	CY	$36.65	$916.25
Walkway (Expanded Steel)	33.0	SF	$17.95	$592.35
Structural Excavation	25.0	CY	$22.95	$573.75

Total Field Cost:		$69,890.12
Active Dewatering:	7.5%	$5,241.76
Contingencies:	10%	$6,989.01
Subtotal:		$82,120.89
Engineering:	10%	$8,212.09
Mobilization:	10%	$8,212.09
Current Replacement Value (CRV):		**$98,545.07**

Facilities Condition Index (FCI):	0.42
Asset Priority Index (API):	100
Remediation Priority Index (RPI):	42

Deficiency

Category:	CMDM
Rating:	Critical

Local Name: Pratt & Ferris #1 Diversion

HKM ID:	1PF-DD1	***BIA ID:***		***Division:***	Clear Creek
Canal Name:	Pratt & Ferris #1	***Structure Type:***	Diversion Dam		
UTM Zone:	13	***Coordinates:***	376306.3, 4935799.7	***Total # of Photos:***	5

Notes: The Pratt & Ferris #1 ditch diverts from Piney Creek. It has a direct flow water right of 18.1 cfs which can serve approximately 1270 acres. Operators indicated that they can run up to 21 cfs. The diversion consists of a concrete diversion spillway across the creek and a 4.5 x 4.5-foot rectangular steel gate on a concrete headwall. The diversion is very old, and the creek at the diversion is rather wide. Irrigators feel that the spillway crest may be too low to adequately divert flow to the head gate. The head gate is mounted on a newer concrete wall that is in front of the original concrete structure. The spillway has old signs and boards across it to increase its height. The spillway needs to be replaced. Handrail should be added at the head gate as well as a trash rack. Miscellaneous costs reflect a fish screen structure.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	69,000.0	$	$1.03	$71,070.00
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
Concrete Demo. & Disposal	75.0	CY	$209.94	$15,745.50
Handrail	80.0	FT	$50.71	$4,056.80
Trash Rack	50.0	SF	$34.22	$1,711.00
			Total Field Cost:	$151,042.91
		Active Dewatering:	7.5%	$11,328.22
		Contingencies:	10%	$15,104.29
			Subtotal:	$177,475.42
		Engineering:	15%	$26,621.31
		Mobilization:	10%	$17,747.54
			Total Rehabilitation Cost:	**$221,844.28**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	69,000.0	$	$1.03	$71,070.00
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
Concrete Demo. & Disposal	85.0	CY	$209.94	$17,844.90
CIP Concrete	6.0	CY	$1,135.47	$6,812.82
4-ft x 4-ft Slide Gate	1.0	Each	$6,460.84	$6,460.84
RCP 48" D	25.0	FT	$256.97	$6,424.25
Handrail	80.0	FT	$50.71	$4,056.80
RCP 24" D	35.0	FT	$89.40	$3,129.00
24" Diameter Canal Gate	1.0	Each	$2,868.20	$2,868.20
Trash Rack	80.0	SF	$34.22	$2,737.60
Riprap Bank Protection	2.0	CY	$55.40	$110.80
			Total Field Cost:	$179,974.82
		Active Dewatering:	7.5%	$13,498.11
		Contingencies:	10%	$17,997.48
			Subtotal:	$211,470.41
		Engineering:	15%	$31,720.56
		Mobilization:	10%	$21,147.04
			Current Replacement Value (CRV):	**$264,338.02**

Facilities Condition Index (FCI):	0.84
Asset Priority Index (API):	80
Remediation Priority Index (RPI):	67

Deficiency

Category: CHSci

Rating: Serious

Local Name: Pratt & Ferris #2 Diversion

HKM ID:	**2PF-DD1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Pratt & Ferris #2**	***Structure Type:***	**Diversion Dam**		
UTM Zone:	**13**	***Coordinates:***	**388758.2, 4941123.2**	***Total # of Photos:***	**12**

Notes: The Pratt & Ferris #2 ditch diverts out of Clear Creek approximately 1.8 miles south of Clearmont. The ditch has a direct flow water right of 28.3 cfs, which can serve approximately 1980 acres. Operators indicated that they typically run around 40 cfs. Irrigators feel that the crest of the diversion spillway has settled and they do not have the available head to push the volume of water they are appropriated. The head gate structure is a three-bay concrete structure. Two of the bays have 3 x 4.5-foot slide gates. The gates no longer seal, so a coffer dam must be build at the end of the irrigation season to prevent flows into the canal. The concrete is in poor condition. There is severe spalling and breakout on the whole structure. A 6" buttress wall was poured around the center piers, but it is cracking and falling away from the original structure. Cracking greater the 1/2" is present on a significant amount of the structure. For cracks greater than 1/2", it is assumed that the structural strength is lost and the section of the structure should be removed and replaced. For this reason, and the diversion elevation issues, the entire structure needs to be replaced. Replacement assumes a 'replace in kind' headgate section with a rock vane diversion; however, wall thicknesses were reduced to one foot. Costs also reflect a concrete weir downstream of the headworks that will spill water back to the creek instead of allowing too much flow down the ditch, which could overtop ditch banks. Miscellaneous costs reflect the costs of a fish screen structure and rated screen.

Remediation Assessment

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	99,000.0	$	$1.03	$101,970.00
CIP Concrete	32.0	CY	$1,135.47	$36,335.04
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
4-ft x 4-ft Slide Gate	4.0	Each	$6,460.84	$25,843.36
Concrete Demo. & Disposal	120.0	CY	$209.94	$25,192.80
USBR Concrete Weir (9' Notch)	1.0	Each	$11,710.55	$11,710.55
Trash Rack	108.0	SF	$34.22	$3,695.76
Handrail	65.0	FT	$50.71	$3,296.15
Structural Fill	70.0	CY	$36.65	$2,565.50
Structural Excavation	70.0	CY	$22.95	$1,606.50
Walkway (Expanded Steel)	54.0	SF	$17.95	$969.30

Total Field Cost:		$271,644.57
Active Dewatering:	7.5%	$20,373.34
Contingencies:	10%	$27,164.46
Subtotal:		$319,182.37
Engineering:	15%	$47,877.36
Mobilization:	10%	$31,918.24
Current Replacement Value (CRV):		**$398,977.97**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	90
Remediation Priority Index (RPI):	90

Deficiency

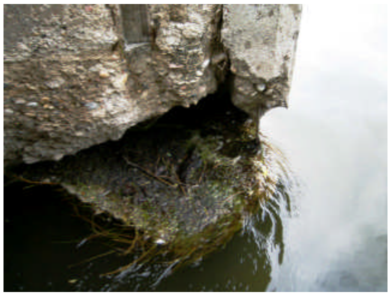
Category: CHSci

Rating: Critical

Local Name: Pratt & Ferris #3 Diversion

HKM ID:	**3PF-DD1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Pratt & Ferris #3**			***Structure Type:***	**Diversion Dam**
UTM Zone:	**13**	***Coordinates:***	**391760.8, 4946201.6**	***Total # of Photos:***	**20**

Notes: The Pratt & Ferris #3 ditch diverts out of Clear Creek approximately four miles downstream of the Pratt & Ferris #2 diversion. The appropriation of the ditch is 40.3 cfs, which serves approximately 2,800 acres. Irrigators indicated that they can run up to 60 cfs. The diversion consists of a four-bay concrete structure with a concrete diversion/spillway that spans the stream channel. Two of the bays have been completely filled with sediment and are inoperable. Only one of the two remaining bays has an operable gate. The concrete shows major spalling, and pop out. There is evidence of concrete repairs in the past, but these repairs are failing. There is exposed rebar and cracking. Complete replacement of the head gate is warranted. The diversion/spillway appears to be in good condition. There is no wasteway behind the head gate, and it was revealed that flows over 60 cfs cause ditch bank destruction downstream of the diversion. A wasteway gate or weir is important to help protect downstream infrastructure from flood events. Replacement of this structure assumes a similar three bay concrete structure with a downstream weir plate to allow excess flows to return to the creek without damaging the downstream ditch. Differences in concrete demo & disposal reflect the removal of the spillway. Replacement of the spillway is accounted for in the Rock Vane diversion costs. Miscellaneous costs reflect a fish screen structure.



Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	135,000.0	$	$1.03	$139,050.00
CIP Concrete	45.0	CY	$1,135.47	$51,096.15
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
4-ft x 4-ft Slide Gate	3.0	Each	$6,460.84	$19,382.52
Concrete Demo. & Disposal	80.0	CY	$209.94	$16,795.20
USBR Concrete Weir (9' Notch)	1.0	Each	$11,710.55	$11,710.55
Structural Fill	140.0	CY	$36.65	$5,131.00
Trash Rack	110.0	SF	$34.22	$3,764.20
Structural Excavation	140.0	CY	$22.95	$3,213.00
Handrail	35.0	FT	$50.71	$1,774.85
Walkway (Expanded Steel)	48.0	SF	$17.95	$861.60
			Total Field Cost:	$280,338.68
		Active Dewatering:	7.5%	$21,025.40
		Contingencies:	10%	$28,033.87
			Subtotal:	$329,397.95
		Engineering:	15%	$49,409.69
		Mobilization:	10%	$32,939.80
			Total Rehabilitation Cost:	**$411,747.44**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	135,000.0	$	$1.03	$139,050.00
CIP Concrete	45.0	CY	$1,135.47	$51,096.15
Concrete Demo. & Disposal	150.0	CY	$209.94	$31,491.00
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
4-ft x 4-ft Slide Gate	4.0	Each	$6,460.84	$25,843.36
USBR Concrete Weir (9' Notch)	1.0	Each	$11,710.55	$11,710.55
Trash Rack	110.0	SF	$34.22	$3,764.20
Structural Fill	100.0	CY	$36.65	$3,665.00
Structural Excavation	100.0	CY	$22.95	$2,295.00
Handrail	35.0	FT	$50.71	$1,774.85
Walkway (Expanded Steel)	48.0	SF	$17.95	$861.60
			Total Field Cost:	$330,011.32
		Active Dewatering:	7.5%	$24,750.85
		Contingencies:	10%	$33,001.13
			Subtotal:	$387,763.30
		Engineering:	15%	$58,164.50
		Mobilization:	10%	$38,776.33
			Current Replacement Value (CRV):	**$484,704.13**

Facilities Condition Index (FCI): 0.85

Asset Priority Index (API): 100

Remediation Priority Index (RPI): 85

Deficiency

Category: CHSdm

Rating: Critical

Local Name: Rock Creek & South Piney Ditch Diversion

HKM ID: **RC-HG1** ***BIA ID:*** ***Division:*** **Clear Creek**
Canal Name: **Rock Creek & South Piney Ditch** ***Structure Type:*** **Headgate**
UTM Zone: **13** ***Coordinates:*** **338491.6, 4926111.4** ***Total # of Photos:*** **4**

Notes: This structure is the diversion structure for the Rock Creek & South Piney Ditch. The ditch diverts flows from South Piney Creek and conveys water to the north fork of Rock Creek. The headgate is composed of dual 3.5' slide gates mounted to a concrete headwall. The flume section of the headgate is made of old wooden logs, and water was clearly returning to the creek along these walls. It was indicated that the ditch master has to get in the creek and stack rocks in the later irrigation season to divert enough water to the headgate. This could be remediated by a rock vane diversion structure. Remediation assumes replacing the wooden walls with concrete. In addition, safety features need to be added. No fish screening structure is recommended as the ditch is just a conveyance ditch that feeds a natural drainage. Replacement assumes installation of a sluice gate to prevent any sedimentation at the gate during the non-irrigation season. The assumed concrete sidewalls will address the diverted losses back to the creek. Additional seepage is evident downstream and will be addressed in the canal sections.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
CIP Concrete	6.0	CY	$1,135.47	$6,812.82
Structural Fill	25.0	CY	$36.65	$916.25
Handrail	16.0	FT	$50.71	$811.36
Structural Excavation	25.0	CY	$22.95	$573.75
Walkway (Expanded Steel)	24.0	SF	$17.95	$430.80
		Total Field Cost:		$68,004.59
		Active Dewatering:	7.5%	$5,100.34
		Contingencies:	15%	$10,200.69
		Subtotal:		$83,305.62
		Engineering:	10%	$8,330.56
		Mobilization:	10%	$8,330.56
		Total Rehabilitation Cost:		**$99,966.75**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
3.5-ft x 3.5-ft Slide Gate	2.0	Each	$4,516.91	$9,033.82
CIP Concrete	7.0	CY	$1,135.47	$7,948.29
3-ft x 3-ft Slide Gate	1.0	Each	$3,728.89	$3,728.89
Structural Fill	30.0	CY	$36.65	$1,099.50
Handrail	16.0	FT	$50.71	$811.36
Structural Excavation	30.0	CY	$22.95	$688.50
Walkway (Expanded Steel)	24.0	SF	$17.95	$430.80
		Total Field Cost:		$82,200.77
		Active Dewatering:	7.5%	$6,165.06
		Contingencies:	15%	$12,330.12
		Subtotal:		$100,695.94
		Engineering:	10%	$10,069.59
		Mobilization:	10%	$10,069.59
		Current Replacement Value (CRV):		**$120,835.13**

Facilities Condition Index (FCI):	0.83
Asset Priority Index (API):	90
Remediation Priority Index (RPI):	75

Deficiency

Category: CHSci
Rating: Critical

HKM ID:	SNF-CH1	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Senff Ditch			**Structure Type:**	Check
UTM Zone:	13	**Coordinates:**	361439.4, 4931484.0	**Total # of Photos:**	1

Notes: This structure location represents the first of four recommended check locations on the Senff Ditch. This location is on Steve Wuthier's property. He flood irrigates the area and has a difficult time regulating his turnout. He uses steel posts/canvas to check water to his culvert, and sometimes takes the whole ditch flow. A new check is recommended with a precast turnout to improve the operation of the ditch.

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$10,823.42
		Contingencies:	10%	$1,082.34
			Subtotal:	$11,905.76
		Engineering:	5%	$595.29
		Mobilization:	10%	$1,190.58

Current Replacement Value (CRV): **$13,691.63**

Deficiency

Category: CMDM

Rating: Serious

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 40

Remediation Priority Index (RPI): 40

HKM ID:	SNF-CH2	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Senff Ditch			**Structure Type:**	Check
UTM Zone:	13	**Coordinates:**	361576.1, 4931748.3	**Total # of Photos:**	0

Notes: This structure location represents the second of four recommended check locations on the Senff Ditch. The irrigator flood irrigates the area and has a difficult time regulating his turnout. A new check is recommended with a precast turnout to improve the operation of the ditch.

Remediation Assessment

Deficiency

Category: CMDM

Rating: Serious

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$10,823.42
		Contingencies:	10%	$1,082.34
			Subtotal:	$11,905.76
		Engineering:	5%	$595.29
		Mobilization:	10%	$1,190.58

Current Replacement Value (CRV): **$13,691.63**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	40

HKM ID:	SNF-CH3	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Senff Ditch			**Structure Type:**	Check
UTM Zone:	13	**Coordinates:**	361662.6, 4931757.4	**Total # of Photos:**	1

Notes: This structure location represents the third of four recommended check locations on the Senff Ditch. The irrigator flood irrigates the area and has a difficult time regulating his turnout. A new check is recommended with a precast turnout to improve the operation of the ditch.

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$10,823.42
		Contingencies:	10%	$1,082.34
			Subtotal:	$11,905.76
		Engineering:	5%	$595.29
		Mobilization:	10%	$1,190.58

Current Replacement Value (CRV): **$13,691.63**

Deficiency

Category: CMDM

Rating: Serious

Facilities Condition Index (FCI): 1.00

Asset Priority Index (API): 40

Remediation Priority Index (RPI): 40

HKM ID:	SNF-CH4	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Senff Ditch			**Structure Type:**	Check
UTM Zone:	13	**Coordinates:**	361895.0, 4932094.6	**Total # of Photos:**	0

Notes: This structure location represents the forth of four recommended check locations on the Senff Ditch. The irrigator flood irrigates the area and has a difficult time regulating his turnout. A new check is recommended with a precast turnout to improve the operation of the ditch. This is the start of a hillside section of the ditch, and the landowner indicated that he feels the ditch seeps along the hillside which sub-irrigates the field and reduces productivity. Remediation for the ditch section is identified in the Canals section.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
			Total Field Cost:	$10,823.42
		Contingencies:	10%	$1,082.34
			Subtotal:	$11,905.76
		Engineering:	5%	$595.29
		Mobilization:	10%	$1,190.58
			Current Replacement Value (CRV):	**$13,691.63**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	40

HKM ID:	**SNF-CH5**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Senff Ditch**			***Structure Type:***	**Check**
UTM Zone:	**13**	***Coordinates:***	**362400.8, 4933054.5**	***Total # of Photos:***	**0**

Notes: This location is the site of an old check that would serve the field below. It would also check water that served lands west of the road. This is in disrepair, but the landowner would like to establish gated pipe on these fields. A new check with precast turnout is recommended to aid in this. The gated pipe configuration is not presented in this section.

Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
Precast Concrete	1.0	CY	$493.93	$493.93

Total Field Cost:		$6,636.87
Contingencies:	10%	$663.69
Subtotal:		$7,300.56
Engineering:	5%	$365.03
Mobilization:	10%	$730.06

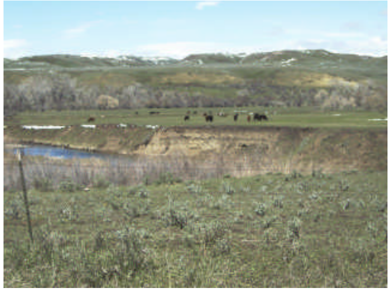
Current Replacement Value (CRV): **$8,395.64**

Facilities Condition Index (FCI):	1.00
Asset Priority Index (API):	40
Remediation Priority Index (RPI):	40

Local Name: Senff Headgate

HKM ID:	SNF-HG1	**BIA ID:**		**Division:**	Clear Creek
Canal Name:	Senff Ditch			**Structure Type:**	Headgate
UTM Zone:	13	**Coordinates:**	360909.3, 4931196.2	**Total # of Photos:**	2

Notes: This structure is the Senff Headgate. This structure diverts out of Piney Creek, and has an appropriation of 3.14 cfs, according to an irrigator. The headgate seems to operate well. There are concerns about stream bank stability up stream of the structure. It was indicated that the diversion rock wall needs to be rebuilt every few years. A rock vane diversion could stabilize this reach of the stream as well as provide a permanent diversion that would not need to be rebuilt every few years. Miscellaneous costs reflect a fish screen structure.



Deficiency

Category: CMDM

Rating: Serious

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Miscellaneous	24,000.0	$	$1.03	$24,720.00
Trash Rack	25.0	SF	$34.22	$855.50
Handrail	10.0	FT	$50.71	$507.10
			Total Field Cost:	$56,982.60
			Contingencies: 10%	$5,698.26
			Subtotal:	$62,680.86
			Engineering: 10%	$6,268.09
			Mobilization: 10%	$6,268.09
			Total Rehabilitation Cost:	**$75,217.03**

Replacement Costs

Item Description	Quantity	Units	Unit Cost	Total
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
Miscellaneous	24,000.0	$	$1.03	$24,720.00
2-ft x 2-ft Slide Gate	2.0	Each	$2,670.63	$5,341.26
CIP Concrete	4.0	CY	$1,135.47	$4,541.88
RCP 24" D	40.0	FT	$89.40	$3,576.00
Trash Rack	50.0	SF	$34.22	$1,711.00
Structural Fill	25.0	CY	$36.65	$916.25
Structural Excavation	25.0	CY	$22.95	$573.75
Riprap Bank Protection	2.0	CY	$55.40	$110.80
			Total Field Cost:	$99,950.55
			Contingencies: 10%	$9,995.06
			Subtotal:	$109,945.61
			Engineering: 10%	$10,994.56
			Mobilization: 10%	$10,994.56
			Current Replacement Value (CRV):	**$131,934.73**

Facilities Condition Index (FCI):	0.57
Asset Priority Index (API):	60
Remediation Priority Index (RPI):	34

Local Name: Six Mile Headgate

HKM ID:	**6M-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Six Mile**			***Structure Type:***	**Headgate**
UTM Zone:	**13**	***Coordinates:***	**360129.1, 4909709.1**	***Total # of Photos:***	**5**

Notes: The Six Mile Ditch diverts out of Clear Creek approximately 0.2 miles downstream of the Johnson Holt Diversion. The Six Mile Ditch has an appropriation of approximately 29.5 cfs, though they typically only run 16 to 20 cfs, and serves approximately 2,060 acres. The head gate consists of a single 3.5 x 5.3-foot rectangular steel gate operated with a Waterman-type screw. The gate is mounted to a concrete headwall and is adjacent to a concrete rock dam. There are no fish screens associated with the structure. Interviews indicated that the head gate operates well, but the stream channel has cut down to the point that it is difficult to divert enough water during the late irrigation season. Remediation for this structure includes a trash rack and rock vane to aid in diversion. Safety features including handrail and walkway should be installed. Miscellaneous costs reflect the costs of a screening structure, as well as the rated fish screen.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	105,000.0	$	$1.03	$108,150.00
Trash Rack	24.0	SF	$34.22	$821.28
Walkway (Expanded Steel)	15.0	SF	$17.95	$269.25
Handrail	5.0	FT	$50.71	$253.55
			Total Field Cost:	$109,494.08
		Active Dewatering:	7.5%	$8,212.06
		Contingencies:	10%	$10,949.41
			Subtotal:	$128,655.54
		Engineering:	10%	$12,865.55
		Mobilization:	10%	$12,865.55
			Total Rehabilitation Cost:	**$154,386.65**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	105,000.0	$	$1.03	$108,150.00
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Stream Control (Medium)	1.0	Each	$27,559.61	$27,559.61
4-ft x 4-ft Slide Gate	1.0	Each	$6,460.84	$6,460.84
NRCS Concrete Check (4'x4' Notch)	1.0	Each	$6,142.94	$6,142.94
Trash Rack	24.0	SF	$34.22	$821.28
Structure Removal: Check (15')	1.0	Each	$756.16	$756.16
Walkway (Expanded Steel)	15.0	SF	$17.95	$269.25
Handrail	5.0	FT	$50.71	$253.55
			Total Field Cost:	$181,313.63
		Active Dewatering:	7.5%	$13,598.52
		Contingencies:	10%	$18,131.36
			Subtotal:	$213,043.52
		Engineering:	10%	$21,304.35
		Mobilization:	10%	$21,304.35
			Current Replacement Value (CRV):	**$255,652.22**

Facilities Condition Index (FCI):	0.6
Asset Priority Index (API):	90
Remediation Priority Index (RPI):	54

Deficiency

Category: CHSci

Rating: Serious

Local Name: Sand Creek Siphon

HKM ID:	6M-SPN2	***BIA ID:***		***Division:***	Clear Creek
Canal Name:	Six Mile			***Structure Type:***	Siphon
UTM Zone:	13	***Coordinates:***	362266.0, 4908035.7	***Total # of Photos:***	3

Notes: This siphon is the second siphon on the Six Mile Ditch. The 30" steel siphon conveys water across Sand Creek and is in good condition, however; it was designed to carry only the ditch appropriation. This introduces safety issues, as a large storm event could contribute enough flows to the ditch, that the ditch banks could overtop upstream of this structure and wash out the ditch. It is recommended that a 30" siphon be installed next to the existing siphon. This would allow for double appropriation flows if they are available, as well as reduce the risk of the siphon overtopping during large storm events. Replacement assumes an upsized RCP siphon.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
RCP 30" D	500.0	FT	$99.93	$49,965.00
CIP Concrete	3.0	CY	$1,135.47	$3,406.41
Trash Rack	30.0	SF	$34.22	$1,026.60
Structural Fill	10.0	CY	$36.65	$366.50
Structural Excavation	10.0	CY	$22.95	$229.50
			Total Field Cost:	$54,994.01
		Contingencies:	10%	$5,499.40
			Subtotal:	$60,493.41
		Engineering:	10%	$6,049.34
		Mobilization:	10%	$6,049.34
			Total Rehabilitation Cost:	**$72,592.09**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
RCP 42" D	500.0	FT	$176.14	$88,070.00
Precast Turnout	1.0	Each	$4,680.48	$4,680.48
CIP Concrete	4.0	CY	$1,135.47	$4,541.88
Trash Rack	40.0	SF	$34.22	$1,368.80
Structural Fill	15.0	CY	$36.65	$549.75
Structural Excavation	15.0	CY	$22.95	$344.25
			Total Field Cost:	$99,555.16
		Contingencies:	10%	$9,955.52
			Subtotal:	$109,510.68
		Engineering:	10%	$10,951.07
		Mobilization:	10%	$10,951.07
			Current Replacement Value (CRV):	**$131,412.81**

Facilities Condition Index (FCI):	0.55
Asset Priority Index (API):	80
Remediation Priority Index (RPI):	44

Deficiency

Category: CMDM

Rating: Serious

Local Name: Sturdovant Headgate

HKM ID:	**ST-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**Sturdovant Ditch**	***Structure Type:***	**Headgate**		
UTM Zone:	**13**	***Coordinates:***	**365283.4, 4937070.4**	***Total # of Photos:***	**3**

Notes: The Sturdovant Ditch diverts out of Piney Creek, upstream of its confluence with Boxelder Creek. The headgate is recessed on the ditch and receives diverted flows from two diversions. The first diversion is on the main stem of Piney Creek and pushes water to a side channel. The side channel flow is then diverted to the ditch from a second dam. The headgate is in good condition and seals well. There are maintenance issues associated with the dams, which require significant labor, and present safety issues. Remediation assumes replacing the current diversions with rock vane diversions. These provide a permanent, fish friendly diversion that will not require the yearly maintenance currently needed. Replacement assumes relocating the headgate upstream to the beginning of the ditch. It is also recommended that a sluice gate be installed to eliminate sedimentation upstream of the rock vane. Miscellaneous costs reflect a fish screen structure at the headgate.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Rock Vane Diversion	2.0	Each	$30,900.00	$61,800.00
Miscellaneous	30,000.0	$	$1.03	$30,900.00
Trash Rack	80.0	SF	$34.22	$2,737.60

Total Field Cost:		$95,437.60
Active Dewatering:	7.5%	$7,157.82
Contingencies:	15%	$14,315.64
Subtotal:		$116,911.06
Engineering:	10%	$11,691.11
Mobilization:	10%	$11,691.11
Total Rehabilitation Cost:		**$140,293.27**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Rock Vane Diversion	2.0	Each	$30,900.00	$61,800.00
Miscellaneous	30,000.0	$	$1.03	$30,900.00
CIP Concrete	8.0	CY	$1,135.47	$9,083.76
3-ft x 3-ft Slide Gate	1.0	Each	$3,728.89	$3,728.89
Trash Rack	80.0	SF	$34.22	$2,737.60
2-ft x 2-ft Slide Gate	1.0	Each	$2,670.63	$2,670.63
RCP 36" D	20.0	FT	$132.48	$2,649.60
Handrail	40.0	FT	$50.71	$2,028.40
RCP 24" D	20.0	FT	$89.40	$1,788.00
Walkway (Expanded Steel)	60.0	SF	$17.95	$1,077.00
Concrete Demo. & Disposal	4.0	CY	$209.94	$839.76
Structural Fill	10.0	CY	$36.65	$366.50
Structural Excavation	10.0	CY	$22.95	$229.50
Riprap Bank Protection	2.0	CY	$55.40	$110.80

Total Field Cost:		$120,010.44
Active Dewatering:	7.5%	$9,000.78
Contingencies:	15%	$18,001.57
Subtotal:		$147,012.79
Engineering:	10%	$14,701.28
Mobilization:	10%	$14,701.28
Current Replacement Value (CRV):		**$176,415.35**

Deficiency

Category: CMDM

Rating: Serious

Facilities Condition Index (FCI):	0.8
Asset Priority Index (API):	60
Remediation Priority Index (RPI):	48

Local Name: WJD Headgate

HKM ID:	**WJD-HG1**	***BIA ID:***		***Division:***	**Clear Creek**
Canal Name:	**WJD Ditch**	***Structure Type:***	**Headgate**		
UTM Zone:	**13**	***Coordinates:***	**366873.2, 4936960.0**	***Total # of Photos:***	**6**

Notes: This structure is the headgate for the WJD (Williams, Jackens, Dickey) Ditch, which diverts out of Piney Creek. The headgate is recessed off of the creek, and there was no evidence of any diversion structure. There is concern of the headgate overtopping and washing out. There are signs of erosion, and bank sloughing around the headgate. The gate does not hold its seal as evident in the leaking behind the gate. This structure should have a sluice gate that allows flows back to the creek, and would reduce the risk of overtopping. As mentioned, there is no evidence of a diversion, but it was not noted that they have any trouble diverting water down the ditch to the headgate. The main gate needs to be replaced and trash rack needs to be added in addition to the sluice gate installation and drainage channel. Miscellaneous costs reflect the cost of a fish screen structure. No rock vane diversion is recommended for rehab as there was no indication of diversion issues. A rock vane is recommended for the replacement cost as this is a typical diversion structure used in the watershed.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Miscellaneous	30,000.0	$	$1.03	$30,900.00
CIP Concrete	4.0	CY	$1,135.47	$4,541.88
3-ft x 3-ft Slide Gate	1.0	Each	$3,728.89	$3,728.89
2-ft x 2-ft Slide Gate	1.0	Each	$2,670.63	$2,670.63
RCP 24" D	20.0	FT	$89.40	$1,788.00
Trash Rack	30.0	SF	$34.22	$1,026.60
Handrail	20.0	FT	$50.71	$1,014.20
Riprap Bank Protection	10.0	CY	$55.40	$554.00
Walkway (Expanded Steel)	30.0	SF	$17.95	$538.50
Structural Fill	6.0	CY	$36.65	$219.90
Structural Excavation	6.0	CY	$22.95	$137.70
Unclassified Excavation	40.0	CY	$2.59	$103.60

Total Field Cost:		$47,223.90
Active Dewatering:	7.5%	$3,541.79
Contingencies:	15%	$7,083.59
Subtotal:		$57,849.28
Engineering:	10%	$5,784.93
Mobilization:	10%	$5,784.93
Total Rehabilitation Cost:		**$69,419.13**

Replacement Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Rock Vane Diversion	1.0	Each	$30,900.00	$30,900.00
Miscellaneous	30,000.0	$	$1.03	$30,900.00
CIP Concrete	8.0	CY	$1,135.47	$9,083.76
3-ft x 3-ft Slide Gate	1.0	Each	$3,728.89	$3,728.89
2-ft x 2-ft Slide Gate	1.0	Each	$2,670.63	$2,670.63
RCP 24" D	20.0	FT	$89.40	$1,788.00
Trash Rack	30.0	SF	$34.22	$1,026.60
Handrail	20.0	FT	$50.71	$1,014.20
Riprap Bank Protection	10.0	CY	$55.40	$554.00
Structural Fill	15.0	CY	$36.65	$549.75
Walkway (Expanded Steel)	30.0	SF	$17.95	$538.50
Structural Excavation	15.0	CY	$22.95	$344.25
Unclassified Excavation	40.0	CY	$2.59	$103.60

Total Field Cost:		$83,202.18
Active Dewatering:	7.5%	$6,240.16
Contingencies:	15%	$12,480.33
Subtotal:		$101,922.67
Engineering:	10%	$10,192.27
Mobilization:	10%	$10,192.27
Current Replacement Value (CRV):		**$122,307.21**

Deficiency

Category: C&ODM

Rating: Minor

Facilities Condition Index (FCI):	0.57
Asset Priority Index (API):	60
Remediation Priority Index (RPI):	34

Canal Reports

Cleaning/Reshaping Report

HKM ID:	**BB-1**	**Division:**	**Clear Creek**		
Canal Name:	**Big Bonanza [BB-1]**	**Length:**	**28,190 ft**	**Total # of Photos:**	**2**

Notes: This reach represents cleaning/reshaping costs associated with the Big Bonanza ditch. Landowner interviews indicated no concern for seepage areas or significant losses within the ditch. The ditch has sections of the ditch which are lined with concrete; however, there were no concerns identified regarding condition of concrete. The cleaning/reshaping costs assume an average cross-section of 12-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	38,000.0	SY	$0.62	$23,560.00

Total Field Cost:		$23,560.00
Contingencies:	10%	$2,356.00
Subtotal:		$25,916.00
Engineering:	0%	$0.00
Mobilization:	10%	$2,591.60
Total Rehabilitation Cost:		**$28,507.60**
Average Rehabilitation Cost per Foot:		**$1.01**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID: **BR-1** **Division:** **Clear Creek**

Canal Name: **Big Redman [BR-1]** **Length:** **24,500 ft** **Total # of Photos:** **2**

Notes: This reach is a cleaning and reshaping estimate for the length of the canal. Included is an area that was identified as a very flat grade section that could be a canal constriction. This reach begins along the hillside west of the George residence. It is assumed that it can be remediated with cleaning/reshaping which could put the section back on grade. Cleaning costs assume a 10-foot cross-section.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	27,300.0	SY	$0.62	$16,926.00

Total Field Cost:		$16,926.00
Contingencies:	10%	$1,692.60
Subtotal:		$18,618.60
Engineering:	0%	$0.00
Mobilization:	10%	$1,861.86
Total Rehabilitation Cost:		**$20,480.46**
Average Rehabilitation Cost per Foot:		**$0.84**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**BF-1**	**Division:**	**Clear Creek**

Canal Name:	**Brown & Foster [BF-1]**	**Length:**	**5,600 ft**	**Total # of Photos:**	**0**

Notes: This reach of the Brown & Foster ditch represents the ditch from the headgate to the start of the recommended pipeline (BF-2). The cost assumes cleaning and expanding the ditch to accommodate additional flows that could be transferred from the Eaglerock Ditch. The cross-section is assumed to have a length of 12-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	8,000.0	SY	$0.62	$4,960.00

Total Field Cost:		$4,960.00
Contingencies:	10%	$496.00
Subtotal:		$5,456.00
Engineering:	0%	$0.00
Mobilization:	10%	$545.60
Total Rehabilitation Cost:		**$6,001.60**
Average Rehabilitation Cost per Foot:		**$1.07**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**DD-1**	**Division:**	**Clear Creek**		
Canal Name:	**Dunlap Ditch [DUN-1]**	**Length:**	**11,740 ft**	**Total # of Photos:**	**1**
Notes:	This reach represents the cleaning/reshaping costs associated with the Dunlap Ditch. There was one section of seepage and bank stability identified by landowners. This section is represented in DD-2. The cross-section length is assumed to be 10-feet.				

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	13,100.0	SY	$0.62	$8,122.00

Total Field Cost:		$8,122.00
Contingencies:	10%	$812.20
Subtotal:		$8,934.20
Engineering:	0%	$0.00
Mobilization:	10%	$893.42
Total Rehabilitation Cost:		**$9,827.62**
Average Rehabilitation Cost per Foot:		**$0.84**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**FOX-1**	**Division:**	**Clear Creek**		
Canal Name:	**Fox Ditch [FOX-1]**	**Length:**	**13,680 ft**	**Total # of Photos:**	**2**

Notes: The this reach represents the cleaning/reshaping recommended for the Fox ditch. The Fox ditch has combined the flows of the Yarwood, Lilly and Pride of the Valley, which has worked well and reduced overall losses. There is interest in a pipeline that could serve the majority of this valley. This is not addressed in this portion of the report. No areas of significant losses or seepage have been identified. The ditch seems to operate well. Canal cleaning assumes an average cross-section length of 11-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	16,750.0	SY	$0.62	$10,385.00

Total Field Cost:		$10,385.00
Contingencies:	10%	$1,038.50
Subtotal:		$11,423.50
Engineering:	0%	$0.00
Mobilization:	10%	$1,142.35
Total Rehabilitation Cost:		**$12,565.85**
Average Rehabilitation Cost per Foot:		**$0.92**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**FH-1**	**Division:**	**Clear Creek**

Canal Name:	**Frank Hopkins [FH-1]**	**Length:**	**21,000 ft**	**Total # of Photos:**	**0**

Notes: This reach represents cleaning costs for the Frank Hopkins Ditch. The ditch has a direct flow right of 10.1 cfs. Cleaning assumes a cross-section of 10-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	23,500.0	SY	$0.62	$14,570.00

Total Field Cost:		$14,570.00
Contingencies:	10%	$1,457.00
Subtotal:		$16,027.00
Engineering:	0%	$0.00
Mobilization:	10%	$1,602.70
Total Rehabilitation Cost:		**$17,629.70**
Average Rehabilitation Cost per Foot:		**$0.84**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**HAL-1**	**Division:**	**Clear Creek**		
Canal Name:	**Hallie Ditch [HAL-1]**	**Length:**	**32,340 ft**	**Total # of Photos:**	**2**
Notes:	This reach reflects the costs of cleaning/reshaping the Hallie Ditch. Seepage was identified by landowners and field visits. This is addressed in HAL-2. Cleaning costs assume a cross-section length of 12-feet.				

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	43,200.0	SY	$0.62	$26,784.00

Total Field Cost:		$26,784.00
Contingencies:	10%	$2,678.40
Subtotal:		$29,462.40
Engineering:	0%	$0.00
Mobilization:	10%	$2,946.24
Total Rehabilitation Cost:		**$32,408.64**
Average Rehabilitation Cost per Foot:		**$1.00**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**HL-1**	**Division:**	**Clear Creek**		
Canal Name:	**High Line Ditch [HL-1]**	**Length:**	**3,500 ft**	**Total # of Photos:**	**1**

Notes: This reach of the High Line Ditch represents the first section of the ditch from the headgate to the interstate. Seepage issues were not identified on this reach. Cleaning/reshaping is recommended. For cost estimation, the ditch cross-section is assumed to be 10-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	3,500.0	SY	$0.62	$2,170.00

Total Field Cost:		$2,170.00
Contingencies:	10%	$217.00
Subtotal:		$2,387.00
Engineering:	0%	$0.00
Mobilization:	10%	$238.70
Total Rehabilitation Cost:		**$2,625.70**
Average Rehabilitation Cost per Foot:		**$0.75**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**HO-1**	***Division:***	**Clear Creek**		
Canal Name:	**Hillyer & Onslow [HO-1]**	***Length:***	**8,700 ft**	***Total # of Photos:***	**0**

Notes: The Hilllyer & Onslow Ditch was identified as being in good condition, with no significant seepage issues. The ditch has a direct flow right of 2.58 cfs. General cleaning and reshaping is recommended. This is estimated assuming an 8-foot cross-section.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Canal Cleaning	7,700.0	SY	$0.62	$4,774.00

Total Field Cost:		$4,774.00
Contingencies:	10%	$477.40
Subtotal:		$5,251.40
Engineering:	0%	$0.00
Mobilization:	10%	$525.14
Total Rehabilitation Cost:		**$5,776.54**
Average Rehabilitation Cost per Foot:		**$0.66**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**JC-2**	**Division:**	**Clear Creek**		
Canal Name:	**Johnson Creek [JC-1]**	**Length:**	**6,900 ft**	**Total # of Photos:**	**1**

Notes: This reach of the Johnson Creek ditch represents cleaning costs associated with the open channel portion of the ditch. JC-1 represents a recommended pipe section for the ditch. JC-2 represents the cleaning upstream and downstream of this recommended pipe section. The cross-section is assumed to be six-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	4,600.0	SY	$0.62	$2,852.00

Total Field Cost:		$2,852.00
Contingencies:	10%	$285.20
Subtotal:		$3,137.20
Engineering:	0%	$0.00
Mobilization:	10%	$313.72
Total Rehabilitation Cost:		**$3,450.92**
Average Rehabilitation Cost per Foot:		**$0.50**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID: JH-1
Division: Clear Creek
Canal Name: Johnson Holt [JH-1]
Length: 43,630 ft
Total # of Photos: 2
Notes: This reach represents cleaning costs associated with the Johnson Holt ditch. This ditch did not have significant seepage areas, but did has sediment issues. These are addressed in other Johnson Holt sections. Cleaning costs assume a cross-section length of 12-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	58,200.0	SY	$0.62	$36,084.00

Total Field Cost:		$36,084.00
Contingencies:	10%	$3,608.40
Subtotal:		$39,692.40
Engineering:	0%	$0.00
Mobilization:	10%	$3,969.24
Total Rehabilitation Cost:		**$43,661.64**
Average Rehabilitation Cost per Foot:		**$1.00**

Deficiency

Category: C&ODM
Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**LADD-1**	**Division:**	**Clear Creek**		
Canal Name:	**Ladd Ditch [LADD-1]**	**Length:**	**9,200 ft**	**Total # of Photos:**	**3**

Notes: This reach of the Ladd Ditch represents cleaning costs for the length of the ditch. No seepage reaches were identified. Cleaning costs assume a 10-foot cross section.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	10,250.0	SY	$0.62	$6,355.00

Total Field Cost:		$6,355.00
Contingencies:	10%	$635.50
Subtotal:		$6,990.50
Engineering:	0%	$0.00
Mobilization:	10%	$699.05
Total Rehabilitation Cost:		**$7,689.55**
Average Rehabilitation Cost per Foot:		**$0.84**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**LDS-1**	**Division:**	**Clear Creek**		
Canal Name:	**Lake Desmet Ditch [LDS-1]**	**Length:**	**69,300 ft**	**Total # of Photos:**	**0**
Notes:	This reach represents cleaning costs for the Lake Desmet (M&M) Ditch. This ditch assumes a 20-foot cross-section.				

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	155,000.0	SY	$0.62	$96,100.00

Total Field Cost:		$96,100.00
Contingencies:	10%	$9,610.00
Subtotal:		$105,710.00
Engineering:	0%	$0.00
Mobilization:	10%	$10,571.00
Total Rehabilitation Cost:		**$116,281.00**
Average Rehabilitation Cost per Foot:		**$1.68**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	LC-1	**Division:**	Clear Creek		
Canal Name:	Last Chance [LC-1]	**Length:**	22,000 ft	**Total # of Photos:**	2
Notes:	This reach represents the Last Chance ditch cleaning estimate. The cross-section length is assumed to be 9-feet.				

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	22,000.0	SY	$0.62	$13,640.00
			Total Field Cost:	$13,640.00
		Contingencies:	10%	$1,364.00
			Subtotal:	$15,004.00
		Engineering:	0%	$0.00
		Mobilization:	10%	$1,500.40
			Total Rehabilitation Cost:	**$16,504.40**
			Average Rehabilitation Cost per Foot:	**$0.75**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**LD-1**	**Division:**	**Clear Creek**		
Canal Name:	**Leiter Ditch [LD-1]**	**Length:**	**7,000 ft**	**Total # of Photos:**	**2**

Notes: This reach represents cleaning costs recommended for the Leiter Ditch. Seepage and canal constrictions are remediated in LD-2, LD-3, and LD-4. Cleaning costs assume a cross section of 20 feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	15,600.0	SY	$0.62	$9,672.00

Total Field Cost:		$9,672.00
Contingencies:	10%	$967.20
Subtotal:		$10,639.20
Engineering:	0%	$0.00
Mobilization:	10%	$1,063.92
Total Rehabilitation Cost:		**$11,703.12**
Average Rehabilitation Cost per Foot:		**$1.67**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**LP-1**	**Division:**	**Clear Creek**		
Canal Name:	**Little Piney Ditch [LP-1]**	**Length:**	**15,700 ft**	**Total # of Photos:**	**0**

Notes: This reach reflects cleaning/reshaping costs associated with the Little Piney ditch. Seepage issues are addressed in LP-2. The cleaning costs assume a cross-section length of 13-feet. The length of the ditch reflects the total length minus the length of identified seepage areas. This includes an area that was recently put in pipe (300 ft).

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	22,700.0	SY	$0.62	$14,074.00

Total Field Cost:		$14,074.00
Contingencies:	10%	$1,407.40
Subtotal:		$15,481.40
Engineering:	0%	$0.00
Mobilization:	10%	$1,548.14
Total Rehabilitation Cost:		**$17,029.54**
Average Rehabilitation Cost per Foot:		**$1.08**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**LX-1**	**Division:**	**Clear Creek**		
Canal Name:	**LX Ditch [LX-1]**	**Length:**	**13,000 ft**	**Total # of Photos:**	**1**

Notes: This reach represents the cleaning costs for the length of the LX Ditch. The ditch has a couple of problem areas that are identified in LX-2 and LX-3. The costs assume a cross section of 8-ft.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	11,600.0	SY	$0.62	$7,192.00

Total Field Cost:		$7,192.00
Contingencies:	10%	$719.20
Subtotal:		$7,911.20
Engineering:	0%	$0.00
Mobilization:	10%	$791.12
Total Rehabilitation Cost:		**$8,702.32**
Average Rehabilitation Cost per Foot:		**$0.67**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**ONO-1**	**Division:**	**Clear Creek**		
Canal Name:	**Ono Ditch [ONO-1]**	**Length:**	**8,000 ft**	**Total # of Photos:**	**0**
Notes:	This reach represents cleaning costs associated with the existing Ono Ditch. The cleaning costs assumes a cross section of 10-ft.				

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	8,900.0	SY	$0.62	$5,518.00

Total Field Cost:		$5,518.00
Contingencies:	10%	$551.80
Subtotal:		$6,069.80
Engineering:	0%	$0.00
Mobilization:	10%	$606.98
Total Rehabilitation Cost:		**$6,676.78**
Average Rehabilitation Cost per Foot:		**$0.83**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**PD-1**	**Division:**	**Clear Creek**		
Canal Name:	**Piney Divide [PD-1]**	**Length:**	**8,250 ft**	**Total # of Photos:**	**4**
Notes:	This reach reflects cleaning/reshaping costs associated with the Piney Divide ditch. Seepage issues are addressed in PD-2. The cleaning costs assume a cross-section length of 13-feet.				

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	12,000.0	SY	$0.62	$7,440.00

Total Field Cost:		$7,440.00
Contingencies:	10%	$744.00
Subtotal:		$8,184.00
Engineering:	0%	$0.00
Mobilization:	10%	$818.40
Total Rehabilitation Cost:		**$9,002.40**
Average Rehabilitation Cost per Foot:		**$1.09**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**1PF-1**	**Division:**	**Clear Creek**		
Canal Name:	**Pratt & Ferris #1 [PF-1]**	**Length:**	**36,760 ft**	**Total # of Photos:**	**3**

Notes: This reach reflects the cleaning/reshaping costs associated with the Pratt & Ferris #1 ditch. The reach has stability issues near the end of the ditch. These are addressed in 1PF-2. No other seepage or problem areas were identified during field investigation. The cleaning cost assumes an average cross-section length of 14-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	57,200.0	SY	$0.62	$35,464.00

Total Field Cost:		$35,464.00
Contingencies:	10%	$3,546.40
Subtotal:		$39,010.40
Engineering:	0%	$0.00
Mobilization:	10%	$3,901.04
Total Rehabilitation Cost:		**$42,911.44**
Average Rehabilitation Cost per Foot:		**$1.17**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**2PF-1**	**Division:**	**Clear Creek**		
Canal Name:	**Pratt & Ferris #2 [PF-2]**	**Length:**	**66,750 ft**	**Total # of Photos:**	**1**
Notes:	This reach represents the cleaning costs associated with the length of the Pratt & Ferris #2. The average cross-section was assumed to be 14 feet.				

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	104,000.0	SY	$0.62	$64,480.00

Total Field Cost:		$64,480.00
Contingencies:	10%	$6,448.00
Subtotal:		$70,928.00
Engineering:	0%	$0.00
Mobilization:	10%	$7,092.80
Total Rehabilitation Cost:		**$78,020.80**
Average Rehabilitation Cost per Foot:		**$1.17**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**3PF-1**	**Division:**	**Clear Creek**		
Canal Name:	**Pratt & Ferris #3 [PF-3]**	**Length:**	**49,400 ft**	**Total # of Photos:**	**4**

Notes: This reach represents the cleaning costs associated with the Pratt & Ferris #3 ditch. Landowners indicated that they have one seepage problem area but that it was to be remedied last fall (2009). No other problem reaches were identified. For this reason, the only costs for this ditch are for cleaning and reshaping. Average cross-section length was estimated to be 16 feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	88,000.0	SY	$0.62	$54,560.00

Total Field Cost:		$54,560.00
Contingencies:	10%	$5,456.00
Subtotal:		$60,016.00
Engineering:	0%	$0.00
Mobilization:	10%	$6,001.60
Total Rehabilitation Cost:		**$66,017.60**
Average Rehabilitation Cost per Foot:		**$1.34**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**PA-1**	***Division:***	**Clear Creek**		
Canal Name:	**Prince Albert [PA-1]**	***Length:***	**22,500 ft**	***Total # of Photos:***	**0**

Notes: This reach represents the cleaning costs associated with Prince Albert Ditch. The Prince Albert Ditch diverts out of Rock Creek from the same headgate that serves the Ono Ditch. These two ditches parallel each other for the length of the Ono Ditch. It could be beneficial to combine the ditches into one. This could reduce seepage lining costs. The cleaning costs assume a 12 foot cross-section.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Canal Cleaning	30,000.0	SY	$0.62	$18,600.00

Total Field Cost:		$18,600.00
Contingencies:	10%	$1,860.00
Subtotal:		$20,460.00
Engineering:	0%	$0.00
Mobilization:	10%	$2,046.00
Total Rehabilitation Cost:		**$22,506.00**
Average Rehabilitation Cost per Foot:		**$1.00**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**SNF-1**	**Division:**	**Clear Creek**		
Canal Name:	**Senff Ditch [SEN-1]**	**Length:**	**4,280 ft**	**Total # of Photos:**	**2**

Notes: This reach represents the Senff Ditch. This ditch diverts out of Piney Creek and serves three ranches. There is a seepage section identified as SNF-2. Costs assume a cross-section of 8-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	3,850.0	SY	$0.62	$2,387.00

Total Field Cost:		$2,387.00
Contingencies:	10%	$238.70
Subtotal:		$2,625.70
Engineering:	10%	$262.57
Mobilization:	0%	$0.00
Total Rehabilitation Cost:		**$2,888.27**
Average Rehabilitation Cost per Foot:		**$0.67**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	6M-1	**Division:**	Clear Creek		
Canal Name:	Six Mile [6M-1]	**Length:**	55,200 ft	**Total # of Photos:**	1

Notes: This reach reflects the cleaning costs for the Six Mile ditch. Landowner interviews indicated that the Six Mile ditch does not have any areas of significant seepage, and typically operates well. The beginning of the ditch conveys water for approximately six miles without a significant delivery. Evaporation and seepage losses could be reduced by lining this section; however, losses were not identified as causing concern. The average cross-section length was estimated to be 14-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	86,000.0	SY	$0.62	$53,320.00

Total Field Cost:		$53,320.00
Contingencies:	10%	$5,332.00
Subtotal:		$58,652.00
Engineering:	0%	$0.00
Mobilization:	10%	$5,865.20
Total Rehabilitation Cost:		**$64,517.20**
Average Rehabilitation Cost per Foot:		**$1.17**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**ST-1**	**Division:**	**Clear Creek**		
Canal Name:	**Sturdovant Ditch [ST-1]**	**Length:**	**20,100 ft**	**Total # of Photos:**	**2**

Notes: This reach represents the cleaning and reshaping costs associated with the Sturdovant Ditch. This ditch provides flood irrigation on the upper end, and sprinkler irrigation on the lower end. The landowners are very proactive in the maintenance of the system. Cleaning assumes a cross-section of 10-feet. There are seepage areas of concern which are addressed in ST-2.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Canal Cleaning	22,400.0	SY	$0.62	$13,888.00
			Total Field Cost:	$13,888.00
		Contingencies:	10%	$1,388.80
			Subtotal:	$15,276.80
		Engineering:	0%	$0.00
		Mobilization:	10%	$1,527.68
			Total Rehabilitation Cost:	**$16,804.48**
			Average Rehabilitation Cost per Foot:	**$0.84**

Deficiency

Category: C&ODM

Rating: Minor

Cleaning/Reshaping Report

HKM ID:	**WJD-1**	***Division:***	**Clear Creek**		
Canal Name:	**WJD Ditch [WJD-1]**	***Length:***	**16,100 ft**	***Total # of Photos:***	**2**

Notes: This reach represents the cleaning and reshaping costs associated with WJD Ditch. The first section of the ditch has significant seepage issues, which are addressed in WJD-2. Cleaning costs assume a cross-section of 10-feet.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Canal Cleaning	18,000.0	SY	$0.62	$11,160.00

Total Field Cost:		$11,160.00
Contingencies:	10%	$1,116.00
Subtotal:		$12,276.00
Engineering:	0%	$0.00
Mobilization:	10%	$1,227.60
Total Rehabilitation Cost:		**$13,503.60**
Average Rehabilitation Cost per Foot:		**$0.84**

Deficiency

Category: C&ODM

Rating: Minor

Canal Liner Rehabilitation Report

HKM ID:	**BB-2**	**Division:**	**Clear Creek**		
Canal Name:	**Big Bonanza [BB-1]**	**Length:**	**5,700 ft**	**Total # of Photos:**	**4**

Notes: This reach of the Big Bonanza ditch is a concrete lined reach approximately 0.6 miles downstream from the headgate. The reach was identified by a downstream landowner. The liner appears to be in poor condition. There is significant cracking along the length of the reach. These cracks are significant. It appears that scour under the concrete liner has occurred, as there are numerous areas where the liner has buckled and sunk. The irrigator of the lands served by this section was contacted to discuss the reach. He indicated that the ditch was designed to serve field ditches from short siphon pipes that convey water out of the ditch to the field ditch. He indicated that the siphons do not draw enough water, and the field ditches are not low enough, or have enough slope to convey water appropriately. This causes water to stand and seep. He indicated that this could work alright for grass hay crop, but it is not appropriate for alfalfa. Due to the condition of the ditch, the only way to rehabilitate the concrete would be to remove it and re-pour it. As the current setup is not efficient and is marginally functional, it is recommended that the lining be removed completely. There are no signs of significant ditch seepage above or below this reach. The lining needs to be removed, and the ditch needs to be re-shaped and regraded. Compacted embankment is recommended to bring the ditch grade and sideslopes up approximately 4" to account for the depth of the removed concrete. A cross-section of 12-feet is assumed for cost estimates.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Concrete Demo. & Disposal	850.0	CY	$209.94	$178,449.00
Compacted Embankment	850.0	CY	$7.50	$6,375.00
			Total Field Cost:	$184,824.00
		Contingencies:	10%	$18,482.40
			Subtotal:	$203,306.40
		Engineering:	10%	$20,330.64
		Mobilization:	10%	$20,330.64
			Total Rehabilitation Cost:	**$243,967.68**
			Average Rehabilitation Cost per Foot:	**$42.80**

Deficiency

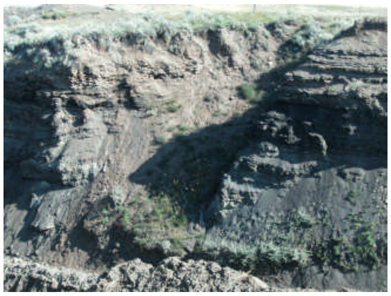
Category: CMDM

Rating: Serious

Canal Constriction Report

HKM ID:	LD-4	**Division:**	Clear Creek		
Canal Name:	Leiter Ditch [LD-1]	**Length:**	1,400 ft	**Total # of Photos:**	13

Notes: This reach of the canal represents the cut section causing constriction of the canal. This cut section was excavated through a ridge, and has steep side slopes. The side slopes have not re-established vegetation, so over the years, significant sediment has built up in the channel. As a result, there has been significant capacity reduction and increased backwater. At times freeboard near the interstate is only one foot. The channel was recently cleaned by excavating an 8' trench through the cut section, but back water is still present in the ditch. Re-grading the ditch is recommended. Piping the canal through the cut section is also recommended. Costs assume a concrete headwall with 48" RCP. The general fill estimate could be accounted for by actually filling the cut section, or re-grading the hillsides above the cut and using the re-grading cut material to fill the current cut section.



Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
RCP 48" D	1,400.0	FT	$256.97	$359,758.00
General Fill	50,000.0	CY	$3.77	$188,500.00
CIP Concrete	10.0	CY	$1,135.47	$11,354.70
Trash Rack	250.0	SF	$34.22	$8,555.00
Structural Fill	10.0	CY	$36.65	$366.50
Structural Excavation	10.0	CY	$22.95	$229.50

Total Field Cost:		$568,763.70
Contingencies:	10%	$56,876.37
Subtotal:		$625,640.07
Engineering:	10%	$62,564.01
Mobilization:	10%	$62,564.01
Total Rehabilitation Cost:		**$750,768.09**
Average Rehabilitation Cost per Foot:		**$536.26**

Deficiency

Category: CMDM

Rating: Serious

Canal Constriction Report

HKM ID:	LX-2	**Division:**	Clear Creek

Canal Name:	LX Ditch [LX-1]	**Length:**	1,950 ft	**Total # of Photos:**	0

Notes: This reach of the LX Ditch represents the length of the ditch that borders the highway. This reach serves as both the irrigation ditch and the road ditch. The side slopes are very steep, and the left bank is fenced, making it very difficult to clean. Remediation assumes the installation of HDPE pipe to pipe the irrigation flows. This includes concrete headwalls at the inlet and outlet as well as a trash rack.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 18" Pipe	1,950.0	FT	$21.93	$42,763.50
CIP Concrete	2.0	CY	$1,135.47	$2,270.94
Trash Rack	30.0	SF	$34.22	$1,026.60
Structural Fill	4.0	CY	$36.65	$146.60
Structural Excavation	4.0	CY	$22.95	$91.80

Total Field Cost:		$46,299.44
Contingencies:	10%	$4,629.94
Subtotal:		$50,929.38
Engineering:	10%	$5,092.94
Mobilization:	10%	$5,092.94
Total Rehabilitation Cost:		**$61,115.26**
Average Rehabilitation Cost per Foot:		**$31.34**

Deficiency

Category: CMDM

Rating: Serious

Bank Instability Report

HKM ID: BR-2 **Division:** Clear Creek

Canal Name: Big Redman [BR-1] **Length:** 300 ft **Total # of Photos:** 2

Notes: This section of bank instability is from the headgate to approximately 300-feet downstream. The Big Redman ditch shares its left canal bank with Clear Creek. Landowners feel that the creek has began to scour along this shared bank. They also indicated that they have seen the creek overtop the ditch bank. Remediation assumes compacted embankment to raise the canal bank by two feet (assuming 12 feet wide). Additional remediation assumes bank protection 6" thick and 15' from the top of the bank to the toe of the slope.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Riprap Bank Protection	90.0	CY	$55.40	$4,986.00
Compacted Embankment	300.0	CY	$7.50	$2,250.00

Total Field Cost:		$7,236.00
Contingencies:	10%	$723.60
Subtotal:		$7,959.60
Engineering:	10%	$795.96
Mobilization:	10%	$795.96
Total Rehabilitation Cost:		**$9,551.52**
Average Rehabilitation Cost per Foot:		**$31.84**

Deficiency

Category: CMDM

Rating: Serious

Bank Instability Report

HKM ID:	**BF-3**	**Division:**	**Clear Creek**		
Canal Name:	**Brown & Foster [BF-1]**	**Length:**	**7,000 ft**	**Total # of Photos:**	**0**

Notes: This section indicates a problem reach on the Brown & Foster ditch. The ditch is an unlined earthen ditch. At this section, ditch flows are dumped into a natural drainage and then diverted out downstream to serve the associated irrigated lands. This natural drainage has begun to erode and head cut, which is of concern to the landowner. A PVC pipeline is recommended to convey these ditch flows from upstream of this head cut section to the irrigated lands. Remediation costs include pressure reducing valve, to reduce pressure from the upper pipe section, a turnout valve to discharge flows into Sand Creek when irrigation water is not needed, and a second pressure reducing valve for the lower end of the pipe. It is assumed that the pipe will tie into the farmer's existing pipe system.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
12" Irrigation Pipe	7,000.0	FT	$14.42	$100,940.00
Pressure Relieve Valve	2.0	Each	$10,000.00	$20,000.00
Turnout Valve	1.0	Each	$5,000.00	$5,000.00
			Total Field Cost:	$125,940.00
		Contingencies:	10%	$12,594.00
			Subtotal:	$138,534.00
		Engineering:	10%	$13,853.40
		Mobilization:	10%	$13,853.40
			Total Rehabilitation Cost:	**$166,240.80**
			Average Rehabilitation Cost per Foot:	**$23.75**

Deficiency

Category: CRPci

Rating: Serious

Bank Instability Report

HKM ID:	LC-2	**Division:**	Clear Creek		
Canal Name:	Last Chance [LC-1]	**Length:**	215 ft	**Total # of Photos:**	3

Notes: This reach of the Last Chance ditch reflects a short segment of approximately 215-feet. The ditch is elevated above Rock Creek, and landowners feel that Rock Creek is migrating toward the ditch. They are concerned that the ditch may be lost if there is more erosion toward the ditch. Remediation assumes piping and covering the reach, and adding bank stabilization along the stream channel. In addition, a concrete headwall at the inlet and outlet is assumed.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 24" Pipe	215.0	FT	$38.03	$8,176.45
Riprap Bank Protection	40.0	CY	$55.40	$2,216.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	9.0	SF	$34.22	$307.98
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$11,955.10
Contingencies:	10%	$1,195.51
Subtotal:		$13,150.61
Engineering:	10%	$1,315.06
Mobilization:	10%	$1,315.06
Total Rehabilitation Cost:		**$15,780.73**
Average Rehabilitation Cost per Foot:		**$73.40**

Deficiency

Category: CMDM
Rating: Serious

Bank Instability Report

HKM ID:	**1PF-2**	***Division:***	**Clear Creek**		
Canal Name:	**Pratt & Ferris #1 [PF-1]**	***Length:***	**500 ft**	***Total # of Photos:***	**3**

Notes: This reach represents the channel section from below 1PF-DR1 to 1PF-CH1 (approximately 500-feet). This reach of the canal is very unstable. Landowner interviews indicated that 1PF-CH1 has been re-set three times in the last nine years. Lining the ditch section up to 1PF-CH1 will stabilize the reach. Improvements to 1PF-CH1 will also stabilize the site. This site has been improved since the kick-off of this project. The improvements include a new inlet structure upstream of the failed chute which pipes ditch flows down the hillside and can either waste water back to the creek or serve downstream irrigation. The entire reach is now in pipe, and the site has be reclaimed to eliminate the instability and erosion. No action is necessary.

Remediation Assessment

Deficiency

Category:

Rating: None

Wasteway Headcutting Report

HKM ID:	BR-4	**Division:**	Clear Creek

Canal Name:	Big Redman [BR-1]	**Length:**	1,300 ft	**Total # of Photos:**	3

Notes: This section of the Big Redman ditch is at the very end. This is the wasteway section of the ditch, as return flows run down the section and eventually returns to Clear Creek. At one time the section was very unstable and has created a cut section that is approximately 30 feet wide and 15 feet deep at the tail end of the reach. Significant vegetation has established in the bottom of the channel, and the lower end appears to be stable. Consideration was given to put the ditch on contour and extend it around the hillside. This would theoretically increase the irrigable lands by approximately 18 acres, based on aerial photos and quad maps. It would be a significant effort to fill the existing ditch to a point that it could be irrigated. Because there is significant vegetation established on the bottom of the channel, the most economical approach would be to add rock check dams in the bottom of the channel. This would slow velocities in the wasteway, and reduce the potential of additional scour. It also allows sediment to drop out behind the dam because velocities are reduced as water filters through the check dam. The rock check is assumed to be three feet high with 1.5:1 side slopes and a width of 15 feet. It is assumed that seven check dams will be installed at even increments down the wasteway. The bottom of the channel appears to be re-vegetated; however, the upper three feet of the wasteway ditch is nearly vertical with no vegetation. It is assumed that this top three feet will be re-graded so that it has a 2:1 slope entering the wasteway ditch. This will require excavation and erosion control to establish vegetation on the slope. This estimate is approximately $60,000 less than filling the wasteway and extending the ditch.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Erosion Control Blanket	1,800.0	SY	$3.75	$6,750.00
Riprap Bank Protection	60.0	CY	$55.40	$3,324.00
Unclassified Excavation	900.0	CY	$2.59	$2,331.00
			Total Field Cost:	$12,405.00
			Contingencies: 10%	$1,240.50
			Subtotal:	$13,645.50
			Engineering: 10%	$1,364.55
			Mobilization: 10%	$1,364.55
			Total Rehabilitation Cost:	**$16,374.60**
			Average Rehabilitation Cost per Foot:	**$12.60**

Deficiency

Category: CMDM

Rating: Serious

Sediment Deposition Report

HKM ID:	**JH-2**	**Division:**	**Clear Creek**		
Canal Name:	**Johnson Holt [JH-1]**	**Length:**	**1,250 ft**	**Total # of Photos:**	**3**

Notes: This reach passes through a cut section through a hill. It appears that the ditch was cut through a hillside to eliminate approximately 1.75 miles of ditch conveyance. This benefits conservation, but the cut section has never been stabilized, and introduces sands into the canal during storm events. Significant sediment is deposited downstream. Remediation assumes the installation of a pipe through this section, as well as earth work to reduce the height of the cut. The cut material should be used to cover the pipe. A concrete headwall is assumed that the inlet and outlet, as well as a trash rack at the upstream end of the pipe.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 24" Pipe	1,250.0	FT	$38.03	$47,537.50
Unclassified Excavation	1,500.0	CY	$2.59	$3,885.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	10.0	SF	$34.22	$342.20
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$53,019.37
Contingencies:	10%	$5,301.94
Subtotal:		$58,321.31
Engineering:	10%	$5,832.13
Mobilization:	10%	$5,832.13
Total Rehabilitation Cost:		**$69,985.57**
Average Rehabilitation Cost per Foot:		**$55.99**

Deficiency

Category: CMDM

Rating: Serious

HKM ID:	**BF-2**	**Division:**	**Clear Creek**		
Canal Name:	**Brown & Foster [BF-1]**	**Length:**	**6,900 ft**	**Total # of Photos:**	**2**

Notes: This reach represents the proposed upper section of pipe that would convey ditch flows for the Brown & Foster Ditch. This pipe would pick up ditch flows and convey them across the Steer Head Ranch. The lower end of this section will discharge into an existing ditch. This lower ditch currently serves downstream pipe. Piping this ditch would eliminate seepage, as well as losses associated with the current Eagle Rock Ditch. Costs reflect an inlet structure, pipeline, and a dissipation structure at the outlet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
18" Irrigation Pipe	6,900.0	FT	$29.87	$206,103.00
USBR Baffled Pipe Outlet: No. 3	1.0	Each	$7,546.95	$7,546.95
CIP Concrete	4.0	CY	$1,135.47	$4,541.88
Trash Rack	30.0	SF	$34.22	$1,026.60
Structural Fill	5.0	CY	$36.65	$183.25
Structural Excavation	5.0	CY	$22.95	$114.75

Total Field Cost:		$219,516.43
Contingencies:	10%	$21,951.64
Subtotal:		$241,468.07
Engineering:	10%	$24,146.81
Mobilization:	10%	$24,146.81
Total Rehabilitation Cost:		**$289,761.69**
Average Rehabilitation Cost per Foot:		**$41.99**

Deficiency

Category: CMDM

Rating: Minor

Pipeline Rehabilitation Report

HKM ID:	**MK-1**	**Division:**	**Clear Creek**		
Canal Name:	**Fort McKinney Ditch [MK-1]**	**Length:**	**600 ft**	**Total # of Photos:**	**7**

Notes: This section is an open channel, unlined reach that is from the headgate to the start of the piped reach. This section is very wide and deep compared to the flow that it conveys. This has resulted in this section being choked with cattails. This may be due to a high crossing culvert under Turkey Lane. Because there is a piped section downstream, it is recommended that the reach be piped from the headgate and tie into the existing pipeline.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 18" Pipe	600.0	FT	$21.93	$13,158.00

Total Field Cost:		$13,158.00
Contingencies:	10%	$1,315.80
Subtotal:		$14,473.80
Engineering:	10%	$1,447.38
Mobilization:	10%	$1,447.38
Total Rehabilitation Cost:		**$17,368.56**
Average Rehabilitation Cost per Foot:		**$28.95**

Deficiency

Category: CMDM

Rating: Serious

Pipeline Rehabilitation Report

HKM ID:	**JC-1**	***Division:***	**Clear Creek**		
Canal Name:	**Johnson Creek [JC-1]**	***Length:***	**3,480 ft**	***Total # of Photos:***	**0**

Notes: This reach represents a section of the Johnson Creek ditch that passes through a subdivision. A section of the ditch is already in pipe, but it would be beneficial to pipe the ditch through the entire subdivision. This assumes HDPE pipe and a concrete headwall at the inlet and outlet of the structure. Trash rack is also recommended.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
HDPE 18" Pipe	3,480.0	FT	$21.93	$76,316.40
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	10.0	SF	$34.22	$342.20
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$77,913.27
Contingencies:	10%	$7,791.33
Subtotal:		$85,704.60
Engineering:	10%	$8,570.46
Mobilization:	10%	$8,570.46
Total Rehabilitation Cost:		**$102,845.52**
Average Rehabilitation Cost per Foot:		**$29.55**

Deficiency

Category: CMDM

Rating: Minor

Seepage Area Lining Report

HKM ID:	**BR-3**	***Division:***	**Clear Creek**		
Canal Name:	**Big Redman [BR-1]**	***Length:***	**3,700 ft**	***Total # of Photos:***	**0**

Notes: This reach identifies a reach of the canal with significant seepage. This reduces production do to the sub-irrigation that occurs from the seepage. Landowners indicated that there are times that they can't drive across the field due to the seepage. The remediation requires the lining to cover the cross-section of the ditch, plus five feet on each side to serve as the anchor section. The cost estimate assumes a 10-foot cross-section plus 10-feet for the liner anchor.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
HDPE 24" Pipe	3,700.0	FT	$38.03	$140,711.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	15.0	SF	$34.22	$513.30
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$142,478.97
Contingencies:	10%	$14,247.90
Subtotal:		$156,726.87
Engineering:	10%	$15,672.69
Mobilization:	10%	$15,672.69
Total Rehabilitation Cost:		**$188,072.24**
Average Rehabilitation Cost per Foot:		**$50.83**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	**DD-2**	**Division:**	**Clear Creek**		
Canal Name:	**Dunlap Ditch [DUN-1]**	**Length:**	**550 ft**	**Total # of Photos:**	**1**

Notes: This section represents an area from approximately 550-ft upstream to the flume over Piney Creek. Landowners indicated that the ditch section washes out almost every year. They feel that there are some downed trees, and the irrigation flows in the ditch will seep until it finds an old root. It then washes down the root until it eventually washes out. Remediation for this problem assumes a geomembrane lining. The cost assumes piping the reach through HDPE pipe. It is assumed that there will be a headwall at the inlet and outlet of the pipe, as well as a trash rack at the inlet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 24" Pipe	550.0	FT	$38.03	$20,916.50
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	15.0	SF	$34.22	$513.30
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$22,684.47
Contingencies:	10%	$2,268.45
Subtotal:		$24,952.92
Engineering:	10%	$2,495.29
Mobilization:	10%	$2,495.29
Total Rehabilitation Cost:		**$29,943.50**
Average Rehabilitation Cost per Foot:		**$54.44**

Deficiency

Category: CMDM

Rating: Critical

Seepage Area Lining Report

HKM ID:	**FH-2**	**Division:**	**Clear Creek**		
Canal Name:	**Frank Hopkins [FH-1]**	**Length:**	**4,400 ft**	**Total # of Photos:**	**0**

Notes: This reach represents the cost estimate for lining a seepage area along the Frank Hopkins ditch. It was identified by the landowner that there is significant seepage. There is standing water below ditch when it is flowing. Equipment can still be operated in the field but the operator has to be careful. Remediation assumes using HDPE pipe to line the ditch.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 24" Pipe	4,400.0	FT	$38.03	$167,332.00
CIP Concrete	2.0	CY	$1,135.47	$2,270.94
Trash Rack	30.0	SF	$34.22	$1,026.60
Structural Fill	4.0	CY	$36.65	$146.60
Structural Excavation	4.0	CY	$22.95	$91.80

Total Field Cost:		$170,867.94
Contingencies:	10%	$17,086.79
Subtotal:		$187,954.73
Engineering:	10%	$18,795.47
Mobilization:	10%	$18,795.47
Total Rehabilitation Cost:		**$225,545.68**
Average Rehabilitation Cost per Foot:		**$51.26**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	**HAL-2**	***Division:***	**Clear Creek**		
Canal Name:	**Hallie Ditch [HAL-1]**	***Length:***	**2,100 ft**	***Total # of Photos:***	**0**

Notes: This reach was identified as a seepage area. It is located approximately 0.65 miles downstream of the headgate. The reach is approximately 2100 feet. Remediation of the seepage assumes installation of HDPE pipe through the section. It is assumed that the pipe will have a headwall at the inlet and outlet of the structure, and a trash rack at the inlet.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
HDPE 30" Pipe	2,100.0	FT	$50.61	$106,281.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	20.0	SF	$34.22	$684.40
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$108,220.07
Contingencies:	10%	$10,822.01
Subtotal:		$119,042.08
Engineering:	10%	$11,904.21
Mobilization:	10%	$11,904.21
Total Rehabilitation Cost:		**$142,850.49**
Average Rehabilitation Cost per Foot:		**$68.02**

Deficiency

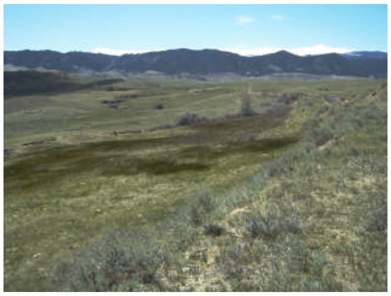
Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	**HAL-3**	***Division:***	**Clear Creek**		
Canal Name:	**Hallie Ditch [HAL-1]**	***Length:***	**3,200 ft**	***Total # of Photos:***	**3**

Notes: This is another seepage area identified by landowner/field investigation. The reach is approximately 4,000 feet and appears to lose significant amounts of water to seepage. Cost assumptions are similar to those in HAL-2.



Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
HDPE 30" Pipe	3,200.0	FT	$50.61	$161,952.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	20.0	SF	$34.22	$684.40
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$163,891.07
Contingencies:	10%	$16,389.11
Subtotal:		$180,280.18
Engineering:	10%	$18,028.02
Mobilization:	10%	$18,028.02
Total Rehabilitation Cost:		**$216,336.21**
Average Rehabilitation Cost per Foot:		**$67.61**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	**HL-2**	**Division:**	**Clear Creek**		
Canal Name:	**High Line Ditch [HL-1]**	**Length:**	**7,800 ft**	**Total # of Photos:**	**6**

Notes: This reach is the second reach on the High Line Ditch. It represents the section from east of the interstate to the end of the ditch. Recently, the lands just east of the interstate have been mined for gravel. Prior to the gravel pit, the lands were irrigated, but there were issues with prairie dogs. Since the mine, the ditch has become more porous, and when they run water in the ditch, they create springs in the lower fields. Piping the ditch from east of the interstate, to three fields that are east of the gravel pit would be beneficial by conserving significant amounts of water lost to seepage, and by providing a potential gravity feed for potential sprinklers. Dissipation at the outfall of the pipe is accounted for in the Pipe Outlet costs. Miscellaneous costs reflect turnout costs associated to flood irrigate the lands, in the event that the landowner does not pursue sprinkler irrigation.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
12" Irrigation Pipe	7,800.0	FT	$14.42	$112,476.00
Miscellaneous	10,000.0	$	$1.03	$10,300.00
USBR Baffled Pipe Outlet: No. 3	1.0	Each	$7,546.95	$7,546.95

Total Field Cost:		$130,322.95
Contingencies:	10%	$13,032.30
Subtotal:		$143,355.25
Engineering:	10%	$14,335.52
Mobilization:	10%	$14,335.52
Total Rehabilitation Cost:		**$172,026.29**
Average Rehabilitation Cost per Foot:		**$22.05**

Deficiency

Category: CRPci

Rating: Critical

Seepage Area Lining Report

HKM ID:	**LDS-2**	***Division:***	**Clear Creek**		
Canal Name:	**Lake Desmet Ditch [LDS-1]**	***Length:***	**6,500 ft**	***Total # of Photos:***	**0**

Notes: This reach represents a conceptual pipe section of the Lake Desmet Ditch. Seepage was not identified through this section, however, the ditch flows for approximately 2.7 miles without a turn out. The pipe section is recommended to eliminate the losses through evaporation and infiltration over the length of the open channel.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
18" Irrigation Pipe	6,500.0	FT	$29.87	$194,155.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	15.0	SF	$34.22	$513.30
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$195,922.97
Contingencies:	10%	$19,592.30
Subtotal:		$215,515.27
Engineering:	10%	$21,551.53
Mobilization:	10%	$21,551.53
Total Rehabilitation Cost:		**$258,618.32**
Average Rehabilitation Cost per Foot:		**$39.79**

Deficiency

Category: CMDM

Rating: Minor

Seepage Area Lining Report

HKM ID:	**LD-2**	**Division:**	**Clear Creek**		
Canal Name:	**Leiter Ditch [LD-1]**	**Length:**	**3,250 ft**	**Total # of Photos:**	**1**

Notes: This section is an area of the Leiter Ditch that has significant seepage. It is sub-irrigating the fields below it which has saturated the fields and made them very unproductive. This backwater is caused poor grade and the cut section identified in LD-4. Lining this reach is recommended. The sponsor prefers to spec HDPE pipe for seepage areas. These will not operate under pressure, and alleviate potential cattle impacts that could arise with geomembrane lining systems

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 48" Pipe	3,250.0	FT	$122.77	$399,002.50

Total Field Cost:		$399,002.50
Contingencies:	10%	$39,900.25
Subtotal:		$438,902.75
Engineering:	10%	$43,890.28
Mobilization:	10%	$43,890.28
Total Rehabilitation Cost:		**$526,683.30**
Average Rehabilitation Cost per Foot:		**$162.06**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	**LD-3**	**Division:**	**Clear Creek**		
Canal Name:	**Leiter Ditch [LD-1]**	**Length:**	**1,100 ft**	**Total # of Photos:**	**8**

Notes: This reach is a section of the Leiter Ditch that passes under the Interstate 90 bridge. It was identified that this reach of the ditch is on a fill section created by the interstate, and consequently can become saturated. There is concern that the ditch may be lost in this section if flows get too high in the canal. Lining this ditch with HDPE pipe is recommended to remediate the seepage issues.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 48" Pipe	1,100.0	FT	$122.77	$135,047.00

Total Field Cost:		$135,047.00
Contingencies:	10%	$13,504.70
Subtotal:		$148,551.70
Engineering:	10%	$14,855.17
Mobilization:	10%	$14,855.17
Total Rehabilitation Cost:		**$178,262.04**
Average Rehabilitation Cost per Foot:		**$162.06**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID: LP-2 **Division:** Clear Creek

Canal Name: Little Piney Ditch [LP-1] **Length:** 3,200 ft **Total # of Photos:** 5

Notes: This reach represents an area of seepage on the ditch. Irrigation personnel indicated that during the irrigation season, water can be seen running out below the ditch bank onto the field below. It was identified that it is difficult to walk below the ditch bank due to water seepage. The vegetation changes below the ditch and at low points in the field indicate seepage as well. The irrigators are concerned with the seepage causing ditch bank failure and loss of an irrigation season. A similar reach upstream of this site was recently piped with HDPE pipe (300-feet), and is now performing well. Irrigators were unsure if the recently installed pipe was 30" or 36". For this assessment 30" HDPE is recommended. Additional costs reflect a concrete headwall and trash rack.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 30" Pipe	3,200.0	FT	$50.61	$161,952.00
CIP Concrete	2.0	CY	$1,135.47	$2,270.94
Trash Rack	25.0	SF	$34.22	$855.50
			Total Field Cost:	$165,078.44
		Contingencies:	10%	$16,507.84
			Subtotal:	$181,586.28
		Engineering:	10%	$18,158.63
		Mobilization:	10%	$18,158.63
			Total Rehabilitation Cost:	**$217,903.54**
			Average Rehabilitation Cost per Foot:	**$68.09**

Deficiency

Category:

Rating:

Seepage Area Lining Report

HKM ID:	LX-3	**Division:**	Clear Creek		
Canal Name:	LX Ditch [LX-1]	**Length:**	1,000 ft	**Total # of Photos:**	3

Notes: This reach represents a seepage area of the LX Ditch. The landowner used to be able to irrigate the field below, but it now can only be used for grazing. There is standing water below the ditch. Remediation assumes the installation of HDPE pipe to stop the seepage.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 18" Pipe	1,000.0	FT	$21.93	$21,930.00
CIP Concrete	2.0	CY	$1,135.47	$2,270.94
Trash Rack	30.0	SF	$34.22	$1,026.60
Structural Fill	4.0	CY	$36.65	$146.60
Structural Excavation	4.0	CY	$22.95	$91.80

Total Field Cost:		$25,465.94
Contingencies:	10%	$2,546.59
Subtotal:		$28,012.53
Engineering:	10%	$2,801.25
Mobilization:	10%	$2,801.25
Total Rehabilitation Cost:		**$33,615.04**
Average Rehabilitation Cost per Foot:		**$33.62**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID: ONO-2 **Division:** Clear Creek

Canal Name: Ono Ditch [ONO-1] **Length:** 1,300 ft **Total # of Photos:** 1

Notes: This reach is the first seepage area identified on the Ono Ditch. Remediation assumes installation of HDPE 18" pipe with concrete headwall. The Ono Ditch is the lower ditch in the photo.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 18" Pipe	1,300.0	FT	$21.93	$28,509.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	15.0	SF	$34.22	$513.30
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$30,276.97
Contingencies:	10%	$3,027.70
Subtotal:		$33,304.67
Engineering:	10%	$3,330.47
Mobilization:	10%	$3,330.47
Total Rehabilitation Cost:		**$39,965.60**
Average Rehabilitation Cost per Foot:		**$30.74**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	ONO-3	**Division:**	Clear Creek		
Canal Name:	Ono Ditch [ONO-1]	**Length:**	2,400 ft	**Total # of Photos:**	1

Notes: This reach is the second seepage area identified on the Ono Ditch. The ditch parallels the Prince Albert ditch and could beneficially be combined together. This would reduce lining costs. Remediation assumes installation of HDPE pipe. The Ono Ditch is the lower ditch in the photo.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 18" Pipe	2,400.0	FT	$21.93	$52,632.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	15.0	SF	$34.22	$513.30
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90
			Total Field Cost:	$54,399.97
		Contingencies:	10%	$5,440.00
			Subtotal:	$59,839.97
		Engineering:	10%	$5,984.00
		Mobilization:	10%	$5,984.00
			Total Rehabilitation Cost:	**$71,807.96**
			Average Rehabilitation Cost per Foot:	**$29.92**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	PD-2	**Division:**	Clear Creek		
Canal Name:	Piney Divide [PD-1]	**Length:**	600 ft	**Total # of Photos:**	0

Notes: This reach represents a seepage section within the Piney Divide ditch. The seepage was identified by landowners and is evident on aerial photos. The costs assume installing HDPE pipe through the section with a headwall at the inlet and outlet. Trash rack is assumed at the inlet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 36" Pipe	600.0	FT	$65.57	$39,342.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	20.0	SF	$34.22	$684.40
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$41,281.07
Contingencies:	10%	$4,128.11
Subtotal:		$45,409.18
Engineering:	10%	$4,540.92
Mobilization:	10%	$4,540.92
Total Rehabilitation Cost:		**$54,491.01**
Average Rehabilitation Cost per Foot:		**$90.82**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	**2PF-2**	**Division:**	**Clear Creek**		
Canal Name:	**Pratt & Ferris #2 [PF-2]**	**Length:**	**2,950 ft**	**Total # of Photos:**	**1**

Notes: This reach of the Pratt & Ferris #2 ditch passes through Clearmont. It was indicated by multiple people that they feel the ditch seeps through town. Flow measurements were taken at multiple locations and indicated minimal seepage through the town. Further investigation may be needed. Cost estimates were developed to quantify potential remediation efforts. Remediation assumes installation of 36" HDPE pipe. This allows for more than double appropriation of the ditch, which would allow for the low-head pipe to flow in a non-pressurized condition. It is assumed that the upstream 15 feet of the ditch above the pipe inlet will be lined with concrete, with safety cable across the ditch and a ladder for a walkout. This accounts for safety concerns identified by numerous land owners.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 36" Pipe	2,950.0	FT	$65.57	$193,431.50
CIP Concrete	8.0	CY	$1,135.47	$9,083.76
Trash Rack	30.0	SF	$34.22	$1,026.60
Safety Cable	15.0	FT	$36.05	$540.75
Structural Fill	10.0	CY	$36.65	$366.50
Safety Ladder (10 feet)	1.0	Each	$235.66	$235.66
Structural Excavation	10.0	CY	$22.95	$229.50

Total Field Cost:		$204,914.27
Contingencies:	10%	$20,491.43
Subtotal:		$225,405.70
Engineering:	10%	$22,540.57
Mobilization:	10%	$22,540.57
Total Rehabilitation Cost:		**$270,486.84**
Average Rehabilitation Cost per Foot:		**$91.69**

Deficiency

Category: CRPci

Rating: Serious

Seepage Area Lining Report

HKM ID:	**3PF-2**	**Division:**	**Clear Creek**		
Canal Name:	**Pratt & Ferris #3 [PF-3]**	**Length:**	**3,300 ft**	**Total # of Photos:**	**2**

Notes: This reach of the Pratt & Ferris #3 Ditch is approximately 1.7 miles downstream of the diversion. Irrigator interviews indicated that the lands below the ditch have never been irrigated due to its 'bogginess'. A drainage culvert under the rail road and highway was recently cleaned and improved, and has eliminated standing water along the railroad. Lining the ditch could eliminate seepage and, with the drainage improvements recently completed, could make the lands productive. Costs assume HDPE pipe with concrete headwalls and a trashrack at the inlet.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 42" Pipe	3,300.0	FT	$100.45	$331,485.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	30.0	SF	$34.22	$1,026.60
Structural Fill	4.0	CY	$36.65	$146.60
Structural Excavation	4.0	CY	$22.95	$91.80
			Total Field Cost:	$333,885.47
			Contingencies: 10%	$33,388.55
			Subtotal:	$367,274.02
			Engineering: 10%	$36,727.40
			Mobilization: 10%	$36,727.40
			Total Rehabilitation Cost:	**$440,728.82**
			Average Rehabilitation Cost per Foot:	**$133.55**

Deficiency

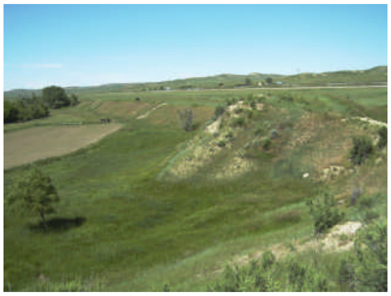
Category: CMDM

Rating: Minor

Seepage Area Lining Report

HKM ID: 3PF-3
Division: Clear Creek
Canal Name: Pratt & Ferris #3 [PF-3]
Length: 2,250 ft
Total # of Photos: 5

Notes: This reach of the Pratt & Ferris #3 Ditch is a section along the highway that shows evidence of seepage. The landowner indicated that the fields below were unusable due to their saturation. He dug a collection ditch below the reach of the Pratt & Ferris #3 ditch, which has helped to dry out the lands and they are now irrigable. The upstream and downstream reaches of the ditch are lined with a buried liner. It is unknown if the section that was visited is unlined, or if it is lined with a failed liner. It is recommended that the reach be piped in HDPE pipe with concrete headwalls and trash rack to remediate the seepage issues.



Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 42" Pipe	2,250.0	FT	$100.45	$226,012.50
CIP Concrete	2.0	CY	$1,135.47	$2,270.94
Trash Rack	30.0	SF	$34.22	$1,026.60
Structural Fill	4.0	CY	$36.65	$146.60
Structural Excavation	4.0	CY	$22.95	$91.80

Total Field Cost:		$229,548.44
Contingencies:	10%	$22,954.84
Subtotal:		$252,503.28
Engineering:	10%	$25,250.33
Mobilization:	10%	$25,250.33
Total Rehabilitation Cost:		**$303,003.94**
Average Rehabilitation Cost per Foot:		**$134.67**

Deficiency

Category: CMDM
Rating: Serious

Seepage Area Lining Report

HKM ID:	**PA-2**	**Division:**	**Clear Creek**		
Canal Name:	**Prince Albert [PA-1]**	**Length:**	**1,320 ft**	**Total # of Photos:**	**1**

Notes: This reach is the first seepage area identified on the Prince Albert Ditch. The seepage is in the same location as the Ono seepage. Remediation assumes HDPE pipe with concrete headwalls. The Prince Albert Ditch is the upper ditch in the photo.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 24" Pipe	1,320.0	FT	$38.03	$50,199.60
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	15.0	SF	$34.22	$513.30
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$51,967.57
Contingencies:	10%	$5,196.76
Subtotal:		$57,164.33
Engineering:	10%	$5,716.43
Mobilization:	10%	$5,716.43
Total Rehabilitation Cost:		**$68,597.19**
Average Rehabilitation Cost per Foot:		**$51.97**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	**PA-3**	**Division:**	**Clear Creek**		
Canal Name:	**Prince Albert [PA-1]**	**Length:**	**1,600 ft**	**Total # of Photos:**	**1**

Notes: This reach is the second seepage area identified on the Prince Albert Ditch. Remediation assumes lining the ditch with HDPE pipe. The Prince Albert Ditch is the upper ditch in the photo.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 24" Pipe	1,600.0	FT	$38.03	$60,848.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	15.0	SF	$34.22	$513.30
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$62,615.97
Contingencies:	10%	$6,261.60
Subtotal:		$68,877.57
Engineering:	10%	$6,887.76
Mobilization:	10%	$6,887.76
Total Rehabilitation Cost:		**$82,653.08**
Average Rehabilitation Cost per Foot:		**$51.66**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	**RC-1**	**Division:**	**Clear Creek**		
Canal Name:	**Rock Creek & South Piney Ditch [RC-1]**	**Length:**	**175 ft**	**Total # of Photos:**	**1**

Notes: This reach is a section of the Rock Creek & South Piney Ditch from the diversion structure to the weir. There were significant losses observed along this section. The ditch is excavated from sandy, gravel material with large boulders in areas. The size of the rocks makes it difficult to prepare the ditch bed appropriately for pipe or even exposed geomembrane liner. Lining on the Rock Creek & South Piney Ditch is assumed to be a gunnite/shotcrete material installed at a thickness of approximately four inches. Some excavation is included to allow for the four inch overlay. A cross-section of 20-feet is assumed.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Shotcrete lining	3,600.0	SF	$3.33	$11,988.00
Galvanized 2"x2" #12 Steel Mesh	3,600.0	SF	$1.50	$5,400.00
Structural Excavation	40.0	CY	$22.95	$918.00

Total Field Cost:		$18,306.00
Contingencies:	10%	$1,830.60
Subtotal:		$20,136.60
Engineering:	10%	$2,013.66
Mobilization:	10%	$2,013.66
Total Rehabilitation Cost:		**$24,163.92**
Average Rehabilitation Cost per Foot:		**$138.08**

Deficiency

Category: CMDM

Rating: Critical

Seepage Area Lining Report

HKM ID:	**RC-2**	***Division:***	**Clear Creek**		
Canal Name:	**Rock Creek & South Piney Ditch [RC-1]**	***Length:***	**330 ft**	***Total # of Photos:***	**1**

Notes: This reach is a second seepage area on the Rock Creek & South Piney Ditch. The seepage evident along this reach was significant enough that it has formed small channels. Lining this reach is recommended. Lining on the Rock Creek & South Piney Ditch is assumed to be a gunnite/shotcrete material installed at a thickness of approximately four inches. Some excavation is included to allow for the four inch overlay. A cross-section of 20-feet is assumed.

Remediation Assessment

Rehabilitation Costs

Item Description	*Quantity*	*Units*	*Unit Cost*	*Total*
Shotcrete lining	7,000.0	SF	$3.33	$23,310.00
Galvanized 2"x2" #12 Steel Mesh	7,000.0	SF	$1.50	$10,500.00
Structural Excavation	70.0	CY	$22.95	$1,606.50
			Total Field Cost:	$35,416.50
			Contingencies: 10%	$3,541.65
			Subtotal:	$38,958.15
			Engineering: 10%	$3,895.82
			Mobilization: 10%	$3,895.82
			Total Rehabilitation Cost:	**$46,749.78**
			Average Rehabilitation Cost per Foot:	**$141.67**

Deficiency

Category: CMDM

Rating: Critical

Seepage Area Lining Report

HKM ID:	**RC-3**	**Division:**	**Clear Creek**		
Canal Name:	**Rock Creek & South Piney Ditch [RC-1]**	**Length:**	**325 ft**	**Total # of Photos:**	**0**

Notes: This reach is the third reach on the Rock Creek & South Piney Ditch with significant seepage. Lining the reach is recommended. Lining on the Rock Creek & South Piney Ditch is assumed to be a gunnite/shotcrete material installed at a thickness of approximately four inches. Some excavation is included to allow for the four inch overlay. A cross-section of 20-feet is assumed.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Shotcrete lining	7,000.0	SF	$3.33	$23,310.00
Galvanized 2"x2" #12 Steel Mesh	7,000.0	SF	$1.50	$10,500.00
Structural Excavation	70.0	CY	$22.95	$1,606.50

Total Field Cost:		$35,416.50
Contingencies:	10%	$3,541.65
Subtotal:		$38,958.15
Engineering:	10%	$3,895.82
Mobilization:	10%	$3,895.82
Total Rehabilitation Cost:		**$46,749.78**
Average Rehabilitation Cost per Foot:		**$143.85**

Deficiency

Category: CMDM

Rating: Critical

Seepage Area Lining Report

HKM ID:	**RC-4**	**Division:**	**Clear Creek**		
Canal Name:	**Rock Creek & South Piney Ditch [RC-1]**	**Length:**	**900 ft**	**Total # of Photos:**	**4**

Notes: This reach is the forth area of significant seepage along the Rock Creek & South Piney Ditch. Areas within the reach have been repaired with tarps and stacked rocks, however, there is significant flow spilling down the seepage channels. Lining the reach is recommended. Lining on the Rock Creek & South Piney Ditch is assumed to be a gunnite/shotcrete material installed at a thickness of approximately four inches. Some excavation is included to allow for the four inch overlay. A cross-section of 20-feet is assumed.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Shotcrete lining	19,000.0	SF	$3.33	$63,270.00
Galvanized 2"x2" #12 Steel Mesh	19,000.0	SF	$1.50	$28,500.00
Structural Excavation	230.0	CY	$22.95	$5,278.50

Total Field Cost:		$97,048.50
Contingencies:	10%	$9,704.85
Subtotal:		$106,753.35
Engineering:	10%	$10,675.34
Mobilization:	10%	$10,675.34
Total Rehabilitation Cost:		**$128,104.02**
Average Rehabilitation Cost per Foot:		**$142.34**

Deficiency

Category: CMDM

Rating: Critical

Seepage Area Lining Report

HKM ID:	**RC-5**	**Division:**	**Clear Creek**		
Canal Name:	**Rock Creek & South Piney Ditch [RC-1]**	**Length:**	**2,900 ft**	**Total # of Photos:**	**5**

Notes: This reach is the final reach of significant seepage along the ditch. Below this reach, the diverted flows turn down a natural drainage (Ditch Creek) until it meets the north fork of Rock Creek. The Ditch Creek section is very steep and it is assumed that there are very little losses through the section. Sections within the reach have been improved with a track hoe, but there is still significant seepage. Lining the reach is recommended. Lining on the Rock Creek & South Piney Ditch is assumed to be a gunnite/shotcrete material installed at a thickness of approximately four inches. Some excavation is included to allow for the four inch overlay. A cross-section of 20-feet is assumed.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
Shotcrete lining	60,000.0	SF	$3.33	$199,800.00
Galvanized 2"x2" #12 Steel Mesh	60,000.0	SF	$1.50	$90,000.00
Structural Excavation	750.0	CY	$22.95	$17,212.50

Total Field Cost:		$307,012.50
Contingencies:	10%	$30,701.25
Subtotal:		$337,713.75
Engineering:	10%	$33,771.38
Mobilization:	10%	$33,771.38
Total Rehabilitation Cost:		**$405,256.50**
Average Rehabilitation Cost per Foot:		**$139.74**

Deficiency

Category: CMDM

Rating: Critical

Seepage Area Lining Report

HKM ID:	SNF-2	**Division:**	Clear Creek		
Canal Name:	Senff Ditch [SEN-1]	**Length:**	2,500 ft	**Total # of Photos:**	1

Notes: This reach represents a hillside section of the Senff ditch. It was indicated that there is significant seepage that sub-irrigates the field and reduces productivity. Piping this reach is recommended. It is assumed that the pipe will have a concrete headwall with trash rack.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 18" Pipe	2,500.0	FT	$21.93	$54,825.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	9.0	SF	$34.22	$307.98
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$56,387.65
Contingencies:	10%	$5,638.77
Subtotal:		$62,026.42
Engineering:	10%	$6,202.64
Mobilization:	10%	$6,202.64
Total Rehabilitation Cost:		**$74,431.70**
Average Rehabilitation Cost per Foot:		**$29.77**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	**ST-2**	**Division:**	**Clear Creek**		
Canal Name:	**Sturdovant Ditch [ST-1]**	**Length:**	**1,400 ft**	**Total # of Photos:**	**1**

Notes: Landowner interviews indicated that they line approximately 1,400 feet of the ditch each irrigation season. It was indicated that there are piping and seepage issues that lining the ditch with plastic lining remediates. The lining is removed each fall. This is because the fields are used as winter pasture for livestock, and the liner would be damaged. It is recommended that the seepage areas be piped using HDPE pipe. This would provide a permanent solution to the cattle impacts as well as the seepage issues. The costs reflect HDPE 30" pipe. The ditch upstream of the seepage area is piped in CMP 36" pipe. The 30" pipe is recommended due to roughness coefficient improvements, as well as providing significant capacity over and above the ditches appropriation.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 30" Pipe	1,400.0	FT	$50.61	$70,854.00
CIP Concrete	1.0	CY	$1,135.47	$1,135.47
Trash Rack	20.0	SF	$34.22	$684.40
Structural Fill	2.0	CY	$36.65	$73.30
Structural Excavation	2.0	CY	$22.95	$45.90

Total Field Cost:		$72,793.07
Contingencies:	10%	$7,279.31
Subtotal:		$80,072.38
Engineering:	10%	$8,007.24
Mobilization:	10%	$8,007.24
Total Rehabilitation Cost:		**$96,086.85**
Average Rehabilitation Cost per Foot:		**$68.63**

Deficiency

Category: CMDM

Rating: Serious

Seepage Area Lining Report

HKM ID:	**WJD-2**	**Division:**	**Clear Creek**		
Canal Name:	**WJD Ditch [WJD-1]**	**Length:**	**5,200 ft**	**Total # of Photos:**	**4**

Notes: This reach of the WJD Ditch represents the first 5100 feet of the ditch. The ditch has significant seepage issues. The majority of the reach is on a hillside section. There have been a number of spots along the reach that have washed out. One section was remedied by piping approximately 90 feet over the worst section. Piping the reach is recommended. 36" pipe is recommended, as that is what is currently installed in one problem reach, however, this is oversized.

Remediation Assessment

Rehabilitation Costs

Item Description	Quantity	Units	Unit Cost	Total
HDPE 36" Pipe	5,100.0	FT	$65.57	$334,407.00

Total Field Cost:		$334,407.00
Contingencies:	10%	$33,440.70
Subtotal:		$367,847.70
Engineering:	10%	$36,784.77
Mobilization:	10%	$36,784.77
Total Rehabilitation Cost:		**$441,417.24**
Average Rehabilitation Cost per Foot:		**$84.89**

Deficiency

Category: CMDM

Rating: Critical

Appendix 6A
Hydrologic Model

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3.9.1 Surface Water Availability and Shortages

Surface water availability and shortages were evaluated using guidance provided in the document "Planning Model Development and Application for the Wyoming State Water Plan" by Boyle/AECOM dated May 2, 2008.

This project is a WWDO Level I Study intended to perform a preliminary/reconnaissance level analysis of project alternatives to economically develop water for Wyoming's use and benefit. This study compares project options based on physical and legal water availability, technical, economic, legal, and environmental considerations.

Basin planning spreadsheets are appropriate tools for this level of study. This project utilizes spreadsheet analyses developed in the "Powder/Tongue River Basin Plan" by HKM Engineering, Inc.; Lord Consulting; and Watts and Associates dated February 2002.

A simulation model would not commonly be developed until a WWDO Level II study. DOWL HKM previously developed a simulation model for Lake DeSmet, an off-stream reservoir that receives a significant amount of water out of the Clear Creek drainage. The simulation model was developed using MODSIM-DSS, a generalized river basin decision support system and network flow model developed at Colorado State University. The MODSIM model was used because it had the capability of modeling multiple reservoir pools, supplied from multiple water sources, with many different priority dates. The StateMod simulation model did not provide these capabilities. The MODSIM model of Lake DeSmet is presented in the report "Final Report for the City of Buffalo – Sheridan Area Water System-Lake DeSmet, Level II Study" by HKM Engineering, Inc. dated June 2008.

Both models, the spreadsheet model from the Powder/Tongue River Basin Plan and the Lake DeSmet MODSIM model are used to evaluate project alternatives for this study.

3.9.1.1 Powder/Tongue River Spreadsheet Model

3.9.1.1.1 Spreadsheet Model

3.9.1.1.1.1 Model Overview

The model developed for the Powder/Tongue River Basin Plan and used in this study is intended to simulate water use and availability under existing conditions. Three models were developed, reflecting each of three hydrologic conditions: dry, normal, and wet year water supply. The spreadsheets each represent one calendar year of flows, on a monthly time step. The modelers relied on historical gage data from 1970 to 1999 to identify the hydrologic conditions for each year in the study period, as discussed in the Surface Water Hydrology memorandum (HKM, 2002). Streamflow, estimated actual diversions, full supply diversions, irrigation returns, and reservoir conditions are the basic input data to the models. For all of these data, average values drawn from the dry, normal, or wet subset of the study period were computed for use in the spreadsheets.

The model does not explicitly account for water rights, appropriations, or compact allocations nor is the model operated based on these legal constraints. Further, the model does not associate supplemental reservoir releases to the appropriate water users. However, by calibrating the models to historical streamflows at gaged locations, the models can be used to generally represent existing operations. Theoretical Maximum Diversion Requirements were calculated using the mapped acreage of irrigated lands (see the Irrigated Lands Mapping and Water Rights Data memorandum [HKM, 2002]) and the consumptive irrigation requirements (CIR) provided by Consumptive Use and Consumptive Irrigation Requirements – Wyoming (Pochop et al., 1992). The historical diversion records were then compared to the Theoretical Maximum Diversions yielding mathematical relationships used to calculate the Estimated Actual Diversions and the Full Supply Diversion Requirements for all modeled irrigated lands. A more detailed discussion of this process is offered in the Agricultural Use memorandum (HKM, 2002). The estimated actual diversions and diversion demands as well as irrigation efficiencies, duration of irrigation, and irrigation return flows were then adjusted as appropriate until the models were reasonably well calibrated. The parameters used in the calibration process as well as a summary of the calibration results will be discussed in subsequent sections.

To mathematically represent the Clear Creek basin, the river system was divided into reaches based primarily upon the location of major tributary confluences. Each reach was then sub-divided by identifying a series of individual nodes representing diversions, reservoirs, tributary confluences, gages, or other significant water resources features. The resulting network is a simplified representation of actual conditions. Figure 1 presents a node diagram of the Clear Creek basin model developed for the Powder/Tongue River.

Historical or virgin flow for each month is supplied to the model at the uppermost node. Where available, upper basin gages were selected as the uppermost model nodes; in their absence, flow at the ungaged headwater point was estimated outside the spreadsheet. A complete discussion of the surface water hydrology work is provided in the Surface Water Hydrology memo (HKM, 2002). For each reach, incremental stream gains (e.g., ungaged tributaries, groundwater inflow, and inflow resulting from man-induced but unmodeled processes) and losses (e.g. seepage, evaporation, and unspecified diversions) are computed by the spreadsheet. These are calculated by adding the net modeled effects (diversions and increases in storage less return flows and decreases in storage) within the basin back into the difference between the upstream and downstream historical gage flows. Stream gains are input at the top of a basin to be available for diversion throughout the basin and losses are subtracted at the bottom of each basin.

At each node, a water budget computation is completed to determine the amount of water that bypasses the node. At non-storage nodes, the difference between inflow, including upstream inflows, return flows, imports and basin gains, and outflows, including diversions, basin losses and exports, is the amount of flow available to the next node downstream. For storage nodes, an additional loss calculation for evaporation and the change in storage is evaluated. Also at storage nodes, any uncontrolled spill that occurs is added to the scheduled release to determine total outflow. Diverted amounts at diversion nodes are the minimum of demand (the full supply diversion at the structure) and physically available streamflow. The mass balance, or water budget calculations, is performed for all nodes in a reach.

Model output includes the full-supply diversion demand and model simulated diversions at each of the diversion points, and streamflow at each of the Clear Creek basin model nodes. Estimates of impacts associated with various water projects can be analyzed by changing input data, as decreases in available streamflow or as changes to diversions occur. New storage projects that alter the timing of streamflows or shortages may also be evaluated.

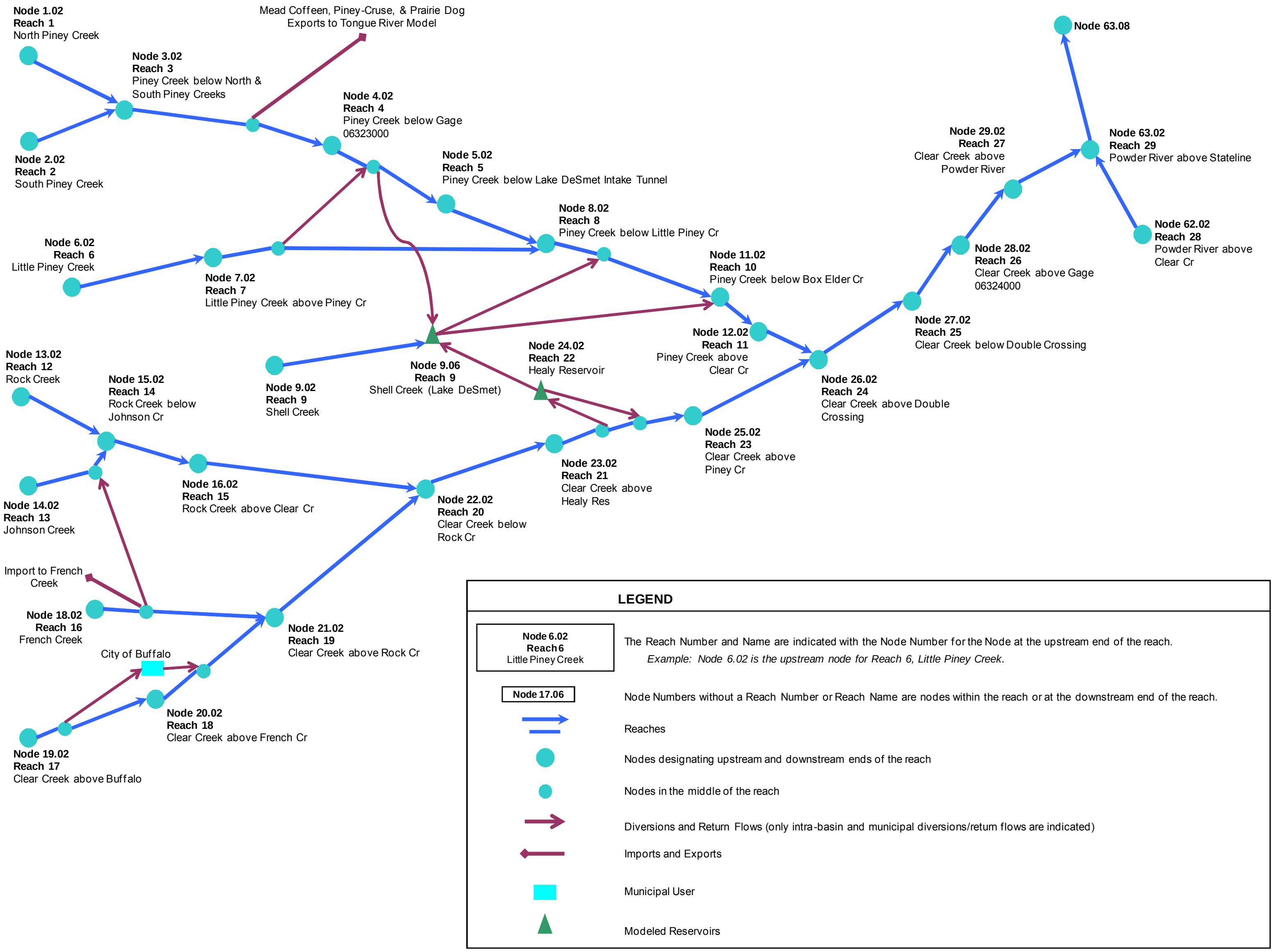


Figure 1: **Clear Creek Basin Schematic**

3.9.1.1.1.2 Model Development

The model was developed using Microsoft® Excel 97. The workbooks contain macros written in the Microsoft® Visual Basic for Applications programming language. The primary function of the macros is to facilitate navigation within the workbook. The models are recalculated and updated automatically whenever a change is made to any of the input data.

The model was developed with the novice Excel user in mind and it is assumed that the user has a basic level of proficiency in spreadsheet usage and programming. Every effort has been taken to lead the User through the model with interactive buttons and mouse-driven options. This memorandum does not provide instructions in the use of the Excel program.

3.9.1.1.1.3 Model Structure and Components

The model is a workbook consisting of numerous individual pages (worksheets). Each worksheet is a component of the model and completes a specific task required for execution of the model. There are five basic types of worksheets:

- **Navigation Worksheets:** Graphical User Interfaces (GUIs) containing buttons used to move within the workbook;
- **Input Worksheets:** Raw data entry worksheets (USGS Gage data or headwater inflow data, Diversion Data, etc.);
- **Computation Worksheets:** Compute various components of the model (reservoir evaporation, irrigation return flows, etc.);
- **Reach/Node Worksheets:** Calculate node by node computations of the water budget; and
- **Results Worksheets:** Tabulate and present the model output.

In the following sections, each component of the model is discussed in greater detail. A general discussion of each component includes a brief overview of the function. The following notes are also included as appropriate:

> **Engineering Notes:**
>
> Detailed discussion of methodologies, assumptions, and sources used in the development of that component;
>
> **Calibration Notes:**
>
> Discussions of how this component is used for model calibration; and
>
> **User Notes:**
>
> “How to” instructions for model Users.

Programmers' Notes, which are instructions and suggestions for programmers modifying the model, are included as the final section. These will assist state staff with any modifications of this model to analyze changed conditions or other applications in the Clear Creek Basin.

3.9.1.1.2 The Navigation Worksheets

The GUI provides a brief tutorial and information regarding the current model version (see Figure 2).

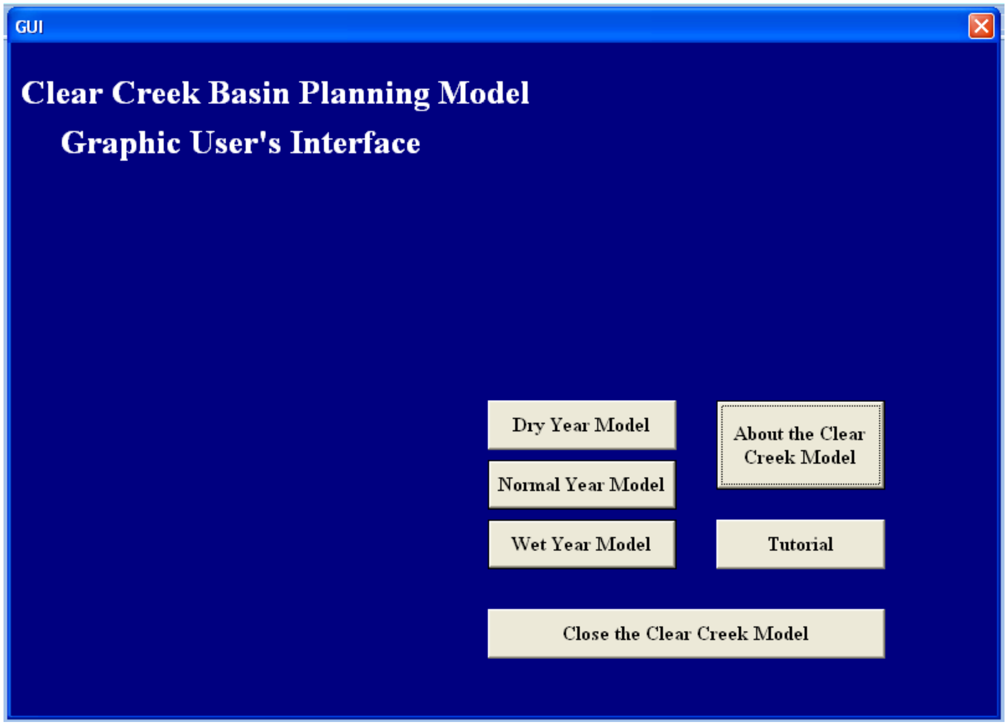


Figure 2: Graphical User's Interface for the Little Bighorn River Model

From the GUI, the User may select the dry, normal, or wet year model.

<u>User Notes:</u>

Upon opening the model file, the User is presented with several options:

Dry Year Model: Open the Dry Year Model workbook,

Normal Year Model: Open the Normal Year Model workbook,

Wet Year Model: Open the Wet Year Model workbook,

About the (basin) Model: Obtain information pertaining to the current version of the model,

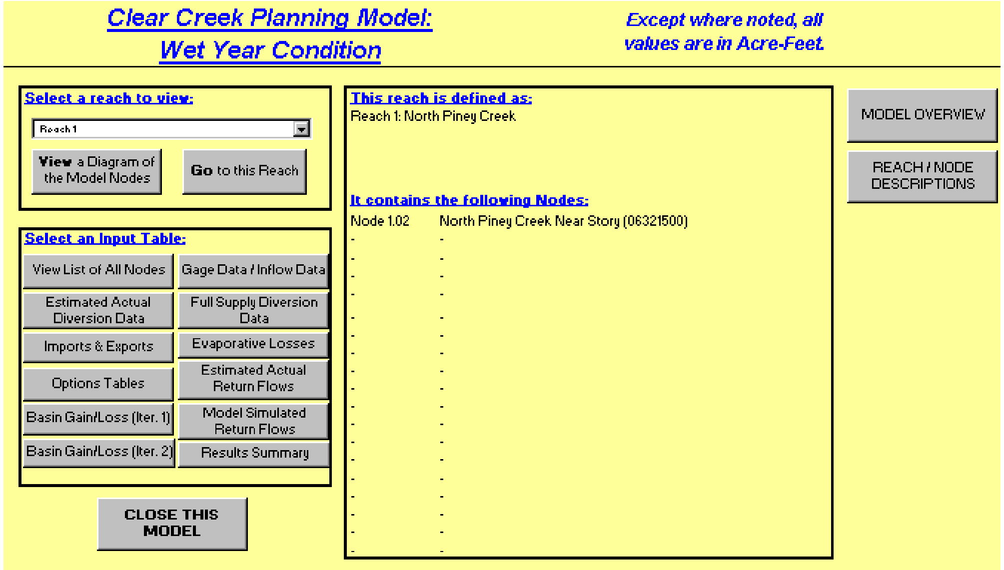
Tutorial: Open a brief tutorial that describes the general structure of a spreadsheet workbook

Close the (basin) Model: Close all open workbooks.

The Dry, Normal, and Wet Year models each have two main navigation worksheets to view other portions of the workbook. A third sheet contains a diagram of the basin to orient the user, and which provides a link to the Reach/Node worksheets. For Users experienced with Excel spreadsheets, all conventional spreadsheet navigation commands are still operative (e.g., page down, GOTO, etc.).

3.9.1.1.2.1 The Central Navigation Worksheet

The Central Navigation Worksheet is the "heart" of the model. From here, the User is provided with links to any worksheet in the model. Figure 3 displays the Central Navigation Worksheet from the Clear Creek Basin Wet Year Model.



This reach is defined as:
Reach 1: North Piney Creek

It contains the following Nodes:
Node 1.02 North Piney Creek Near Story (06321500)

Figure 3: **Central Navigation Worksheet for the Clear Creek Planning Model: Wet Year Condition**

<u>User Notes:</u>

This is the first worksheet the User sees upon selecting a hydrologic condition from the GUI. Using the gray buttons, the User can move to:

- The basin diagram (View a Diagram of the Model Nodes),
- Any of the Reach/Node worksheets (Go to this Reach),
- The Input Worksheets and Computation Worksheets (View List of All Nodes, Gage Data / Inflow Data, Estimated Actual Diversion Data, Full Supply Diversions Data, Imports &

Exports, Evaporative Losses, Options Tables, Estimated Actual Return Flows, Basin Gain/Loss Iteration 1, Model Simulated Return Flows, Basin Gain/Loss Iteration 2), and

- The Results Navigator (Results Summary) which leads in turn to several summaries of output.

The User specifies the reach he wants to go to by selecting it from the pull-down menu. When a reach is selected, the table to the right lists all the nodes in that reach by number and name.

3.9.1.1.2.2 The Basin Map

User Notes:

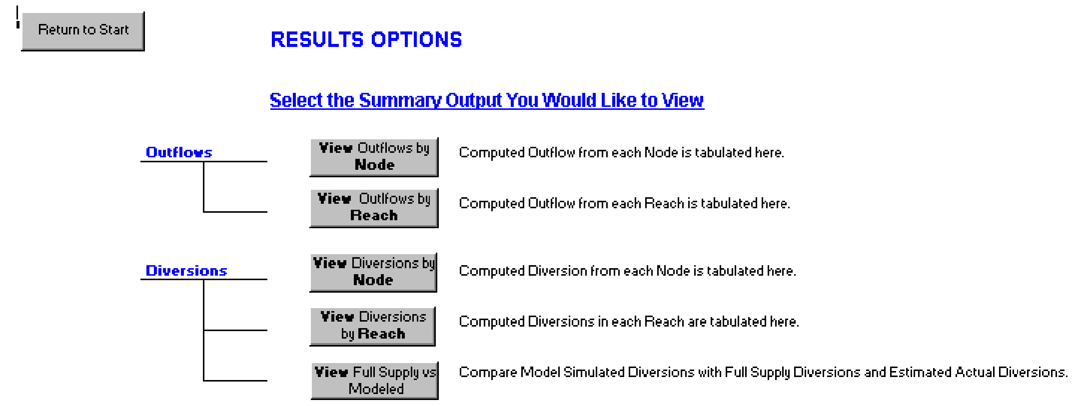
The Basin Map Worksheet provides a navigable schematic diagram of the basin (see Figure 1). This interactive screen allows the User to visually select a reach. To move to the water budget calculations for a reach, simply click on the desired reach arrow or its name.

3.9.1.1.3 The Results Navigator

User Notes:

The Results Navigator (Figure 4) allows selection of any of the following output tabulations:

- Outflows summarized by node
- Outflows summarized by reach
- Diversions summarized by node
- Diversions summarized by reach
- Model Simulated versus Full Supply and Estimated Actual Diversions



Computed Outflow from each Node is tabulated here.

Computed Outflow from each Reach is tabulated here.

Computed Diversion from each Node is tabulated here.

Computed Diversions in each Reach are tabulated here.

Compare Model Simulated Diversions with Full Supply Diversions and Estimated Actual Diversions.

Figure 4: **Results Navigator**

3.9.1.1.4 The Input Worksheets

3.9.1.1.4.1 Master List of Nodes

The model is structured around nodes at which mass balance calculations are performed and reaches that connect the nodes. Nodes are points on the river that represent such water resources features as gage locations, diversion headgates, major tributary confluences within the Clear Creek basin, or reservoirs. Table 1 lists the nodes for the Clear Creek basin model.

Engineering Notes:

The decision of how best to represent a river basin by reaches and nodes is a key element of river basin modeling. The choice of nodes must consider the objectives of the study and the available data. It also must represent all the key water resources features that govern the operation of the basin.

The following is a summary of the number of reaches and nodes used to represent Clear Creek basin:

- Clear Creek Model: 29 reaches, 107 nodes

User Notes:

This worksheet presents a master list of all nodes included in the Clear Creek basin model. The list allows the User to view a simple, comprehensive listing of all nodes within the model, organized by reach and node number. This master list governs naming and numbering conventions on many worksheets, so changes to the list must be done with great care. Many of the calculations within the spreadsheet are dependent on the proper correlation of node names and numbers.

Table 1
Clear Creek Model Nodes

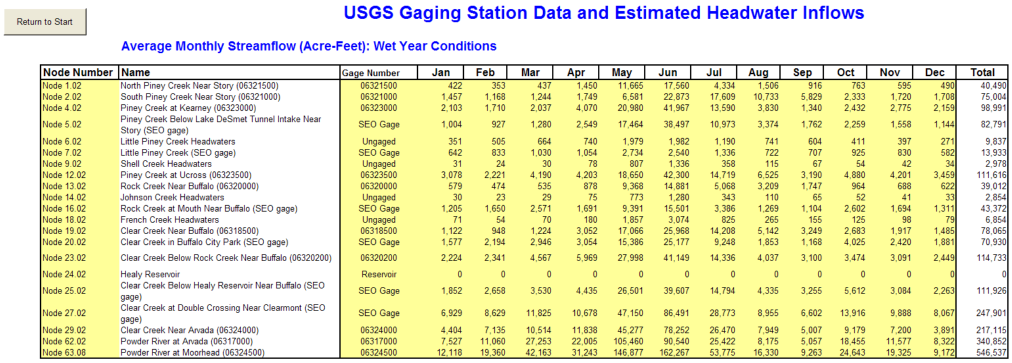
Reach No.	Node No.	Node Name
1	Node 1.02	North Piney Creek Near Story (06321500)
2	Node 2.02	South Piney Creek Near Story (06321000)
3	Node 3.02	Junction of North Piney Creek & South Piney Creek
	Node 3.04	Mead Coffeen Ditch Diversions (Transbasin)
	Node 3.06	Diversions d/s of Mead Coffeen Ditch
	Node 3.08	Piney & Cruse Ditch Diversions (Transbasin)
	Node 3.10	Piney Divide Ditch Diversions to Little Piney Creek
	Node 3.12	Piney Divide Ditch Diversions to irrigated lands
	Node 3.14	Prairie Dog Ditch Diversions (Transbasin)
	Node 3.16	Diversions d/s of Prairie Dog Ditch
	Node 3.18	Return Flow u/s of gage 06323000
4	Node 4.02	Piney Creek at Kearney (06323000)
	Node 4.04	Leiter Ditch Diversions
	Node 4.06	High Line Ditch Diversions
	Node 4.08	Lake DeSmet Intake Tunnel Diversions
	Node 4.10	Return Flow d/s of Lake DeSmet Intake Tunnel
5	Node 5.02	Piney Creek Below Lake DeSmet Tunnel Intake Near Story (SEO gage)
6	Node 6.02	Little Piney Creek Headwaters
	Node 6.04	Diversions u/s of Little Piney Divide Ditch
	Node 6.06	Little Piney Divide Ditch Diversions
	Node 6.08	Diversions d/s of Little Piney Divide Ditch
	Node 6.10	Return Flow on Little Piney Creek
7	Node 7.02	Little Piney Creek (SEO gage)
	Node 7.04	Little Piney Diversions to Piney Creek
8	Node 8.02	Junction of Piney Creek & Little Piney Creek
	Node 8.04	Upper Flying E, Lower Flying E & Senff Ditch Diversions
	Node 8.06	Maverick, Sturdevent & WJD Ditch Diversions
	Node 8.08	Anthorpe Rogers Ditch Diversions
	Node 8.10	Dunlap Ditch Diversions
9	Node 9.02	Shell Creek Headwaters
	Node 9.04	Diversions on Shell Creek
	Node 9.06	Lake DeSmet Reservoir
10	Node 11.02	Junction of Piney Creek & Box Elder Creek
	Node 11.04	Pratt & Ferris #1 Ditch Diversions
	Node 11.06	Return Flows from Dunlap Ditch
12	Node 12.02	Piney Creek at Ucross (06323500)
	Node 13.02	Rock Creek Near Buffalo (06320000)
	Node 13.04	Mowry Basin Ditch Diversions
	Node 13.06	Diversions d/s of Mowry Basin Ditch
	Node 13.08	Hallie Ditch Diversions
	Node 13.10	Diversions d/s of Hallie Ditch
	Node 13.12	Lake DeSmet (M&M) Ditch Diversions to irrigated lands
	Node 13.14	Lake DeSmet (M&M) Ditch Diversions to Lake DeSmet
13	Node 14.02	Johnson Creek Headwaters
	Node 14.04	Penrose Johnson Ditch Diversions
	Node 14.06	Diversions u/s Penrose Johnson Ditch Return Flows
	Node 14.08	Diversions d/s Penrose Johnson Ditch Return Flows
14	Node 15.02	Junction of Rock Creek & Johnson Creek
	Node 15.04	Diversions d/s of Sand Creek
	Node 15.06	Prince Albert Ditch Diversions
	Node 15.08	Return Flows from Prince Albert Ditch
15	Node 16.02	Rock Creek at Mouth Near Buffalo (SEO gage)
16	Node 18.02	French Creek Headwaters
	Node 18.04	Penrose Ditch Diversions to Johnson Creek
	Node 18.06	Diversions d/s of Penrose Ditch
	Node 18.08	Hopkins Ditch Diversions

Table 1 (continued)
Clear Creek Model Nodes

Reach No.	Node No.	Node Name
	Node 18.10	Diversions d/s of Hopkins Ditch
17	Node 19.02	Clear Creek Near Buffalo (06318500)
	Node 19.04	Diversions d/s of gage 06318500
	Node 19.06	Buffalo City Municipal Diversions
	Node 19.07	Diversions u/s of Snider Ditch
	Node 19.08	Snider Ditch Diversions
	Node 19.10	Johnson Holt Ditch Diversions
	Node 19.12	Six Mile Ditch Diversions
	Node 19.14	Crown Ditch Diversions
	Node 19.16	Diversions d/s of Crown Ditch
	Node 19.18	Clear Creek Land & Co Ditch Diversions
	Node 19.20	Clear Creek at Buffalo
18	Node 20.02	Clear Creek in Buffalo City Park (SEO gage)
18	Node 21.02	Junction of Clear Creek & French Creek
	Node 21.04	Diversions d/s of Clear Cr & French Cr Junction
20	Node 22.02	Junction of Clear Creek & Rock Creek
	Node 22.04	Return Flow d/s of Clear Cr & Rock Cr Junction
21	Node 23.02	Clear Creek Below Rock Creek Near Buffalo (06320200)
	Node 23.04	Redman Ditch Diversions
	Node 23.06	Diversions d/s of Redman Ditch
	Node 23.08	Hillyer & Onslow Ditch Diversions
	Node 23.10	Diversions to Healy Reservoir
	Node 23.12	Clear Creek d/s of Hillyer & Onslow Ditch
22	Node 24.02	Healy Reservoir
23	Node 25.02	Clear Creek Below Healy Reservoir Near Buffalo (SEO gage)
	Node 25.04	Frank G Hopkins Ditch Diversions
	Node 25.06	Des Moines Ditch Diversions
	Node 25.08	Diversions d/s Des Moines Ditch Diversions
	Node 25.10	Big Bonanza Ditch Diversions
24	Node 26.02	Junction of Clear Creek & Piney Creek
	Node 26.04	Diversions u/s of Roberts Ditch
	Node 26.06	Roberts Ditch Diversions
	Node 26.08	Diversions d/s of Roberts Ditch
	Node 26.10	Return Flows u/s of Double Crossing gage
25	Node 27.02	Clear Creek at Double Crossing Near Clearmont (SEO gage)
	Node 27.04	Diversions u/s of Pratt & Ferris #2 Ditch
	Node 27.06	Pratt & Ferris #2 Ditch Diversions
	Node 27.08	Diversions d/s of Pratt & Ferris #2 Ditch
	Node 27.10	Pratt & Ferris #3 Ditch Diversions
	Node 27.12	Clear Creek above SEO Gage
26	Node 28.02	Clear Creek Below P&F#3 Ditch Near Clearmont (SEO gage)
	Node 28.04	Diversions d/s of Pratt & Ferris #3 Ditch
	Node 28.06	Diversions u/s of Kendrick Ditch
	Node 28.08	Kendrick Ditch Diversions
	Node 28.10	Return Flows from Kendrick Ditch
27	Node 29.02	Clear Creek Near Arvada (06324000)
28	Node 62.02	Powder River at Arvada (06317000)
29	Node 63.02	Junction of Powder River & Clear Creek
	Node 63.04	Diversions d/s of Powder River & Clear Creek Junction
	Node 63.06	Return Flow from Diversions d/s of Powder R & Clear Cr Junction
	Node 63.08	Powder River at Moorhead (06324500)

3.9.1.1.4.2 Gage Data

Historic monthly stream gage data were obtained from the USGS or the Wyoming Water Resources Data System (WRDS) for each of the stream gages used in the model (Figure 5). Linear regression techniques were used to estimate missing values for the many gages that had incomplete records. Once the gages were filled in for the study period, monthly values for Dry, Normal, and Wet conditions were averaged from the Dry, Normal, or Wet years of the study period.



USGS Gaging Station Data and Estimated Headwater Inflows

Average Monthly Streamflow (Acre-Feet): Wet Year Conditions

Node Number	Name	Gage Number	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Node 1.02	North Piney Creek Near Story (06321500)	06321500	422	353	437	1,450	11,665	17,560	4,334	1,506	916	763	595	490	40,490
Node 2.02	South Piney Creek Near Story (06321000)	06321000	1,457	1,168	1,244	1,749	6,581	22,873	17,609	10,733	5,829	2,333	1,720	1,708	75,004
Node 4.02	Piney Creek at Kearney (06323000)	06323000	2,103	1,710	2,037	4,070	20,980	41,967	13,590	3,830	1,340	2,432	2,775	2,159	98,991
Node 5.02	Piney Creek Below Lake DeSmet Tunnel Intake Near Story (SEO gage)	SEO Gage	1,004	927	1,280	2,549	17,464	38,497	10,973	3,374	1,762	2,259	1,558	1,144	82,791
Node 6.02	Little Piney Creek Headwaters	Ungaged	351	505	664	740	1,979	1,982	1,190	741	604	411	397	271	9,837
Node 7.02	Little Piney Creek (SEO gage)	SEO Gage	642	833	1,030	1,054	2,734	2,540	1,336	722	707	925	830	582	13,933
Node 9.02	Shell Creek Headwaters	Ungaged	31	24	30	78	807	1,336	358	115	67	54	42	34	2,978
Node 12.02	Piney Creek at Ucross (06323500)	06323500	3,078	2,221	4,190	4,203	18,650	42,300	14,719	6,525	3,190	4,880	4,201	3,459	111,616
Node 13.02	Rock Creek Near Buffalo (06320000)	06320000	579	474	535	878	9,368	14,881	5,068	3,209	1,747	964	688	622	39,012
Node 14.02	Johnson Creek Headwaters	Ungaged	30	23	29	75	773	1,280	343	110	65	52	41	33	2,854
Node 16.02	Rock Creek at Mouth Near Buffalo (SEO gage)	SEO Gage	1,205	1,650	2,571	1,691	9,391	15,501	3,386	1,269	1,104	2,602	1,694	1,311	43,372
Node 18.02	French Creek Headwaters	Ungaged	71	54	70	180	1,857	3,074	825	265	155	125	98	79	6,854
Node 19.02	Clear Creek Near Buffalo (06318500)	06318500	1,122	948	1,224	3,052	17,066	25,968	14,208	5,142	3,249	2,683	1,917	1,485	78,065
Node 20.02	Clear Creek in Buffalo City Park (SEO gage)	SEO Gage	1,577	2,194	2,946	3,054	15,386	25,177	9,248	1,853	1,168	4,025	2,420	1,881	70,930
Node 23.02	Clear Creek Below Rock Creek Near Buffalo (06320200)	06320200	2,224	2,341	4,567	5,969	27,998	41,149	14,336	4,037	3,100	3,474	3,091	2,449	114,733
Node 24.02	Healy Reservoir	Reservoir	0	0	0	0	0	0	0	0	0	0	0	0	0
Node 25.02	Clear Creek Below Healy Reservoir Near Buffalo (SEO gage)	SEO Gage	1,852	2,658	3,530	4,435	26,501	39,607	14,794	4,335	3,255	5,612	3,084	2,263	111,926
Node 27.02	Clear Creek at Double Crossing Near Clearmont (SEO gage)	SEO Gage	6,929	8,629	11,825	10,678	47,150	86,491	28,773	8,955	6,602	13,916	9,888	8,067	247,901
Node 29.02	Clear Creek Near Arvada (06324000)	06324000	4,404	7,135	10,514	11,838	45,277	78,252	26,470	7,949	5,007	9,179	7,200	3,891	217,115
Node 62.02	Powder River at Arvada (06317000)	06317000	7,527	11,060	27,253	22,005	105,460	90,540	25,422	8,175	5,057	18,455	11,577	8,322	340,852
Node 63.08	Powder River at Moorhead (06324500)	06324500	12,118	19,360	42,163	31,243	146,877	162,267	53,775	16,330	9,263	24,643	19,325	9,172	546,537

Figure 5: Gage Data for the Clear Creek Wet Year Model

Headwater inflow at several ungaged locations is also included on the Gage Data worksheet. Different approaches to estimating the flow were used, depending on the complexity of the stream system and availability of data. For a more detailed discussion of the development of flow estimates at ungaged locations as well as missing data a gaged locations, see the Surface Water Hydrology memorandum (HKM, 2002).

User Notes:

The Gage Data Table presents the average historical monthly gage data for each hydrologic condition used in the model. Only the data pertaining to the hydrologic condition being modeled are included in each respective model.

3.9.1.1.4.3 Diversion Data

Diversions in the Clear Creek basin model is associated either to municipal use, or agricultural use. The spreadsheet model both the entire diversion and the consumptive portion of all municipal diversions. Agricultural diversion nodes fall into two categories: those for which historical diversion records are available and those for which estimates of actual diversions had to be made. The ditches with historical diversion records served as indicators of irrigation practices throughout the Clear Creek Basin. Their historical diversion records were used to determine Estimated Actual Diversions and Full Supply Diversion Requirements as discussed in the Agricultural Use memorandum (HKM, 2002). Estimated actual diversions are made outside of the spreadsheet model in order to make an initial determination of unaccounted for gains and losses. The points of diversion (service area) GIS theme contains the information designating the node used in the models.

Two Diversion Data worksheets are used: Estimated Actual Diversion Data and Full Supply Diversion Data. Data on the Estimated Actual Diversion Data sheet are used in calculating Estimated Actual Return Flows and initial Ungaged Basin Gains and Losses. Data on the Full Supply Diversion Data sheet are used as the Diversion Demand in the Reach/Node worksheets and are used in determining diversion shortages. The Full Supply Diversion Data are not directly used to calculate return flows, though the modeled return flow calculations are limited by the minimum of the full supply diversion data or by the available inflow to a particular node.

Engineering Notes:

Collection of agricultural diversion data is discussed in the Irrigation Diversion Operation and Description memorandum (HKM, 2002).

The estimated consumptive irrigation requirement (CIR), duration of irrigation, actual historic diversions and full supply diversions are the result of a great deal of analysis outside of the spreadsheet as described in the Agricultural Use memorandum (HKM, 2002).

Municipal diversions for Buffalo were taken from the Municipal Use memorandum (HKM, 2002). Values reported in this memorandum represent the consumptive use portion as well as the entire historical diversion amount of the municipal diversions. No attempts were made to develop dry, normal and wet year municipal diversions. There were no industrial uses significant enough to be modeled.

User Notes:

The diversion data worksheets contain only input data for each node for an average dry, normal, or wet year. Note that all nodes are listed in the tables, even if no diversions occur at them. At the top of the worksheets are buttons that will take the User to the table summarizing the total monthly diversions in each reach. With the exception of these summary tables, no computations occur within these worksheets.

3.9.1.1.4.4 Import and Export Data

Engineering Notes:

Historical records were obtained as described in the Irrigation Diversion Operation and Description memorandum (HKM, 2002). Monthly exports were averaged for the Dry, Normal and Wet years of the study period, as indicated in the Surface Water Hydrology memorandum (HKM, 2002).

The Clear Creek model includes the Four Lakes & French Creek Ditch diversion imports to French Creek. The exports to the Tongue River model from North and South Piney Creek (the Mead Coffeen, Piney & Cruse, and Prairie Dog Ditches) are handled as regular diversions without flow returning to the Clear Creek model.

User Notes:

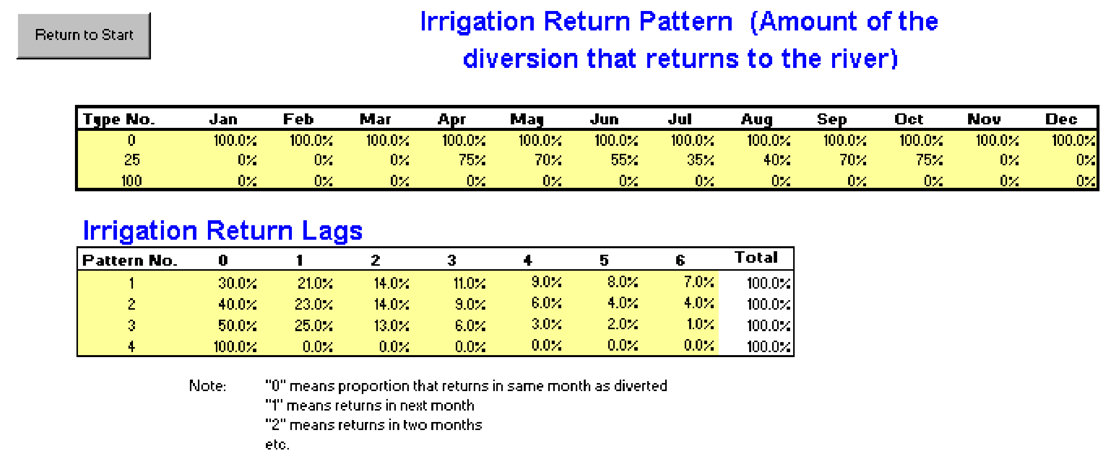
The Imports / Exports Table summarizes the monthly imports to or exports from other basins. As noted above, only the Four Lake & French Creek imports were explicitly modeled as such. However, the node water balance tables in the Reach/Node Worksheets are set up to incorporate imports to or exports from any node.

3.9.1.1.4.5 Options Tables

Two tables are included in the Options Tables worksheet (see Figure 6):

- Irrigation Return Pattern – a percentage representing the amount of the diversion that returns to the river (inefficiencies), and

- Irrigation Return Lags – a percentage representing the amount of the return flow from a given month that reaches the river in the month of the diversion and in subsequent months.



Irrigation Return Pattern (Amount of the diversion that returns to the river)

Type No.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
25	0%	0%	0%	75%	70%	55%	35%	40%	70%	75%	0%	0%
100	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Irrigation Return Lags

Pattern No.	0	1	2	3	4	5	6	Total
1	30.0%	21.0%	14.0%	11.0%	9.0%	8.0%	7.0%	100.0%
2	40.0%	23.0%	14.0%	9.0%	6.0%	4.0%	4.0%	100.0%
3	50.0%	25.0%	13.0%	6.0%	3.0%	2.0%	1.0%	100.0%
4	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Note: "0" means proportion that returns in same month as diverted
"1" means returns in next month
"2" means returns in two months
etc.

Figure 6: Irrigation Return Patterns and Irrigation Return Lags

Engineering Notes:

The unused, or inefficiency portion of diversions is returned to the river over the course of one or more months either by direct surface runoff, or through the alluvial aquifer. For modeling purposes, an estimate must be made of amount, location, and timing of returns. The Options Table addresses amount and timing of return flows. The points of diversion (service area) GIS theme contains the information designating the Return Pattern and Return Lags for each model node.

The Irrigation Return Pattern table provides the monthly return fractions (inefficiencies) for every diversion in the model. One pattern is characterized by zeros in all months, which is applicable to all intra-basin diversion nodes (e.g., Lake DeSmet Tunnel Intake diversions from Piney Creek). Monthly efficiencies for irrigation diversions were developed by comparing historical diversion records to the theoretical maximum diversion requirement (based on CIR) as discussed in the Agricultural Use memorandum (HKM, 2002). The return flow fraction is defined as (1.0 – Efficiency).

Lags for irrigation diversions were patterned after similar previous projects and adjusted based on the type of irrigation system defined in the irrigated lands mapping (i.e. conventional irrigation systems as opposed to spreader dikes or intermittent diversions from ephemeral streams). Irrigation Return Lags for municipal nodes were set to 100 percent during the month of diversion.

Calibration Notes:

The efficiencies and return lags initially selected were further calibrated to fit the conditions of the Clear Creek basin using the magnitude and monthly pattern of the Ungaged Basin Gain/Loss term as a reasonableness check.

User Notes:

The Options Tables incorporate the information used in the computation of irrigation return flow quantities and their timing. The data in the first table, “Irrigation Return Patterns,” consist of the percentages of water diverted which eventually will return to the river and be made available to downstream users.

The second worksheet table, “Irrigation Return Lags”, controls the timing of these returns. Flows diverted in any month can be lagged up to six months beyond the month in which they are diverted. An example pattern is:

Month	0	1	2	3	4	5	6
Percent	30	21	14	11	9	8	7

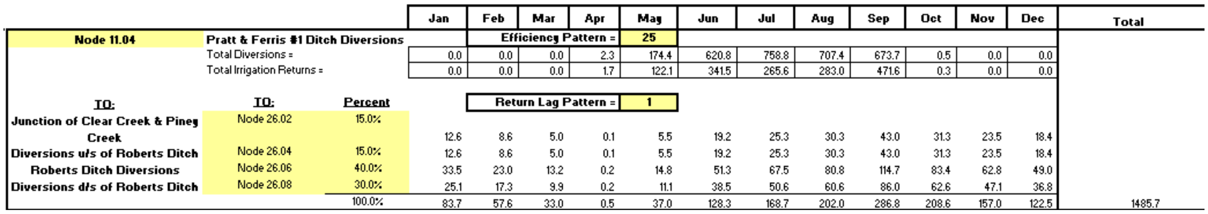
By way of example, for a diversion occurring in July, 30 percent of the Total Irrigation Returns (i.e., that portion not lost to consumptive use, evaporation, etc.) will return in July, 21 percent in August, 14 percent in September, 11 percent in October, 9 percent in November, 8 percent in December, and the remaining 7 percent will return in January.

3.9.1.1.5 The Computation Worksheets

The Computation Worksheets are calculators for parameters required by the Reach/Node water balance computations. They use data supplied in the Input Worksheets. Irrigation returns, ungaged basin gains and losses, and evaporative losses are calculated in the Computation Worksheets.

3.9.1.1.5.1 Irrigation Returns

The unused portion of a headgate diversion either returns to the river as surface runoff during the month it is diverted, or "deep percolates" into the alluvial aquifer. The deep percolation portion returns to the river through the aquifer but generally lags the time of diversion by several months. The location of the return flow's re-entry to the stream is an important factor in modeling the basin, and depends on the specific topography and layout of the irrigation system. The location of irrigation return flows were determined through the irrigated lands mapping task and are specified as a GIS attribute for each irrigated service area. See Figure 7.



			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Node 11.04	**Pratt & Ferris #1 Ditch Diversions**			**Efficiency Pattern =**			**25**								
	Total Diversions =		0.0	0.0	0.0	2.3	174.4	620.8	758.8	707.4	673.7	0.5	0.0	0.0	
	Total Irrigation Returns =		0.0	0.0	0.0	1.7	122.1	341.5	265.6	283.0	471.6	0.3	0.0	0.0	
TO:	**TO:**	**Percent**		**Return Lag Pattern =**			**1**								
Junction of Clear Creek & Piney Creek	Node 26.02	15.0%	12.6	8.6	5.0	0.1	5.5	19.2	25.3	30.3	43.0	31.3	23.5	18.4	
Diversions u/s of Roberts Ditch	Node 26.04	15.0%	12.6	8.6	5.0	0.1	5.5	19.2	25.3	30.3	43.0	31.3	23.5	18.4	
Roberts Ditch Diversions	Node 26.06	40.0%	33.5	23.0	13.2	0.2	14.8	51.3	67.5	80.8	114.7	83.4	62.8	49.0	
Diversions d/s of Roberts Ditch	Node 26.08	30.0%	25.1	17.3	9.9	0.2	11.1	38.5	50.6	60.6	86.0	62.6	47.1	36.8	
		100.0%	83.7	57.6	33.0	0.5	37.0	128.3	168.7	202.0	286.8	208.6	157.0	122.5	1485.7

Figure 7: **Sample Irrigation Return Flow Calculation**

There are two Irrigation Return worksheets: the Estimated Actual Return Flows and the Model Simulated Return Flows. Each of these Irrigation Return worksheets has three tables. The first calculates the amount of return flow resulting from each month's diversion at each node, and distributes it in time and place according to the information in the Options Table. The second table then effectively "collects" all the incoming return flows for each month at each node, from the various sources. This table produces the return flow component of inflow at each node. The third table summarizes return flows by reach.

Engineering Notes:

Figure 7 shows a typical irrigation return flow calculation for the Pratt & Ferris #1 Ditch Diversions.

Efficiency Pattern: The value entered here is used to look up the Irrigation Return Pattern found in the Options Table.

Total Diversions: On the Estimated Actual Return Flows worksheet, these values are referenced from the Estimated Actual Diversion Data input worksheet. On the Model Simulated Return Flows worksheet, these values are referenced from the "Summary of Diversion Calculations: By Reach" table on the Diversion Summary worksheet.

Total Irrigation Returns: These data are computed by multiplying the Total Diversions by the selected Irrigation Return Pattern for the month. For example, for a month with Total Diversions of 1000 acre-feet and an irrigation return fraction of 80%, the Total Irrigation Returns from that diversion for that month will be 800 acre-feet.

Return Pattern: The value entered here is used to look up the Irrigation Return Lag found in the Options Table.

To and Percent: This feature allows the User to define the node(s) in the model where irrigation returns will return and in what percentages. Total Irrigation Returns are distributed according to the node numbers entered in the "To" box, their corresponding percentages of the Total Irrigation Returns, and the Irrigation Return Lag pattern in the Options Table. The percentages entered at each node must total either 0 or 100% or a warning message will appear.

The location of the irrigated acreage in relation to natural topographic features was used in determining return flow locations and percentages.

Irrigation Returns: Node Totals Table: This table lists all of the irrigation returns that have been directed to each Node and provides their sum.

Irrigation Returns: Reach Totals Table: This table lists all of the irrigation returns that have been directed to each Reach and provides their sum.

User Notes:

This worksheet computes the return flows from irrigation diversions. The User should modify only those cells highlighted in yellow.

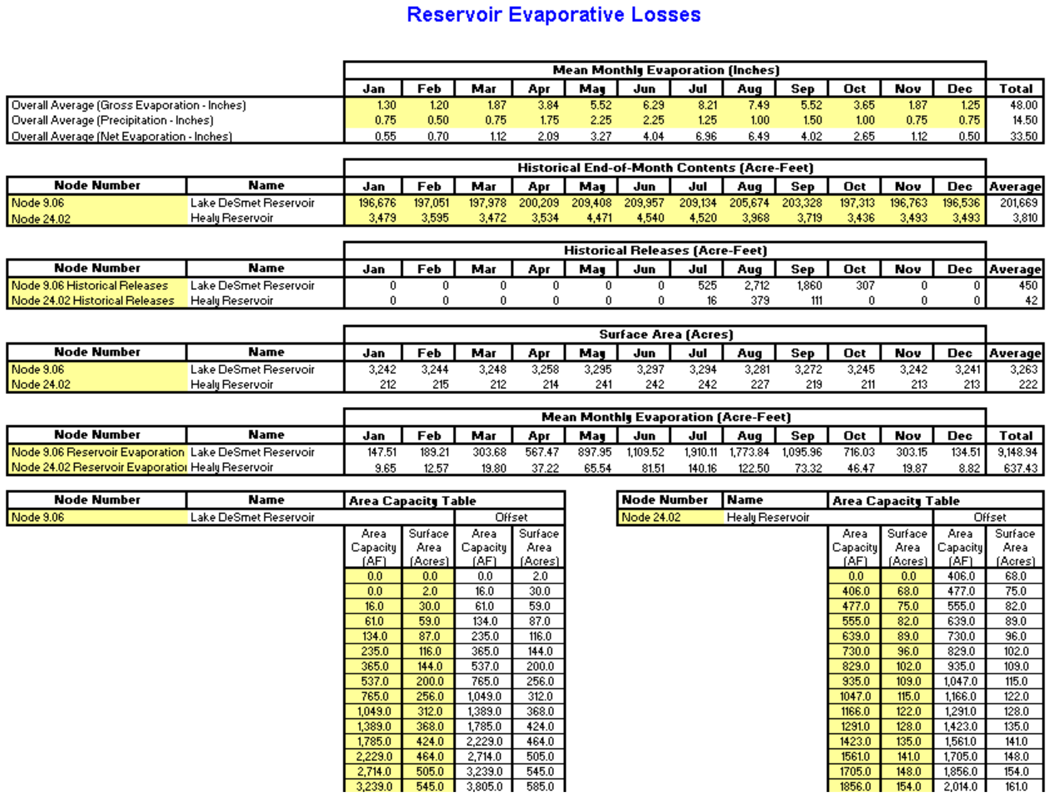
Buttons at the top of the worksheet take the User directly to each of the three tables in the Irrigation Return Worksheet. “View Individual Nodes” takes the User to the first table, which calculates return flows from each node and distributes them in time and place. “View ‘Node Totals’ Summary Table” takes the User to the second table, the Node Totals Table. “View ‘Reach Totals’ Summary Table” takes the User to the Reach Totals Table.

3.9.1.1.5.2 Evaporative Losses

Two reservoirs are explicitly modeled in the Clear Creek basin model: Lake DeSmet and Healy Reservoir in the Clear Creek Model. Other reservoirs were not explicitly modeled because there is insufficient historical data or operational information to model their operation. The effects of these relatively minor reservoirs are accounted for in the gain/loss terms for these reaches. Several reservoirs are also located upstream of the limits of the models. Although these reservoirs are not explicitly modeled, their operations are reflected in the historical records of streamflow gages representing the uppermost limits of the models. The model calculates evaporation losses included in the mass balance calculations at each modeled reservoir node and in the ungaged gain/loss determination. See Figure 8.

Engineering Notes:

Monthly gross evaporation and area-capacity data for each of the modeled reservoirs was obtained from the Storage Operation and Description memorandum (HKM, 2002). Precipitation was obtained from the Wyoming Average Monthly or Annual Precipitation, 1961-1990 GIS theme (Daly and Taylor, 1998). Historical end-of-month reservoir contents, diversions, and releases were obtained from the State Engineer’s Office for Lake DeSmet and Healy Reservoir. Dry, normal and wet year end-of-month contents were determined for each reservoir for modeling the respective hydrologic conditions.



Reservoir Evaporative Losses

	Mean Monthly Evaporation (Inches)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Overall Average (Gross Evaporation - Inches)	1.30	1.20	1.87	3.84	5.52	6.29	8.21	7.49	5.52	3.65	1.87	1.25	48.00
Overall Average (Precipitation - Inches)	0.75	0.50	0.75	1.75	2.25	2.25	1.25	1.00	1.50	1.00	0.75	0.75	14.50
Overall Average (Net Evaporation - Inches)	0.55	0.70	1.12	2.09	3.27	4.04	6.96	6.49	4.02	2.65	1.12	0.50	33.50

		Historical End-of-Month Contents (Acre-Feet)												
Node Number	Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Node 9.06	Lake DeSmet Reservoir	196,676	197,051	197,978	200,209	209,408	209,957	209,134	205,674	203,328	197,313	196,763	196,536	201,669
Node 24.02	Healy Reservoir	3,479	3,595	3,472	3,534	4,471	4,540	4,520	3,968	3,719	3,436	3,493	3,493	3,810

		Historical Releases (Acre-Feet)												
Node Number	Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Node 9.06 Historical Releases	Lake DeSmet Reservoir	0	0	0	0	0	0	525	2,712	1,860	307	0	0	450
Node 24.02 Historical Releases	Healy Reservoir	0	0	0	0	0	0	16	379	111	0	0	0	42

		Surface Area (Acres)												
Node Number	Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Node 9.06	Lake DeSmet Reservoir	3,242	3,244	3,248	3,258	3,295	3,297	3,294	3,281	3,272	3,245	3,242	3,241	3,263
Node 24.02	Healy Reservoir	212	215	212	214	241	242	242	227	219	211	213	213	222

		Mean Monthly Evaporation (Acre-Feet)												
Node Number	Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Node 9.06 Reservoir Evaporation	Lake DeSmet Reservoir	147.51	189.21	303.68	567.47	897.95	1,109.52	1,910.11	1,773.84	1,095.96	716.03	303.15	134.51	9,148.94
Node 24.02 Reservoir Evaporatio	Healy Reservoir	9.65	12.57	19.80	37.22	65.54	81.51	140.16	122.50	73.32	46.47	19.87	8.82	637.43

Node Number	Name	Area Capacity Table			
Node 9.06	Lake DeSmet Reservoir			Offset	
		Area Capacity (AF)	Surface Area (Acres)	Area Capacity (AF)	Surface Area (Acres)
		0.0	0.0	0.0	2.0
		0.0	2.0	16.0	30.0
		16.0	30.0	61.0	59.0
		61.0	59.0	134.0	87.0
		134.0	87.0	235.0	116.0
		235.0	116.0	365.0	144.0
		365.0	144.0	537.0	200.0
		537.0	200.0	765.0	256.0
		765.0	256.0	1,049.0	312.0
		1,049.0	312.0	1,389.0	368.0
		1,389.0	368.0	1,785.0	424.0
		1,785.0	424.0	2,229.0	464.0
		2,229.0	464.0	2,714.0	505.0
		2,714.0	505.0	3,239.0	545.0
		3,239.0	545.0	3,805.0	585.0

Node Number	Name	Area Capacity Table			
Node 24.02	Healy Reservoir			Offset	
		Area Capacity (AF)	Surface Area (Acres)	Area Capacity (AF)	Surface Area (Acres)
		0.0	0.0	406.0	68.0
		406.0	68.0	477.0	75.0
		477.0	75.0	555.0	82.0
		555.0	82.0	639.0	89.0
		639.0	89.0	730.0	96.0
		730.0	96.0	829.0	102.0
		829.0	102.0	935.0	109.0
		935.0	109.0	1,047.0	115.0
		1047.0	115.0	1,166.0	122.0
		1166.0	122.0	1,291.0	128.0
		1291.0	128.0	1,423.0	135.0
		1423.0	135.0	1,561.0	141.0
		1561.0	141.0	1,705.0	148.0
		1705.0	148.0	1,856.0	154.0
		1856.0	154.0	2,014.0	161.0

Figure 8: **Evaporation Losses**

User Notes:

Monthly gross evaporation (inches) and total precipitation (inches) data are included in the table. The net evaporation in inches is then calculated within the worksheet. The end-of month surface area is calculated from the area-capacity table and used to determine the mean monthly evaporative loss in acre-feet. As with other tables in the model spreadsheet, cells that require an entry are highlighted in yellow.

3.9.1.1.5.3 Reach Gain/Loss

The Clear Creek basin model simulates the major diversions and features of the basin, but many water resources features, such as small tributaries and diversions on those tributaries, are not explicitly included in the computer representation of the physical system. These less-significant water supplies and water uses are lumped together between measured flow points in the river by a modeling construct called ungaged reach gains and losses. These ungaged gains and losses account for all water in the budget that is not explicitly accounted for and includes ungaged tributaries, groundwater/surface water interactions, or any other process not explicitly or perfectly modeled.

Engineering Notes:

Ungaged gains and losses are computed between gages using a water budget approach, as:

{Q downstream – Q upstream } + Σ Diversions within Reach - Σ Return flows to Reach +/- Δ Storage

All terms are supplied from the Input Worksheets, the Computation Worksheets, or the Summary Worksheets.

Calibration Notes:

Two computational iterations are performed in establishing the ungaged gain/loss. The first iteration uses the Estimated Actual Diversion Data and Return Flows developed outside of the model to estimate ungaged gain/loss, while the second iteration uses the Model Simulated Diversions and Return Flows. The second iteration accounts for reductions in return flows resulting from diversion shortages and is necessary to achieve closure in the water balance calculations. Basin gains are equated to positive values, while basin losses are equated to negative values.

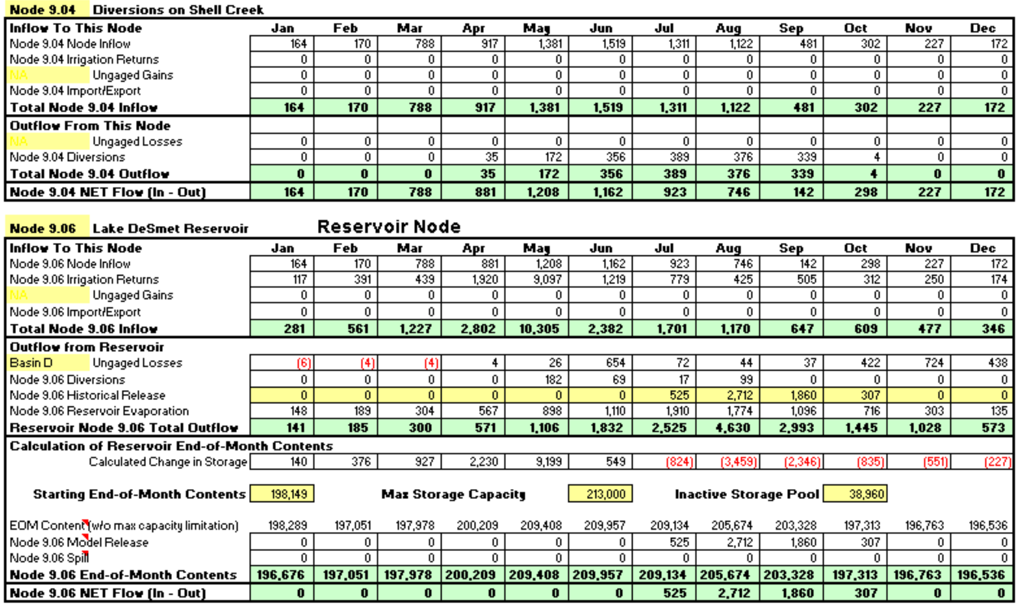
The basin gain/loss charts are used to visually verify the reasonableness of the gain/loss pattern and magnitude. Model assumptions, input data, and schematic representations of the physical system were adjusted as necessary through a trial-and-error process until the magnitude and monthly distribution of the gain/loss term appeared reasonable given the inherent limitations of the model and data deficiencies.

User Notes:

The worksheet uses positive values from iteration one as Basin Gains and negative values from iteration two as Basin Losses. Mathematical closure in the water balance calculations is accomplished through adjustments made in the second iteration. The two Basin Summary Tables (Basin Gains, Basin Losses) are viewed by selecting the "Basin Summary" button. The Basin Charts are similarly viewed by selecting the appropriate "View Basin _ Chart" button.

3.9.1.1.6 Reach/Node Tables

Each non-storage node is represented in the spreadsheet by an inflow section, which includes inflow from the upstream node, irrigation returns, ungaged gains, and imports, if applicable; and an outflow section, which includes ungaged losses and diversions, if applicable. The algebraic sum of these flows is then the net outflow from the node. In the case of storage nodes, evaporation is included as a loss and flow can either go to or come from storage. Again, the water balance is done for the node and outflow is calculated (Figure 9) and Appendix B.



Node 9.04 **Diversions on Shell Creek**

Inflow To This Node	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Node 9.04 Node Inflow	164	170	788	917	1,381	1,519	1,311	1,122	481	302	227	172
Node 9.04 Irrigation Returns	0	0	0	0	0	0	0	0	0	0	0	0
NA Ungaged Gains	0	0	0	0	0	0	0	0	0	0	0	0
Node 9.04 Import/Export	0	0	0	0	0	0	0	0	0	0	0	0
Total Node 9.04 Inflow	**164**	**170**	**788**	**917**	**1,381**	**1,519**	**1,311**	**1,122**	**481**	**302**	**227**	**172**
Outflow From This Node												
NA Ungaged Losses	0	0	0	0	0	0	0	0	0	0	0	0
Node 9.04 Diversions	0	0	0	35	172	356	389	376	339	4	0	0
Total Node 9.04 Outflow	**0**	**0**	**0**	**35**	**172**	**356**	**389**	**376**	**339**	**4**	**0**	**0**
Node 9.04 NET Flow (In - Out)	**164**	**170**	**788**	**881**	**1,208**	**1,162**	**923**	**746**	**142**	**298**	**227**	**172**

Node 9.06 **Lake DeSmet Reservoir** **Reservoir Node**

Inflow To This Node	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Node 9.06 Node Inflow	164	170	788	881	1,208	1,162	923	746	142	298	227	172
Node 9.06 Irrigation Returns	117	391	439	1,920	9,097	1,219	779	425	505	312	250	174
NA Ungaged Gains	0	0	0	0	0	0	0	0	0	0	0	0
Node 9.06 Import/Export	0	0	0	0	0	0	0	0	0	0	0	0
Total Node 9.06 Inflow	**281**	**561**	**1,227**	**2,802**	**10,305**	**2,382**	**1,701**	**1,170**	**647**	**609**	**477**	**346**
Outflow from Reservoir												
Basin D Ungaged Losses	(6)	(4)	(4)	4	26	654	72	44	37	422	724	438
Node 9.06 Diversions	0	0	0	0	182	69	17	99	0	0	0	0
Node 9.06 Historical Release	0	0	0	0	0	0	525	2,712	1,860	307	0	0
Node 9.06 Reservoir Evaporation	148	189	304	567	898	1,110	1,910	1,774	1,096	716	303	135
Reservoir Node 9.06 Total Outflow	**141**	**185**	**300**	**571**	**1,106**	**1,832**	**2,525**	**4,630**	**2,993**	**1,445**	**1,028**	**573**
Calculation of Reservoir End-of-Month Contents												
Calculated Change in Storage	140	376	927	2,230	9,199	549	(824)	(3,459)	(2,346)	(835)	(551)	(227)
Starting End-of-Month Contents	198,149		**Max Storage Capacity**			213,000		**Inactive Storage Pool**		38,960		
EOM Content (w/o max capacity limitation)	198,289	197,051	197,978	200,209	209,408	209,957	209,134	205,674	203,328	197,313	196,763	196,536
Node 9.06 Model Release	0	0	0	0	0	0	525	2,712	1,860	307	0	0
Node 9.06 Spill	0	0	0	0	0	0	0	0	0	0	0	0
Node 9.06 End-of-Month Contents	**196,676**	**197,051**	**197,978**	**200,209**	**209,408**	**209,957**	**209,134**	**205,674**	**203,328**	**197,313**	**196,763**	**196,536**
Node 9.06 NET Flow (In - Out)	**0**	**0**	**0**	**0**	**0**	**0**	**525**	**2,712**	**1,860**	**307**	**0**	**0**

Figure 9: Reach/Node Tables

Engineering Notes:

This is the heart of the spreadsheet model where water budget calculations are performed for each node represented in the model. Water balance is maintained in each river reach through the use of the Ungaged Basin Gain/Loss term.

3.9.1.1.6.1 User Notes:

The Node Tables compute the flow available to downstream users (NET flow) using a water budget approach.

The nodes must be organized in an upstream-to-downstream order within each reach. Diversion demands at each node are referenced from the Full Supply Diversion Data worksheet. Model simulated diversions are the lesser of full supply diversion requirements and available flow. In the event that the full supply demand cannot be met, a warning is provided to inform the User that the diversion has been shorted.

The following subsections contain miscellaneous notes about specific nuances within the Reach/Node tables in the Clear Creek basin model. See the “Model Node Map” and Node list within the Clear Creek model for the locations of the reaches and nodes discussed below.

3.9.1.1.6.2 Clear Creek Model

Reach 3:

Nodes 3.04, 3.08, & 3.14 — Mead Coffeen, Piney & Cruse, & Prairie Dog Ditches: These ditches export water for use in the Tongue River Basin.

Nodes 3.10 & 3.12 — Piney Divide Ditch: This ditch diverts for irrigated lands lying along the ditch as well as for use by other ditches on Little Piney Creek. The diversion amount for Node 3.10 uses the Estimated Actual Diversion and the Full Supply Diversion based on the acreage of lands served directly by the Piney Divide Ditch as indicated by the irrigated lands and service area GIS themes. The diversion amount for Node 3.12 is the remaining portion of the historical diversion data.

Node 4.08 — Lake DeSmet Intake Tunnel Diversions: The data for this diversion is taken directly from data provided on the operation of Lake DeSmet and Healy Reservoir by the SEO.

Reach 7:
Node 7.04 — Little Piney Diversions to Piney Creek: The data for this diversion is taken from data provided on the operation of Lake DeSmet and Healy Reservoir by the SEO.

Reach 9:
Node 9.06 — Lake DeSmet Reservoir: The releases from this node enter Piney Creek below the junction with Little Piney Creek (Node 8.04). The diversions from the reservoir are the releases to Box Elder Creek and in the model enter Piney Creek at Node 11.02.

Reach 12:
Nodes 13.12 & 13.14: Lake DeSmet (M&M) Ditch Diversions: This ditch diverts for irrigated lands lying along the ditch as well as for Lake DeSmet. The diversion amount for Node 13.12 uses the Estimated Actual Diversion and the Full Supply Diversion based on the acreage of lands served directly by the ditch as indicated by the irrigated lands and service area GIS themes. The diversion amount for node 13.14 is the remaining portion of the historical diversion data.

Reach 16:
Node 18.04 — Penrose Ditch Diversions to Johnson Creek: The historical diversion data for Penrose Ditch on French Creek are used for this intra-basin diversion. The import data is the historical data from the Four Lakes & French Creek Diversion to French Creek.

Reach 17:

Node 19.06 — Buffalo City Municipal Diversions: A constant diversion of 6 cubic feet per second (cfs) was used. The consumptive use amount was used to determine the remainder (returns to Clear Creek) and is found in the Municipal Use memorandum (HKM, 2002).

Reaches 21 & 22:
Nodes 23.08, 23.10, & 24.02 (Node 23.10 is upstream of Node 23.08 on Clear Creek) — Healy Reservoir: The diversions to Healy Reservoir leave Clear Creek at Node 23.10 and the reservoir releases enter Clear Creek at Node 23.08. The reservoir data is from data provided on the operation of Lake DeSmet and Healy Reservoir by the SEO.

3.9.1.1.7 The Results Worksheets

Several forms of model output can be accessed from the Summary Options worksheet. These include river outflow data (by node or by reach), and diversion data (by node, by reach, or model simulated compared to full supply and estimated actual).

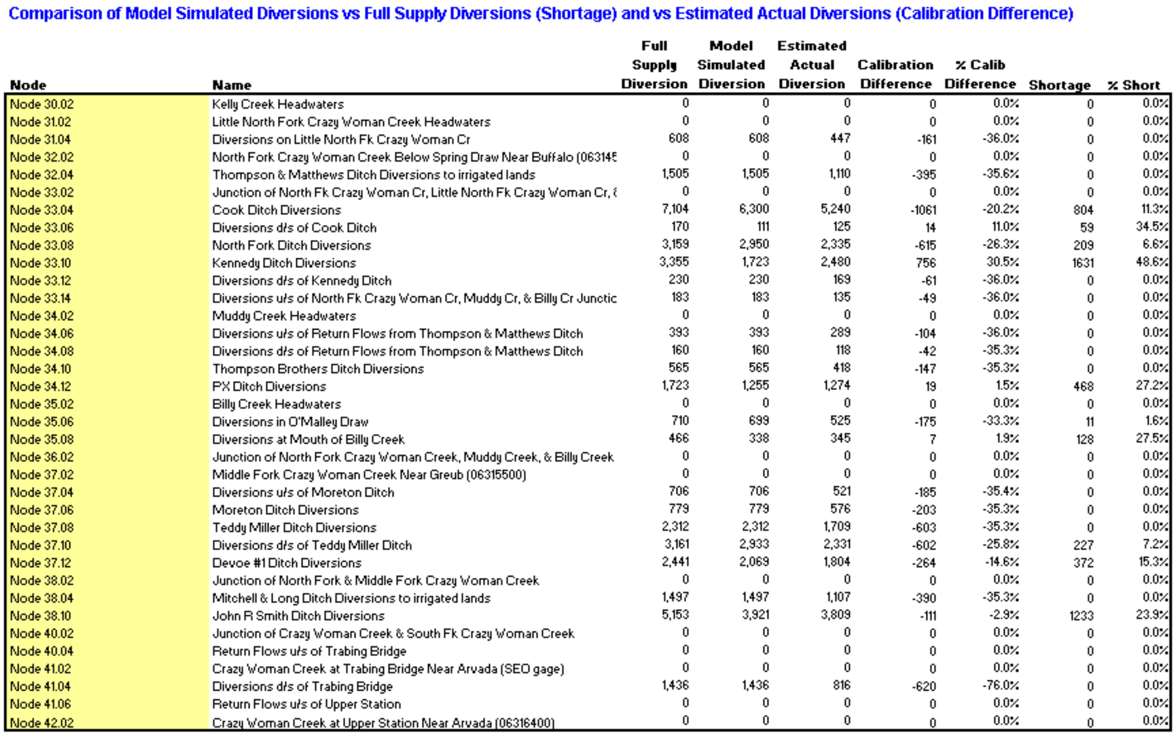
3.9.1.1.7.1 Outflows

This worksheet summarizes the flows at all nodes in the model. The "Outflow Calculations: By Node" table summarizes the net outflow for all nodes. The nodes are grouped by reach. The "Outflow Calculations: By Reach" table presents the net outflow for each reach.

A primary purpose for developing the spreadsheet model was to determine surface water availability under baseline conditions. The Outflow by Reach table provided the basis for determination of baseline surface water availability, as described in the Available Surface Water Determination memorandum (HKM, 2002).

3.9.1.1.7.2 Diversions

This worksheet summarizes the diversions at all nodes in the model. The "Summary of Diversion Calculations: By Node" tables summarizes the computed diversions which are made at each node. The nodes are grouped by reach. The "Summary of Diversion Calculations: By Reach" table presents the total diversions taken within each reach. The "Comparison of Model Simulated Diversions vs. Full Supply Diversions (Shortage) and vs. Estimated Actual Diversions (Calibration Difference)" table presents the estimated shortages and a measure of calibration of modeled diversions (Figure 10).



Comparison of Model Simulated Diversions vs Full Supply Diversions (Shortage) and vs Estimated Actual Diversions (Calibration Difference)

Node	Name	Full Supply Diversion	Model Simulated Diversion	Estimated Actual Diversion	Calibration Difference	% Calib Difference	Shortage	% Short
Node 30.02	Kelly Creek Headwaters	0	0	0	0	0.0%	0	0.0%
Node 31.02	Little North Fork Crazy Woman Creek Headwaters	0	0	0	0	0.0%	0	0.0%
Node 31.04	Diversions on Little North Fk Crazy Woman Cr	608	608	447	-161	-36.0%	0	0.0%
Node 32.02	North Fork Crazy Woman Creek Below Spring Draw Near Buffalo (063145	0	0	0	0	0.0%	0	0.0%
Node 32.04	Thompson & Matthews Ditch Diversions to irrigated lands	1,505	1,505	1,110	-395	-35.6%	0	0.0%
Node 33.02	Junction of North Fk Crazy Woman Cr, Little North Fk Crazy Woman Cr, &	0	0	0	0	0.0%	0	0.0%
Node 33.04	Cook Ditch Diversions	7,104	6,300	5,240	-1061	-20.2%	804	11.3%
Node 33.06	Diversions d/s of Cook Ditch	170	111	125	14	11.0%	59	34.5%
Node 33.08	North Fork Ditch Diversions	3,159	2,950	2,335	-615	-26.3%	209	6.6%
Node 33.10	Kennedy Ditch Diversions	3,355	1,723	2,480	756	30.5%	1631	48.6%
Node 33.12	Diversions d/s of Kennedy Ditch	230	230	169	-61	-36.0%	0	0.0%
Node 33.14	Diversions u/s of North Fk Crazy Woman Cr, Muddy Cr, & Billy Cr Junctic	183	183	135	-49	-36.0%	0	0.0%
Node 34.02	Muddy Creek Headwaters	0	0	0	0	0.0%	0	0.0%
Node 34.06	Diversions u/s of Return Flows from Thompson & Matthews Ditch	393	393	289	-104	-36.0%	0	0.0%
Node 34.08	Diversions d/s of Return Flows from Thompson & Matthews Ditch	160	160	118	-42	-35.3%	0	0.0%
Node 34.10	Thompson Brothers Ditch Diversions	565	565	418	-147	-35.3%	0	0.0%
Node 34.12	PX Ditch Diversions	1,723	1,255	1,274	19	1.5%	468	27.2%
Node 35.02	Billy Creek Headwaters	0	0	0	0	0.0%	0	0.0%
Node 35.06	Diversions in O'Malley Draw	710	699	525	-175	-33.3%	11	1.6%
Node 35.08	Diversions at Mouth of Billy Creek	466	338	345	7	1.9%	128	27.5%
Node 36.02	Junction of North Fork Crazy Woman Creek, Muddy Creek, & Billy Creek	0	0	0	0	0.0%	0	0.0%
Node 37.02	Middle Fork Crazy Woman Creek Near Greub (06315500)	0	0	0	0	0.0%	0	0.0%
Node 37.04	Diversions u/s of Moreton Ditch	706	706	521	-185	-35.4%	0	0.0%
Node 37.06	Moreton Ditch Diversions	779	779	576	-203	-35.3%	0	0.0%
Node 37.08	Teddy Miller Ditch Diversions	2,312	2,312	1,709	-603	-35.3%	0	0.0%
Node 37.10	Diversions d/s of Teddy Miller Ditch	3,161	2,933	2,331	-602	-25.8%	227	7.2%
Node 37.12	Devoe #1 Ditch Diversions	2,441	2,069	1,804	-264	-14.6%	372	15.3%
Node 38.02	Junction of North Fork & Middle Fork Crazy Woman Creek	0	0	0	0	0.0%	0	0.0%
Node 38.04	Mitchell & Long Ditch Diversions to irrigated lands	1,497	1,497	1,107	-390	-35.3%	0	0.0%
Node 38.10	John R Smith Ditch Diversions	5,153	3,921	3,809	-111	-2.9%	1233	23.9%
Node 40.02	Junction of Crazy Woman Creek & South Fk Crazy Woman Creek	0	0	0	0	0.0%	0	0.0%
Node 40.04	Return Flows u/s of Trabing Bridge	0	0	0	0	0.0%	0	0.0%
Node 41.02	Crazy Woman Creek at Trabing Bridge Near Arvada (SEO gage)	0	0	0	0	0.0%	0	0.0%
Node 41.04	Diversions d/s of Trabing Bridge	1,436	1,436	816	-620	-76.0%	0	0.0%
Node 41.06	Return Flows u/s of Upper Station	0	0	0	0	0.0%	0	0.0%
Node 42.02	Crazy Woman Creek at Upper Station Near Arvada (06316400)	0	0	0	0	0.0%	0	0.0%

Figure 10: Diversion Comparison Table

Shortage is defined as the difference between Full Supply Diversions and Model Simulated Diversions. The Calibration Difference is the term used to determine how close the model simulates historical diversions. As the model does not explicitly take into account water right priorities and other legal constraints nor does it explicitly associate supplemental reservoir releases to the appropriate diversions, values within 35 percent are considered reasonable. Calibration values greater than 35 percent are primarily due to lack of information concerning irrigation practices (efficiencies, return lags, and historical diversion records) for those lands served by spreader dikes and intermittent diversions on ephemeral streams and in some cases also reflect inadequate surface water hydrology data.

3.9.1.1.8 Programmers' Notes

Programmers' notes are provided in Appendix A.

3.9.1.2 Calibration Summary

The Basin Gain/Loss Charts along with the "Comparison of Model Simulated Diversions vs. Full Supply Diversions (Shortage) and vs. Estimated Actual Diversions (Calibration Difference)" tables provide the basis for assessing how well calibrated the model is.

3.9.1.2.1 Water Short Areas

HKM reviewed the results of the water availability modeling runs to make a determination of where water shortages occur under existing conditions. The results of the modeling were further reviewed by identifying those ditches that have experienced relatively low diversions historically in comparison to other ditches. As a further crosscheck, the initial determinations of water short areas were reviewed with the SEO Division 2 Superintendent for reasonableness. It is recognized that almost every area of the planning area can be considered water short during severe dry years such as were experienced during the summer of 2001. The purpose of this investigation is to identify those areas that experience relatively high shortages in comparison to other areas in the Basin. The areas listed in Table 2 were identified as being water short in a typical year.

Table 2
Water Short Areas During Normal Hydrologic Conditions

River Basin	Stream
Clear Creek	Little Piney Cr. Rock Cr. Johnson Cr. French Cr. Clear Cr.

3.9.1.2.2 Available Flow

The basin model is divided into a number of reaches, each composed of several nodes, or water balance points. Reaches are typically defined by gages or confluences, and represent tributary basins or subsections of the mainstem. A Reach Outflow worksheet is provided in the model summarizing the monthly flow at the downstream end of each reach. The information provided in these summaries is the basis for this analysis.

While simulated flow at the reach terminus indicates the estimated amount of water physically present, it does not fully reflect availability. Downstream demands relying on the water physically available at any given location must first be accounted for. These downstream demands fall into three general categories:

1. Existing irrigation, or municipal diversions
2. Instream flow constraints
3. Compact constraints

3.9.1.2.2.1 Available Flow in Excess of Existing Diversion Demands

To determine how much of the physical supply is actually available in excess of existing demands, “available flow” at each reach terminus is defined as the minimum of the physically available flow at that point, and the “available flow” at all downstream reaches. Thus available flow must be defined first at the most downstream point, with upstream availability calculated in stream order. These calculations are made on a monthly basis, and annual water availability is computed as the sum of monthly values. Note that calculating annual availability in this way yields a different result than applying the same logic to annual flows for each reach. The summation of monthly values is more accurate, reflecting constraints of downstream use on a monthly basis.

3.9.1.2.2.2 Instream Flow Constraints

Instream flow rights exert a demand on the river but do not affect physical supply, because the water is not removed from the stream. Sufficient flow must be bypassed through upstream reaches to satisfy downstream instream flow requirements. The available flow for reaches located upstream from permitted instream flows are determined as the minimum of physical flow at that point, and available flow in excess of existing diversion demands less the instream flow requirement at the downstream reach.

The permitted instream flow rights in the planning area are described in the Environmental Water Use memorandum (HKM, 2002). The instream flow rights are located above the most upstream reach explicitly simulated in the model. The available flow for future development reported herein, therefore, is downstream from most of these instream flow constraints.

The reach by reach results of the monthly available flow determination, accounting for the instream flow constraints, are provided in Table 4, Table 5 and Table 6 for the Clear Creek Basin and for each of the three hydrologic conditions (wet, normal, and dry years). The total annual available flow is summarized in Table 3 for each hydrologic condition.

Table 3
Total Annual Available Flow

	Hydrologic Condition		
Subbasin	Wet Years	Normal Years	Dry Years
Clear Creek	213,000	124,000	80,000

The yield potential of the basin is limited by the dry year conditions. Further, the timing of these available flows does not necessarily match the timing of the demand for this water. Reservoir storage would be required to store this excess flow to satisfy demands throughout the year. The available flow

Table 4
Available Flow for Clear Creek Basin (Acre-Feet)
Wet Year Hydrologic Conditions

Reach	Reach Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	North Piney Creek	225	215	333	1,155	10,872	16,085	2,167	415	182	556	400	255	32,862
2	South Piney Creek	779	712	947	1,393	6,134	20,952	8,806	2,959	1,158	1,702	1,158	889	47,589
3	Piney Creek below North & South Piney Creeks	1,004	927	1,280	2,549	17,006	37,038	10,973	3,374	1,340	2,259	1,558	1,144	80,451
4	Piney Creek below USGS gage 06323000	1,004	927	1,280	2,549	17,006	37,038	10,973	3,374	1,762	2,259	1,558	1,144	80,873
5	Piney Creek below Lake DeSmet Intake Tunnel	1,655	1,142	2,336	3,204	17,006	37,038	12,311	4,386	1,852	2,655	2,529	1,150	87,264
6	Little Piney Creek above SEO gage	642	833	1,030	904	1,426	2,311	1,336	722	707	925	830	582	12,246
7	Little Piney Creek above Piney Creek	1,058	960	1,786	904	1,426	2,311	1,434	939	743	1,087	1,346	585	14,578
8	Piney Creek below Little Piney Creek	2,712	2,191	4,172	4,108	18,431	39,348	13,745	5,325	2,595	3,742	4,072	1,736	102,179
10	Piney Creek below Box Elder Creek	2,712	2,221	4,190	4,203	18,431	39,348	13,745	5,325	2,595	3,742	4,072	1,736	102,322
11	Piney Creek above Clear Creek	2,712	3,224	5,689	5,198	18,431	39,348	13,745	5,325	2,595	3,742	4,072	1,736	105,819
12	Rock Creek	524	815	1,408	1,274	8,173	12,220	2,799	769	615	1,008	863	330	30,798
13	Johnson Creek	48	50	83	38	326	456	0	0	0	122	134	45	1,304
14	Rock Creek below Johnson Creek	573	865	1,491	1,451	9,102	12,676	2,799	769	615	1,130	997	376	32,844
15	Rock Creek above Clear Creek	573	865	1,491	1,451	9,102	12,676	2,799	769	615	1,130	997	376	32,844
16	French Creek	73	53	57	55	1,135	1,981	1,672	182	0	118	141	55	5,523
17	Clear Creek above City of Buffalo	1,046	1,423	1,982	2,929	15,386	21,221	8,254	1,672	1,168	2,226	1,945	756	60,007
18	Clear Creek above French Creek	1,046	1,423	1,982	2,929	15,449	21,221	8,254	1,672	1,168	2,226	1,945	756	60,070
19	Clear Creek above Rock Creek	1,119	1,476	2,039	2,984	16,584	23,202	9,926	1,854	1,398	2,344	2,086	811	65,823
20	Clear Creek below Rock Creek	1,691	2,341	3,530	4,435	25,686	35,878	12,725	2,624	2,014	3,474	3,084	1,186	98,668
21	Clear Creek above Healy Reservoir	1,691	2,658	3,530	4,435	25,686	35,878	12,725	2,624	2,014	4,444	3,084	1,186	99,955
23	Clear Creek above Piney Creek	1,691	3,911	4,824	5,374	25,686	35,878	12,725	2,624	2,014	4,444	3,128	1,186	103,486
24	Clear Creek above Double Crossing	4,404	7,135	10,514	10,678	44,118	75,227	26,470	7,949	4,609	8,186	7,200	2,922	209,410
25	Clear Creek below Double Crossing	4,404	7,135	10,514	10,929	44,118	75,227	26,470	7,949	4,609	8,186	7,200	2,922	209,661
26	Clear Creek above USGS gage 06324000	4,404	7,135	10,514	10,929	44,118	75,227	26,470	7,949	4,609	8,186	7,200	2,922	209,661
27	Clear Creek above Powder River	4,440	7,568	11,728	10,929	44,118	75,227	27,431	8,047	4,609	8,186	7,345	2,922	212,547
28	Powder River above Clear Creek	7,589	11,731	30,400	20,315	102,759	87,040	26,344	8,276	4,655	16,458	11,810	6,250	333,625
29	Powder River above State Line	12,118	19,360	42,163	31,243	146,877	162,267	53,775	16,330	9,263	24,643	19,325	9,172	546,537

Table 5
Available Flow for Clear Creek Basin (Acre-Feet)
Normal Year Hydrologic Conditions

Reach	Reach Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	North Piney Creek	171	173	282	891	5,910	5,342	714	217	197	427	316	188	14,829
2	South Piney Creek	472	422	578	788	3,263	10,730	3,104	1,680	1,235	1,036	741	525	24,574
3	Piney Creek below North & South Piney Creeks	642	595	861	1,678	9,173	16,073	3,818	1,897	1,432	1,463	1,057	713	39,403
4	Piney Creek below USGS gage 06323000	642	595	861	1,678	9,173	16,073	3,818	2,047	1,432	1,463	1,057	713	39,552
5	Piney Creek below Lake DeSmet Intake Tunnel	914	656	1,389	2,465	9,915	16,073	3,818	2,631	1,858	1,463	1,668	1,036	43,887
6	Little Piney Creek above SEO gage	549	707	950	954	904	828	652	584	718	744	722	580	8,892
7	Little Piney Creek above Piney Creek	781	781	1,533	1,339	904	828	652	750	931	744	1,139	842	11,224
8	Piney Creek below Little Piney Creek	1,823	1,524	2,971	3,804	10,819	16,901	4,470	3,504	3,595	3,045	3,091	2,080	57,629
10	Piney Creek below Box Elder Creek	1,851	1,543	2,979	3,926	10,819	16,901	4,470	3,504	3,595	3,045	3,150	2,126	57,910
11	Piney Creek above Clear Creek	2,483	2,956	5,419	4,932	10,819	16,901	4,470	3,504	3,595	3,823	4,018	2,659	65,579
12	Rock Creek	283	441	1,061	766	3,283	4,820	954	479	439	545	417	297	13,787
13	Johnson Creek	28	32	62	0	0	0	0	0	0	86	74	42	324
14	Rock Creek below Johnson Creek	311	474	1,123	1,203	3,283	4,820	954	479	514	631	491	339	14,623
15	Rock Creek above Clear Creek	311	474	1,123	1,203	3,283	4,820	954	479	514	631	491	339	14,623
16	French Creek	63	45	49	67	552	1,022	619	0	0	170	125	94	2,805
17	Clear Creek above City of Buffalo	457	526	1,090	2,159	6,836	11,079	3,063	1,339	1,501	1,115	757	563	30,483
18	Clear Creek above French Creek	457	526	1,090	2,261	6,836	11,079	3,063	1,339	1,501	1,115	757	563	30,586
19	Clear Creek above Rock Creek	520	571	1,138	2,329	7,388	12,101	3,682	1,339	1,614	1,285	882	656	33,504
20	Clear Creek below Rock Creek	831	1,044	2,262	3,532	10,670	16,921	4,636	1,818	2,127	1,916	1,373	996	48,127
21	Clear Creek above Healy Reservoir	831	1,044	2,262	3,532	10,670	16,921	4,636	1,818	2,127	1,916	1,373	996	48,127
23	Clear Creek above Piney Creek	1,197	2,062	4,148	4,253	10,670	16,921	4,636	1,818	2,127	2,638	1,933	1,364	53,768
24	Clear Creek above Double Crossing	3,680	5,128	9,624	9,332	21,489	33,822	9,106	5,322	5,723	6,461	5,951	4,023	119,660
25	Clear Creek below Double Crossing	3,680	5,673	9,946	9,798	21,489	33,822	9,106	5,322	5,723	6,461	5,951	4,023	120,994
26	Clear Creek above USGS gage 06324000	3,680	5,852	10,041	9,798	21,489	33,822	9,106	5,322	6,083	6,461	5,951	4,023	121,630
27	Clear Creek above Powder River	3,734	6,701	10,850	9,798	21,489	33,822	9,635	5,322	6,083	6,523	5,951	4,023	123,932
28	Powder River above Clear Creek	6,519	13,902	25,996	22,124	40,971	37,368	14,105	6,557	6,452	9,968	9,003	6,715	199,680
29	Powder River above State Line	10,319	20,648	36,869	31,922	62,461	71,190	23,837	11,879	12,535	16,672	14,954	10,739	324,023

Table 6
Available Flow for Clear Creek Basin (Acre-Feet)
Dry Year Hydrologic Conditions

Reach	Reach Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	North Piney Creek	102	96	127	1,422	3,684	1,116	263	77	61	294	179	116	7,536
2	South Piney Creek	284	260	331	758	2,029	4,195	1,770	707	436	680	373	306	12,129
3	Piney Creek below North & South Piney Creeks	387	356	458	2,180	5,713	5,311	2,033	784	497	974	552	422	19,666
4	Piney Creek below USGS gage 06323000	387	356	458	2,180	5,713	5,311	2,871	1,073	1,094	974	552	422	21,391
5	Piney Creek below Lake DeSmet Intake Tunnel	1,168	464	548	2,517	5,713	5,311	3,138	1,668	1,621	974	1,305	1,262	25,688
6	Little Piney Creek above SEO gage	627	589	941	809	263	534	660	538	586	766	760	636	7,708
7	Little Piney Creek above Piney Creek	1,894	768	1,128	934	263	534	721	836	868	766	1,799	1,901	12,411
8	Piney Creek below Little Piney Creek	3,181	1,307	1,717	3,451	5,976	5,845	3,859	3,013	2,522	3,235	3,416	3,176	40,699
10	Piney Creek below Box Elder Creek	3,181	1,307	1,717	3,657	5,976	5,845	3,859	3,013	2,522	3,235	3,416	3,176	40,905
11	Piney Creek above Clear Creek	3,670	1,828	2,931	3,810	5,976	5,845	3,859	3,013	2,522	4,247	4,579	3,176	45,456
12	Rock Creek	315	485	904	173	2,269	617	0	0	0	409	379	342	5,890
13	Johnson Creek	28	30	47	0	0	0	0	0	0	59	60	39	263
14	Rock Creek below Johnson Creek	343	515	951	905	2,269	617	146	97	111	467	439	381	7,241
15	Rock Creek above Clear Creek	343	515	951	905	2,269	617	146	97	111	467	439	381	7,241
16	French Creek	66	47	44	0	410	161	240	0	0	180	138	90	1,376
17	Clear Creek above City of Buffalo	643	919	1,106	2,403	4,118	2,681	530	339	322	1,000	871	776	15,707
18	Clear Creek above French Creek	643	919	1,106	2,403	4,118	2,681	530	339	322	1,000	871	776	15,707
19	Clear Creek above Rock Creek	709	966	1,150	2,403	4,528	2,841	769	339	322	1,180	1,009	867	17,082
20	Clear Creek below Rock Creek	1,052	1,480	2,101	3,308	6,797	3,458	915	436	433	1,647	1,448	1,248	24,323
21	Clear Creek above Healy Reservoir	1,052	1,480	2,101	3,308	6,797	3,458	915	436	433	1,647	1,448	1,248	24,323
23	Clear Creek above Piney Creek	1,294	2,120	3,625	3,308	6,797	3,458	915	436	433	2,440	2,165	1,287	28,278
24	Clear Creek above Double Crossing	4,964	3,949	6,584	7,413	12,773	9,303	4,774	3,449	2,955	6,687	6,744	4,462	74,056
25	Clear Creek below Double Crossing	4,964	3,949	8,902	8,139	12,773	9,303	4,774	3,449	2,955	6,687	6,744	4,462	77,102
26	Clear Creek above USGS gage 06324000	4,964	3,949	8,956	8,554	12,773	9,400	4,774	3,449	3,482	6,687	6,744	4,462	78,194
27	Clear Creek above Powder River	4,964	3,949	9,016	8,554	12,773	10,282	4,774	3,698	3,482	7,125	7,038	4,462	80,118
28	Powder River above Clear Creek	6,602	9,561	18,787	13,486	20,647	10,304	5,594	3,013	2,122	8,145	8,998	5,803	113,062
29	Powder River above State Line	11,567	13,510	27,822	22,040	33,420	20,735	10,368	6,822	5,603	15,447	16,172	10,265	193,770

presented in Figure 3 does not include the constraints of the Yellowstone River Compact. This will be discussed in the next section.

3.9.1.2.2.3 Compact Constraints

A determination of the amount of water available to Wyoming for future development is not complete without an evaluation of the constraints imposed by interstate compacts. The Yellowstone River Compact of 1950 governs the allocation of the waters in the Powder River and Tongue River between the States of Montana and Wyoming.

The following is a brief summary of the rules for dividing the waters according to the Yellowstone River Compact (SEO, 1982):

1. *existing rights as of January 1, 1950 maintain their status quo;*
2. *no water may be diverted from the Yellowstone River Basin for use in another River Basin without consent from all states;*
3. *existing and future domestic and stock water uses including stock water reservoirs up to a capacity of 20 acre-feet are exempted from provisions of the Compact.*

> *The unappropriated or unused total divertible flow of each tributary after needs for supplemental supply for existing rights are met, is allocated to Wyoming and Montana on a percentage basis*
>
> *Nothing contained in the Compact is to be construed to adversely affect any rights to the use of the waters of the Yellowstone River by or for Indians, Indian tribes, and their reservations.*

Additional discussion of the Compact is provided in the Legal and Institutional Constraints memorandum (Lord Consulting, 2002).

The methodology used in the current study to evaluate water availability under the Yellowstone River Compact was coordinated through the Wyoming State Engineers Office and relies heavily on previous work performed by others on behalf of each of the two States (Tavelli, October 2001). A more detailed, “from the ground up” evaluation is beyond the scope of the current planning effort. The methodology employed provides estimates of Wyoming’s allocation under each of the three hydrologic conditions (wet, normal, and dry years).

3.9.1.2.2.4 Powder River

The allocable flows of the Powder River drainage are to be divided between the two States in accordance with the following percentages per the Yellowstone River Compact:

Wyoming	42%
Montana	58%

Wyoming's allocation of the Powder River is based on the estimate reported in the previous water plan as directed by the SEO (Tavelli, October 2001). This estimate has, however, been adjusted to reflect the current study period. The water availability presented in the 1972 water plan was based on the 21-year study period of 1948 through 1968; whereas, the current study utilizes the 30-year period 1970 through 1999. The average annual flow of the Powder River near Locate for the 1948 – 1968 study period is 377,100. The corresponding average for the 1970 – 1999 study period is 424,400. Wyoming's average annual unused and unappropriated portion of the Powder River estimated through the earlier study is 120,700 acre-feet. This value is adjusted upwards by 12.5% to 135,800 to reflect the somewhat wetter average annual flow during the current study period. Wyoming's allocation of the available flows of the Powder River is summarized in Table 7 for each of the three hydrologic conditions. The derivation of these estimates is described on Table 8.

Table 7
Wyoming's Remaining Allocation of Available Flow
Per Yellowstone River Compact

Hydrologic Condition	Powder River Basin
Wet Years	211,500 AF
Normal Years	131,100 AF
Dry Years	74,300 AF

Table 8
Derivation of Wyoming Share of Powder River Flow Per Yellowstone Compact

Water Year	Published Measured Annual Flow at Gage 06326500 Powder R. nr. Locate, MT [1]	Proportioned Annual Wyoming Share of Unused and Unappropriated Flow in AF [3]
1970	406,200	129,986
1971	647,600	207,234
1972	720,800	230,659
1973	458,500	146,722
1974	336,800	107,777
1975	586,600	187,714
1976	414,500	132,642
1977	295,600	94,593
1978	1,078,000	344,964
1979	323,800	103,617
1980	199,800	63,937
1981	268,000	85,761
1982	317,600	101,633
1983	390,300	124,897
1984	484,300	154,978
1985	205,400	65,729
1986	356,600	114,113
1987	404,000	129,282
1988	174,200	55,745
1989	130,400	41,728
1990	244,600	78,273
1991	321,200	102,785
1992	246,300	78,817
1993	544,100	174,114
1994	414,500	132,642
1995	651,000	208,322
1996	506,100	161,954
1997	569,900	182,370
1998	438,700	140,386
1999	595,700	190,626
1970-99 Avg.	424,370	135,800 [2]
Wet Year Avg	660,917	211,496
Dry Year Avg.	232,050	74,257
Normal Year Avg.	409,628	131,082

Notes:

(1) USGS gage 06326500 is the Compact measuring point for determining Powder River allocable flow, per Wyoming Water Planning Report #10, April, 1972.

(2) Based on 120,700 AF (average annual Wyoming share of unused and unappropriated flow of the Powder River for 1948-68 study period) from Water Planning Report #10, April,1972, and adjusted to 1970-99 study period (135,800 = 120,700 *(424,370 / 377,124).

(3) Annual Wyoming share calculated as (135,800 AF/1970-99 Avg.Measured Flow) x (Annual Measured Flow).

(4) The wet, dry and normal year averages are based on the following years selected from hydrological analyses in the Surface Water Hydrology Memorandum:
Wet--1975,1978,1984,1995,1997,1999
Dry--1980,1981,1985,1988,1989,1994
Normal--All other years between 1970-1999

3.9.1.2.3 Spreadsheet Model Update

Study Period

A study period of 1970-1999 was used in the 2002 Powder/Tongue River Basin Plan. Additional data for the period 2000-2009 is now available. Selection of the study period was revisited to determine how the additional data would affect the results presented in the Basin Plan.

Three gages were used in the Basin Plan to determine the study period:
- USGS 06311000 North Fork Powder River near Hazelton, Wyoming
- USGS 06298000 Tongue River near Dayton, Wyoming
- USGS 06289000 Little Bighorn River at State Line near Wyola, Montana

The North Fork Powder River near Hazelton, Wyoming and Tongue River near Dayton, Wyoming represent the hydrologic conditions of the Powder River and Tongue River basins, respectively. A comparison of average annual flows at these gages for the periods 1970-1999 and 1970-2009 is provided in Table 9.

Table 9
Average Annual Flows

	Tongue River near Dayton	North Fork Powder River near Hazelton
Average Annual 1970-1999	**133,175 AF**	**11,511 AF**
Average Annual 1970-2009	**126,319 AF**	**10,896 AF**
Average Annual Percent Change	**-5%**	**-5%**

The average annual flows for both watersheds reduced by only 5% which is within the accuracy of the measurements. However, several significant dry years occurred during the years 2000-2009 which could have a more significant impact on water availability.

The study period was extended to include the years 2000-2009. Consistent with the 2002 Basin Plan, typical wet, dry, and normal years were established for the extended study period.

Selection of Wet, Dry, and Normal Years

Selection of wet, dry, and normal years was made for three separate areas in the 2002 basin plan:
- Tongue and Powder Rivers

- Little Bighorn River
- Little Powder River

For the Tongue and Powder River, the following gages were used in determining the wet, dry and normal years:

- USGS 06298000 Tongue River near Dayton, Wyoming
- USGS 06300500 East Fork Big Goose Creek near Big Horn, Wyoming
- USGS 06309200 Middle Fork Powder River near Barnum, Wyoming
- USGS 06309460 Beaver Creek above White Panther Ditch, near Barnum, Wyoming
- USGS 06311000 North Fork Powder River near Hazelton, Wyoming
- USGS 06314000 North Fork Crazy Woman Creek near Buffalo, Wyoming
- USGS 06321500 North Piney Creek near Story, Wyoming

The annual flows for these gages were ranked using the Weibull Plotting Position for the original study period (1970-1999). With 30 annual flows for each of these gages, six (6) values fell within the top 20% by plotting position and six (6) fell within the lower 20% by plotting position.

For each of the seven stations, six "dry" years were chosen which placed as many years as possible in the lowest 20% for each gage individually. The same process was followed for "wet" years.

Of the seven gages, the gages originally selected as representative of the hydrologic conditions for the two basins (North Fork Powder River near Hazelton, Wyoming and Tongue River near Dayton, Wyoming) were reevaluated in this current study to update the "dry" year which is the basis for determining available flow. See Tables 10, 11, and 12.

Table 10
Affect of Adding Years 2000-2009 on Representative Dry Year

	Tongue River near Dayton	**North Fork Powder River near Hazelton**
Lowest 20% Years 1970-1999	**1979, 1980, 1985, 1987, 1989, 1994**	**1974, 1980, 1981, 1985, 1988, 1994**
Lowest 20% Average Annual 1970-1999	**95,869 AF**	**7751 AF**
Lowest 20% Years 1970-2009	**1980, 1985, 1987, 1989, 2001, 2002, 2004, 2006**	**1981, 1985, 1988, 2001, 2002, 2004, 2006, 2007**
Lowest 20% Average Annual 1970-2009	**77,153 AF**	**6520 AF**
Lowest 20% Percent Change	**-20%**	**-16%**

Table 11
North Fork Powder River Near Hazelton, WY

1970-1999				1970-2009			
Year	Avg Annual (AF)	Weibull Plotting Position	Dry Year Avg Annual (AF)	Year	Avg Annual (AF)	Weibull Plotting Position	Dry Year Avg Annual (AF)
1985	6974	0.0323		2001	3656	0.0244	
1981	7608	0.0645		2004	5958	0.0488	
1988	7889	0.0968		2007	6226	0.0732	
1980	7931	0.1290		2002	6856	0.0976	
1974	8001	0.1613		1985	6974	0.1220	
1994	8105	0.1935	7751	2006	6994	0.1463	
1989	8693	0.2258		1981	7608	0.1707	
1972	8818	0.2581		1988	7889	0.1951	6520
1977	8882	0.2903		1980	7931	0.2195	
1973	9131	0.3226		1974	8001	0.2439	
1990	9213	0.3548		1994	8105	0.2683	
1987	9735	0.3871		1989	8693	0.2927	
1970	10137	0.4194		1972	8818	0.3171	
1979	10405	0.4516		1977	8882	0.3415	
1986	10860	0.4839		1973	9131	0.3659	
1971	11584	0.5161		1990	9213	0.3902	
1976	12204	0.5484		1987	9735	0.4146	
1998	12443	0.5806		2000	9774	0.4390	
1992	12580	0.6129		1970	10137	0.4634	
1991	12926	0.6452		1979	10405	0.4878	
1983	13118	0.6774		1986	10860	0.5122	
1996	13603	0.7097		2003	11511	0.5366	
1982	13633	0.7419		2005	11511	0.5610	
1993	13847	0.7742		1971	11584	0.5854	
1984	14335	0.8065		1976	12204	0.6098	
1995	15254	0.8387		1998	12443	0.6341	
1997	15384	0.8710		2009	12452	0.6585	
1975	15883	0.9032		1992	12580	0.6829	
1999	17182	0.9355		1991	12926	0.7073	
1978	18963	0.9677		1983	13118	0.7317	
Avg 70-99	11511			1996	13603	0.7561	
				1982	13633	0.7805	
				1993	13847	0.8049	
				1984	14335	0.8293	
				1995	15254	0.8537	
				1997	15384	0.8780	
				2008	15566	0.9024	
				1975	15883	0.9268	
				1999	17182	0.9512	
				1978	18963	0.9756	
				Avg 70-09	10896		

Table 12
Tongue River Near Dayton, WY

1970 - 1999				1970-2009				
Year	Avg Annual (AF)	Weibull Plotting Position	Dry Year Avg Annual (AF)		Year	Avg Annual (AF)	Weibull Plotting Position	Dry Year Avg Annual (AF)
1989	76527	0.0323		1	2004	58976	0.0244	
1985	88393	0.0645		2	2001	64843	0.0488	
1987	91860	0.0968		3	2002	65486	0.0732	
1980	97481	0.1290		4	2006	73655	0.0976	
1979	107713	0.1613		5	1989	76527	0.1220	
1994	113240	0.1935	95869	6	1985	88393	0.1463	
1998	115427	0.2258		7	1987	91860	0.1707	
1982	118780	0.2581		8	1980	97481	0.1951	77153
1988	120159	0.2903		9	2003	99476	0.2195	
1981	122507	0.3226		10	1979	107713	0.2439	
1992	122866	0.3548		11	1994	113240	0.2683	
1993	126667	0.3871		12	2005	114429	0.2927	
1986	129213	0.4194		13	1998	115427	0.3171	
1977	133134	0.4516		14	2000	117674	0.3415	
1991	133469	0.4839		15	1982	118780	0.3659	
1976	134000	0.5161		16	1988	120159	0.3902	
1983	135628	0.5484		17	1981	122507	0.4146	
1971	136242	0.5806		18	1992	122866	0.4390	
1996	136583	0.6129		19	1993	126667	0.4634	
1972	138031	0.6452		20	1986	129213	0.4878	
1990	138184	0.6774		21	1977	133134	0.5122	
1997	144068	0.7097		22	1991	133469	0.5366	
1974	145021	0.7419		23	1976	134000	0.5610	
1999	145292	0.7742		24	1983	135628	0.5854	
1973	149701	0.8065		25	1971	136242	0.6098	
1995	157750	0.8387		26	2009	136534	0.6341	
1984	170772	0.8710		27	1996	136583	0.6585	
1970	170984	0.9032		28	1972	138031	0.6829	
1978	197249	0.9355		29	1990	138184	0.7073	
1975	198294	0.9677	174125	30	1997	144068	0.7317	
Avg 70-99	133175			31	1974	145021	0.7561	
				32	1999	145292	0.7805	
				33	1973	149701	0.8049	
				34	1995	157750	0.8293	
				35	2007	158861	0.8537	
				36	2008	167580	0.8780	
				37	1984	170772	0.9024	
				38	1970	170984	0.9268	
				39	1978	197249	0.9512	
				40	1975	198294	0.9756	171399
					Avg 70-09	126319		

The representative “dry” year monthly flow for each gage used in the 2002 Basin Plan were developed by averaging the monthly flows considered to be "dry" (e.g. lowest 20%). Using the annual dry year average at the Tongue River and North Fork Powder River gages as representative, the “dry” year flows for the 1970-2009 study period are 16 to 20 percent less than "dry" year flows for the 1970-1999 study period.

Available Flow

Available flows in the Tongue and Powder River basins as revised by expanding the study period to 1970-2009 are as shown in Tables 13 and 14.

Table 13
Available Flow for Tongue River ab State Line (Acre-Feet)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1970-1999	8,018	8,497	16,247	19,902	61,280	43,982	10,638	6,433	7,775	14,045	12,138	8,888	217,843
1970-2009	6,414	6,798	12,998	15,922	49,024	35,186	8,510	5,146	6,220	11,236	9,710	7,110	174,274

Table 14
Available Flow for Clear Creek Above Powder River (Acre-Feet)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1970-1999	4,964	3,949	9,016	8,554	12,773	10,282	4,774	3,698	3,482	7,125	7,038	4,462	80,118
1970-2009	4,170	3,317	7,573	7,185	10,729	8,637	4,010	3,106	2,925	5,985	5,912	3,748	67,297

The available flows were further adjusted to reflect the assumed constraints of the Yellowstone River Compact, similar to the 2002 Basin Plan.

Yellowstone River Compact

The 2002 Basin Plan estimated Wyoming's remaining allocation of available flow per the Yellowstone River Compact. A comparison of the results for 1970-1999 from the 2002 Basin Plan and the revised estimates based on the 1970-2009 study period used in the current study are provided in Tables 15, 16 and 17.

Table 15
Wyoming's Remaining Allocation of Available Flow Per Yellowstone River Compact

Period	Hydrologic Condition	Tongue River Basins		Powder River Basin (AF)
		Conservative Estimate (AF)	Liberal Estimate (AF)	
1970-1999	Dry	40,000	67,000	74,300
1970-2009	Dry	16,700	40,300	58,500

Table 16
Derivation of Wyoming Share of Tongue River Flow Per Yellowstone River Compact

Water Year	Measured Ann. Flow in AF at Gage 06308500 Tongue R.at Miles City,MT(1)	Liberal Estimate of Remaining Allocable Flow			Conservative Estimate of Remaining Allocable Flow		
		Adjustments to Measured Flow, AF (2)	Remaining Unappropriated Flow, AF (3)	Wyoming Share=40% in AF (3)	Adjustments to Measured Flow AF (2)	Remaining Unappropriated Flow, AF (3)	Wyoming Share=40% in AF (3)
1970	429,400	18,702	410,698	164,279	85,702	343,698	137,479
1971	532,100	18,702	513,398	205,359	85,702	446,398	178,559
1972	438,500	18,702	419,798	167,919	85,702	352,798	141,119
1973	380,800	18,702	362,098	144,839	85,702	295,098	118,039
1974	312,800	18,702	294,098	117,639	85,702	227,098	90,839
1975	668,700	18,702	649,998	259,999	85,702	582,998	233,199
1976	291,600	18,702	272,898	109,159	85,702	205,898	82,359
1977	278,100	18,702	259,398	103,759	85,702	192,398	76,959
1978	714,000	18,702	695,298	278,119	85,702	628,298	251,319
1979	294,400	18,702	275,698	110,279	85,702	208,698	83,479
1980	193,100	18,702	174,398	69,759	85,702	107,398	42,959
1981	230,200	18,702	211,498	84,599	85,702	144,498	57,799
1982	215,100	18,702	196,398	78,559	85,702	129,398	51,759
1983	299,300	18,702	280,598	112,239	85,702	213,598	85,439
1984	384,500	18,702	365,798	146,319	85,702	298,798	119,519
1985	148,200	18,702	129,498	51,799	85,702	62,498	24,999
1986	302,100	18,702	283,398	113,359	85,702	216,398	86,559
1987	177,200	18,702	158,498	63,399	85,702	91,498	36,599
1988	170,700	18,702	151,998	60,799	85,702	84,998	33,999
1989	119,800	18,702	101,098	40,439	85,702	34,098	13,639
1990	246,600	18,702	227,898	91,159	85,702	160,898	64,359
1991	302,100	18,702	283,398	113,359	85,702	216,398	86,559
1992	215,000	18,702	196,298	78,519	85,702	129,298	51,719
1993	351,100	18,702	332,398	132,959	85,702	265,398	106,159
1994	256,700	18,702	237,998	95,199	85,702	170,998	68,399
1995	407,600	18,702	388,898	155,559	85,702	321,898	128,759
1996	326,500	18,702	307,798	123,119	85,702	240,798	96,319
1997	415,300	18,702	396,598	158,639	85,702	329,598	131,839
1998	212,500	18,702	193,798	77,519	85,702	126,798	50,719
1999	364,100	18,702	345,398	138,159	85,702	278,398	111,359
2000	172,100	18,702	153,398	61,359	85,702	86,398	34,559
2001	103,500	18,702	84,798	33,919	85,702	17,798	7,119
2002	49,200	18,702	30,498	12,199	85,702	0	0
2003	192,700	18,702	173,998	69,599	85,702	106,998	42,799
2004	57,600	18,702	38,898	15,559	85,702	0	0
2005	238,700	18,702	219,998	87,999	85,702	152,998	61,199
2006	106,500	18,702	87,798	35,119	85,702	20,798	8,319
2007	360,100	18,702	341,398	136,559	85,702	274,398	109,759
2008	356,800	18,702	338,098	135,239	85,702	271,098	108,439
2009	292,100	18,702	273,398	109,359	85,702	206,398	82,559
1970-99 Avg	322,603	18,702	299,046	119,619	85,702	236,901	94,761
1970-2009 Avg.	290,185			108,593			82,439
Dry Yr Avg				40,274			16,704

Notes:

(1) USGS Gage 06308500 is the Compact measuring point for determining Tongue River allocable flow, per WWPP Report #10.

(2) Adjustments in AF to be subtracted from measured streamflow are as follows:

Item	Max Case	Min Case	Source of information
Depletions for unused Wyoming supplemental supply for pre-1950 irrigation rights	18702	18702	Letter from Sue Lowry, June 19, 1990
Depletions for N. Cheyenne tribal water rights*		31800	Tongue River Water Allocation
Winter bypass flow at Tongue R. Dam*		23800	Model Program Documentation
Depletions for unused 1924 priority USDA irrigation right near Miles City, MT		1900	by GeoResearch, Inc. for Montana DNRC,July 18,1991**
Depletions for unused Montana supplemental supply on MT tributaries for pre-1950 irrigation rights		9500	(used to develop Water Rights Compact w/N.Cheyenne Tribe)
Total	18702	85702	

* N. Cheyenne Tribal rights and the Tongue R. Dam winter bypass flow are considered to be pre-1950 rights in the Tongue River Water Allocation Model (The State of Wyoming does not necessarily agree w/ this interpretation)

** Values used herein from the GeoResearch report are average annual values.

(3) Remaining unappropriated flow = measured flow at gage -adjustments. Wyoming share of this flow per compact = 40%.

Table 17
Derivation of Wyoming Share of Powder River Flow Per Yellowstone River Compact

Water Year	Published Measured Annual Flow at Gage 06326500 Powder R. nr. Locate, MT [1]	Proportioned Annual Wyoming Share of Unused and Unappropriated Flow in AF [3]
1970	406,200	130,021
1971	647,600	207,290
1972	720,800	230,721
1973	458,500	146,761
1974	336,800	107,806
1975	586,600	187,765
1976	414,500	132,677
1977	295,600	94,619
1978	1,078,000	345,057
1979	323,800	103,645
1980	199,800	63,954
1981	268,000	85,784
1982	317,600	101,661
1983	390,300	124,931
1984	484,300	155,020
1985	205,400	65,747
1986	356,600	114,144
1987	404,000	129,316
1988	174,200	55,760
1989	130,400	41,740
1990	244,600	78,294
1991	321,200	102,813
1992	246,300	78,838
1993	544,100	174,161
1994	414,500	132,677
1995	651,000	208,379
1996	506,100	161,998
1997	569,900	182,419
1998	438,700	140,424
1999	595,700	190,678
2000	231,000	73,941
2001	132,500	42,412
2002	89,000	28,488
2003	199,500	63,858
2004	57,300	18,341
2005	282,600	90,457
2006	189,200	60,561
2007	345,700	110,655
2008	541,700	173,393
2009	396,100	126,788
1970-99 Avg.	424,370	135,800
1970-2009 Avg.	379,893	121,600 [2]
Dry Year Avg.	182,663	58,468

Notes:

(1) USGS gage 06326500 is the Compact measuring point for determining Powder River allocable flow, per Wyoming Water Planning Report #10, April, 1972.

(2) Based on 120,700 AF (average annual Wyoming share of unused and unappropriated flow of the Powder River for 1948-68 study period) from Water Planning Report #10, April,1972, and adjusted to 1970-2009 study period (121,600 = 120,700 *(379,893 / 377,124).

(3) Annual Wyoming share calculated as (121,600 AF/1970-2009 Avg.Measured Flow) x (Annual Measured Flow).

(4) The dry year averages are based on the following years selected from hydrological analyses in the Surface Water Hydrology Memorandum:
Dry--1981, 1985, 1988, 2001, 2002, 2004, 2006 and 2007

Results

The water availability results from the 2002 Powder/Tongue River Basin Plan have been updated as a part of this study to include the years 2000-2009. These additional years include several significant dry years. As a result, the estimates of available flow have been reduced by 16 to 20%. The Basin Plan evaluated the existing level of development which did not include the impacts of operating Lake DeSmet Reservoir at its full potential. Lake DeSmet is currently used on a limited basis. If any significant use of Lake DeSmet storage water occurs (up to 235,000 AF) there would be limited water available in the Clear Creek drainage.

3.9.1.3 MODSIM

3.9.1.3.1 Model

A model of the Clear Creek River basin, concentrating on DeSmet Reservoir, has been prepared by HKM using MODSIM. MODSIM is a river basin management decision support system originally conceived at Colorado State University (Shafer and Labadie, 1978). MODSIM is designed as a computer-aided tool for developing improved basin wide and regional strategies for short-term management, long-term operational planning, drought contingency planning, water rights analysis and resolving conflicts between urban, agricultural, and environmental concerns. MODSIM has many capabilities important for DeSmet Reservoir including analysis of water rights and storage contracts. DeSmet Reservoir receives water from many sources including Piney Creek, Little Piney Creek, Shell Creek, Rock Creek and Clear Creek. Water is stored in 13 different “accounts” within the reservoir. Each of these supply and storage permits has its own priority date.

3.9.1.3.2 Study Period

The natural flow gage “North Fork Powder River near Hazelton, WY” (USGS 06311000) was reviewed to determine if the study period should be updated to reflect recent dry years (Figure 11). This streamflow gage is relatively close to Lake DeSmet and should be representative of the hydrologic conditions. The North Fork Powder River site also has a lengthy record and therefore represents long-term hydrologic conditions. Extended drought periods existed from 1948 to 1961, and again from 2000 to 2007. A study period of 1945-2009 was selected because it contains both critical dry periods and because of the availability of data for this period. Missing data was filled in using regression analysis with the gage “North Fork Powder River near Hazelton”.

3.9.1.3.3 Analysis

A schematic diagram of the MODSIM model is provided in Figure 12. This figure shows each of the supply permits and storage permits and their relative priority dates.

The delivery pattern for each storage contract or release was assumed to be uniform for the twelve-month period for municipal/industrial uses with three exceptions. A release of 10,720 acre-feet per year of agricultural use from June-September is specified from storage permit 973R. An agricultural release of 875 acre-feet per year during the months June-September is specified for the Belus family from storage permit 1300R. An agricultural release of 11,800 acre-feet per year during the months of June-September is also specified for the Lower Clear Creek Irrigation Company from storage permit 7292R.

The firm yield for each individual "account" is determined by applying an assumed pattern of delivery with volume summing to the storage volume for the permit and operating the model. The volume of storage delivery was lowered iteratively until the storage reached approximately zero during the critical dry period. The annual delivery volume at this point represents the firm yield for that "account" or storage permit. The total firm yield of Lake DeSmet is the sum of the firm yields for each of the individual "accounts".

Other assumptions in the modeling include the following. As per the "Engineering Report on the Estimated Water Yield of the Lake DeSmet Project" (Tipton and Kalmbach, December 1980), no reservoir storage is allowed in the months of July-September because senior downstream direct flow rights, and a 10 cubic feet per second instream flow are assumed to require all available flow.

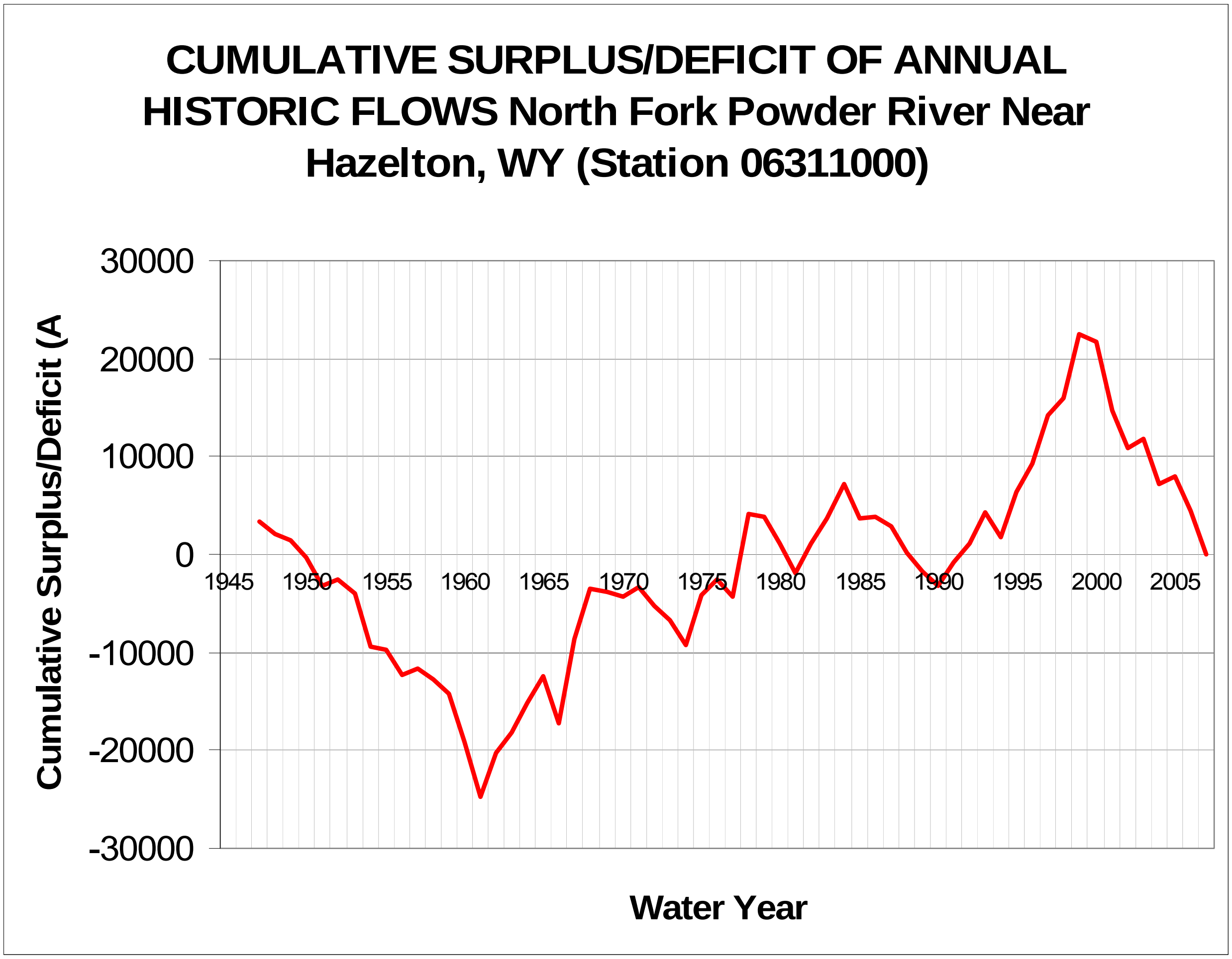


Figure 11: **Cumulative Surplus/Deficit of Annual Historic Flows**

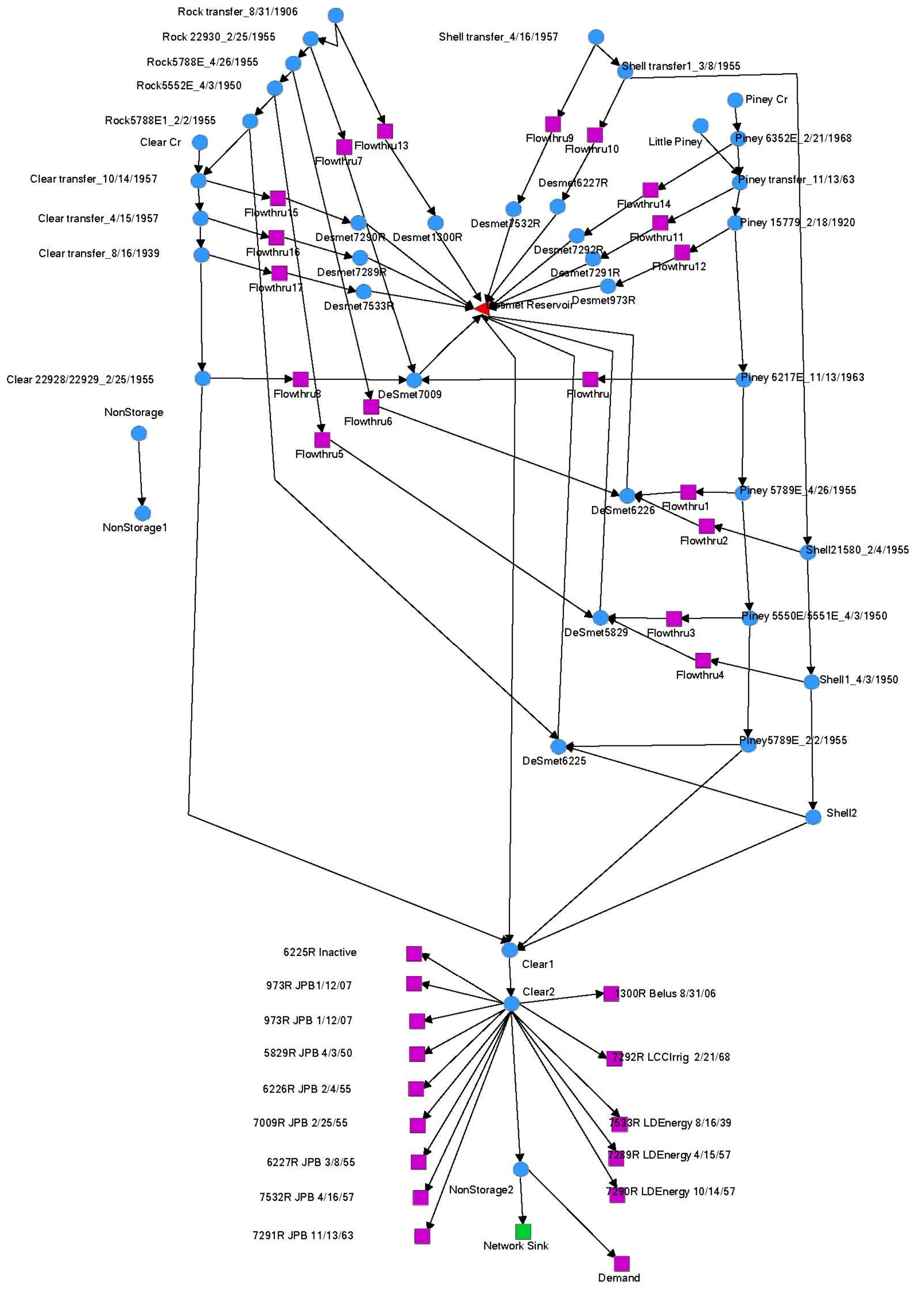


Figure 12: **Modsim Model Schematic**

3.9.1.3.4 Results

Figures 13, 14, 15 and 16 for Lake DeSmet Reservoir illustrate inflow, storage release, evaporation loss, and storage, respectively. These graphs represent the accumulated total for all of the thirteen reservoir accounts. Graphs and tables pertaining to the thirteen individual accounts are provided in Appendix C.

Table 18 provides the firm yield as calculated for each of the individual reservoir "accounts".

Table 18
Lake DeSmet Firm Yield

Owner	Permit	Storage Permit[1/] (Acre-feet)		Firm Yield (Acre-feet)	
Lake DeSmet Counties Coalition JPB	6225R	38,960		Inactive Storage	
	973R	10,720 14,280		8.000 ag 11,300 M&I	
	5829R	30,129		13,700	
	6226R	8,902		2,300	
	7009R	17,738		9,000	
	6227R	1,304		300	
	7532R	740		200	
	7291R	37,340		7,700	
Subtotal			160,113		52,500
Pacificorp	7533R	11,640		7,800	
	7289R	36,834		10,100	
	7290R	13,725		1,500	
Subtotal			62,199		19,400
Belus	1300R	875		800	
Subtotal			875		800
Lower Clear Creek Irrigation District	7292R	11,800		1,500	
Subtotal			11,800		1,500
Total			**234,987**		**74,200**

[1/] Supply permit 7499E dated 6-19-2003 for diversion from Piney Creek by the Counties Coalition is not included in the model. The model indicates there would be no water available for this permit in the critical dry period.

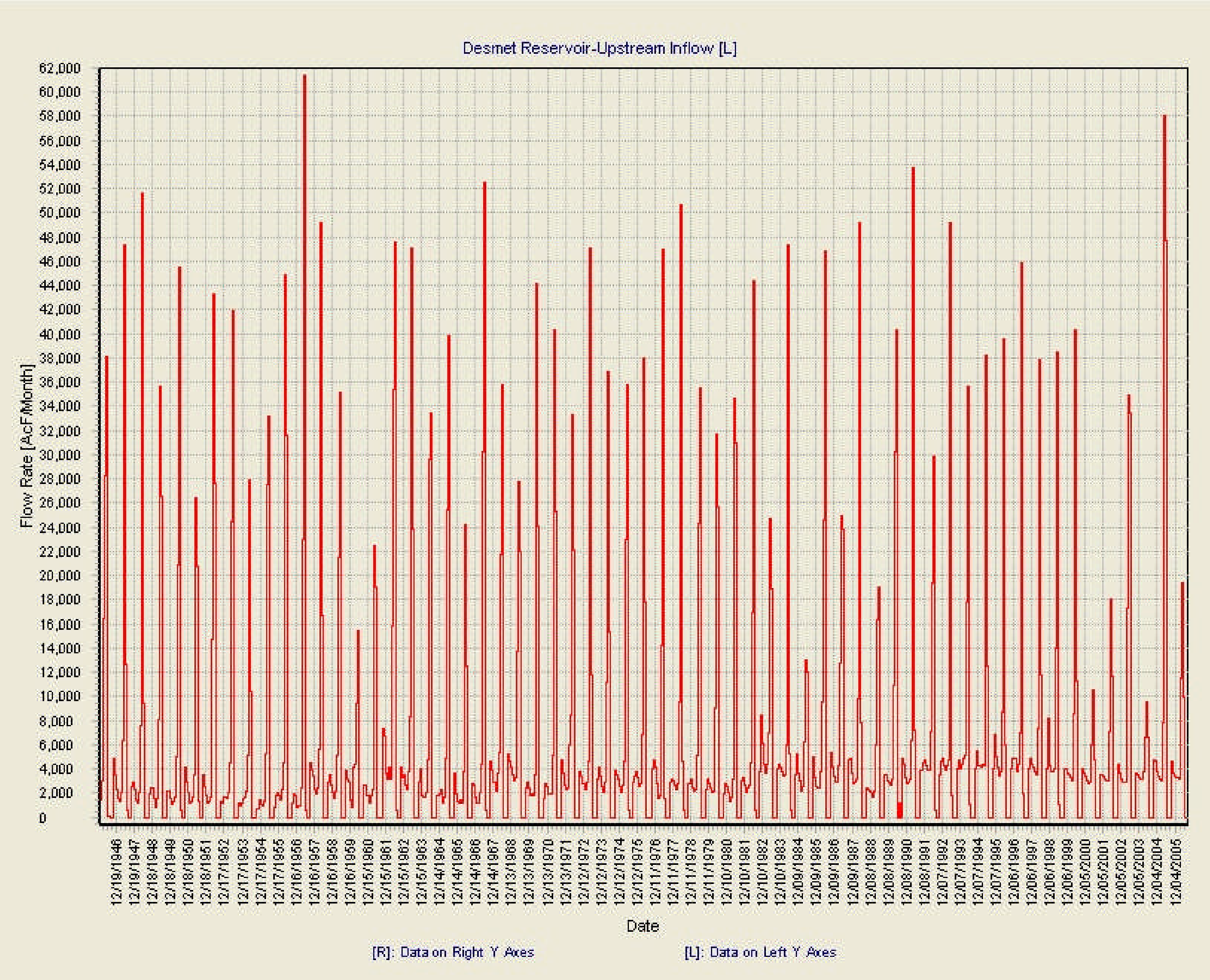


Figure 13: **DeSmet Reservoir – Upstream Inflow [L]**

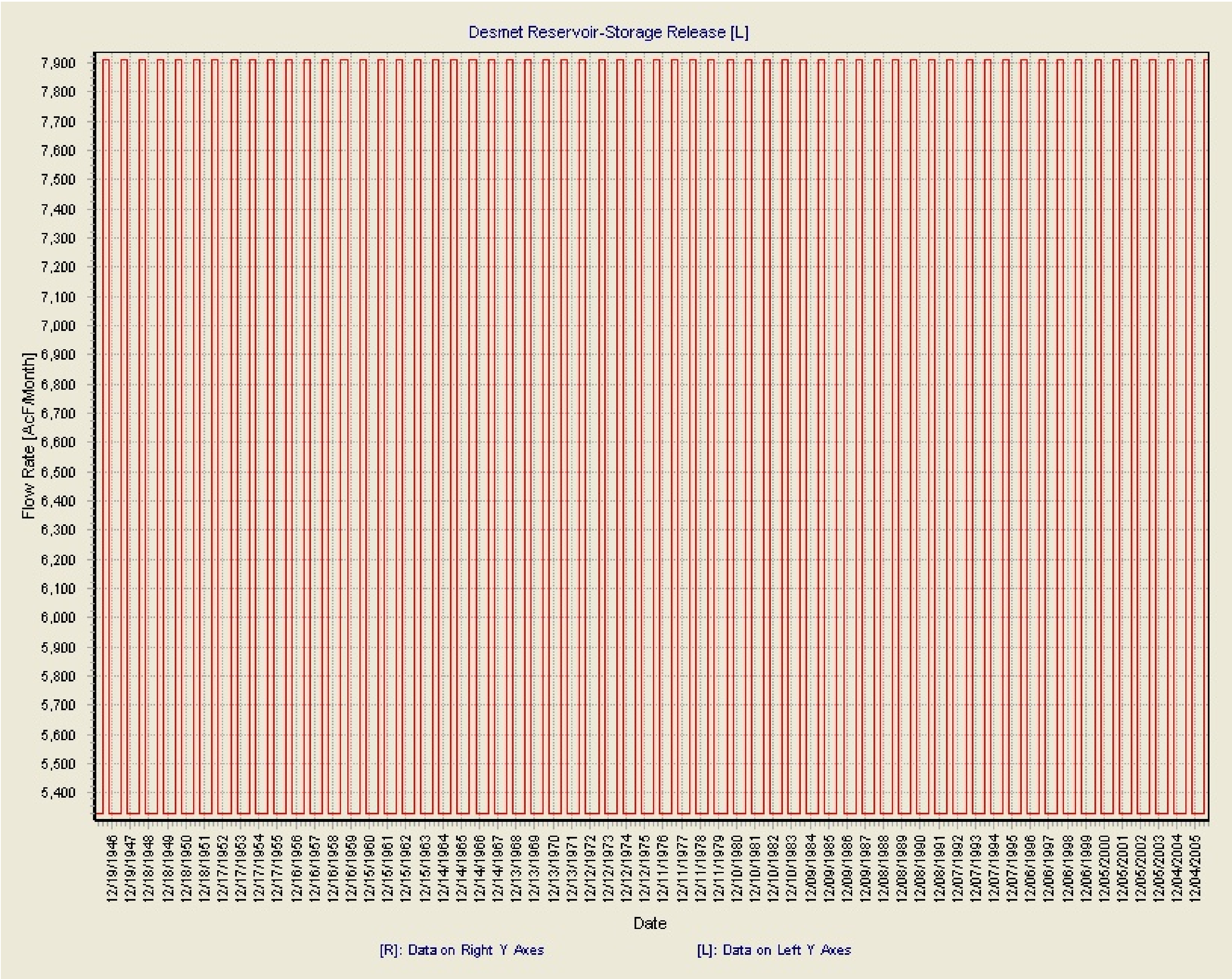


Figure 14: **DeSmet Reservoir - Storage Release [L]**

Figure 15: DeSmet Reservoir – Evaporation Loss [L]

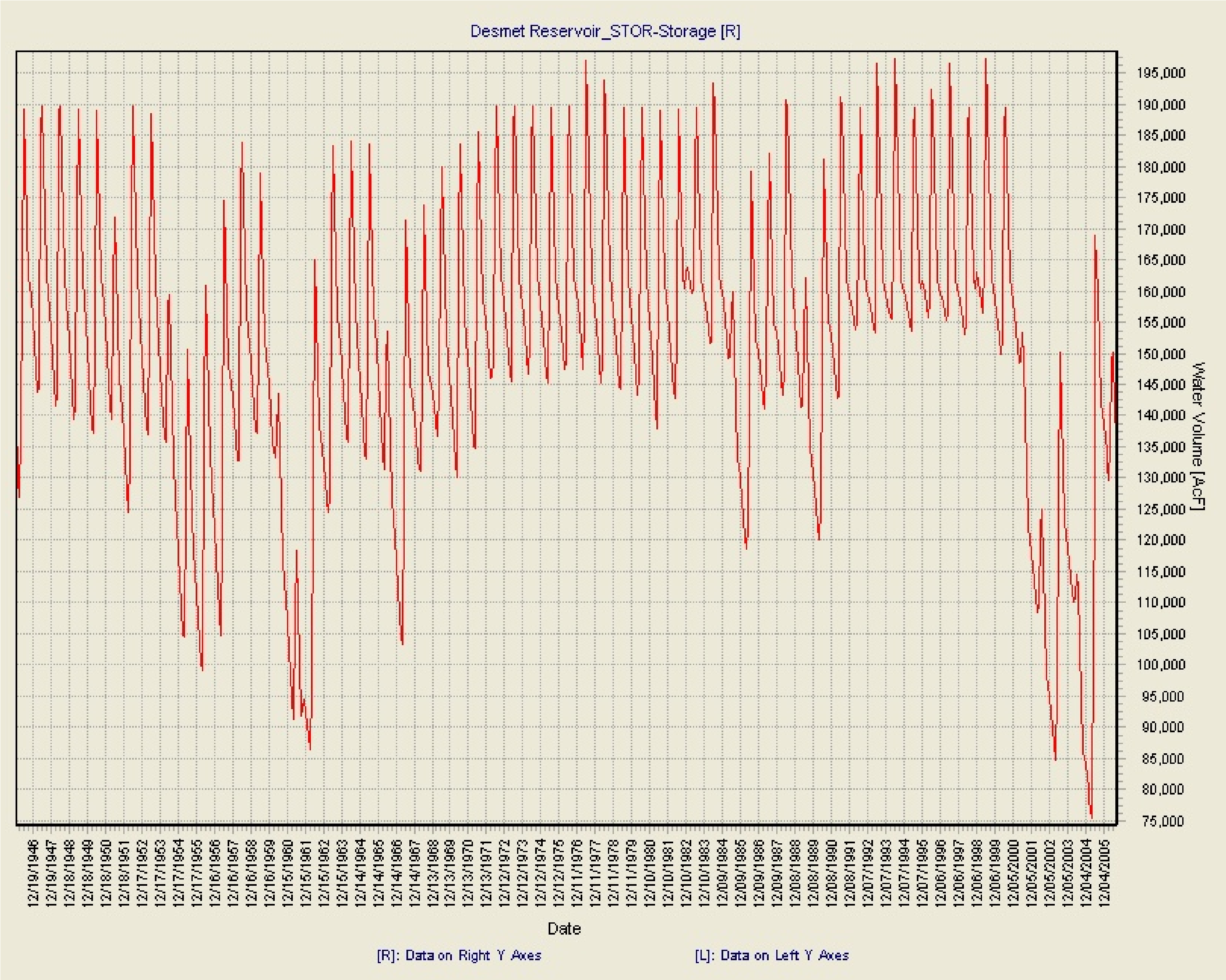


Figure 16: **DeSmet Reservoir STOR – Storage [R]**

In all "accounts", the firm yield is less than the volume of the storage permit. Reasons include the fact that all "accounts" share in evaporation losses and due to water supply constraints from each of the various water sources, a given account does not necessarily have access to all water storable in the reservoir. For example, storage permit 973R has one of the best priority dates (1-12-07), but it is only served by Piney Creek. As a result, the firm yield for this permit is 19,300 AF out of a permit volume of 25,000 AF even though Lake DeSmet in total has a firm yield of 74,200 AF.

The model results were checked to verify that the reported capacities of the Piney Creek tunnel and the Clear Creek delivery system were not violated.

3.9.1.4 Modeling Scenarios

3.9.1.4.1 Clear Creek Off-Channel Storage Alternative

There are issues regarding the Yellowstone River Compact and limited water availability in Lake DeSmet if fully utilized that limit the amount of water available for new projects. Storage permit 7533R owned by the M&M Ranch offers potential benefits to reduce current shortages in the Clear Creek basin. This permit is currently not being used and has a priority date of 8/16/1939 . The Yellowstone River Compact does not place restraints on the development of pre-1950 storage permits. If an agreement can be negotiated with M&M Ranch and approval is obtained from the Wyoming State Engineer's Office, this storage permit could be transferred upstream to supply a new off-stream storage project in the upper Clear Creek basin.

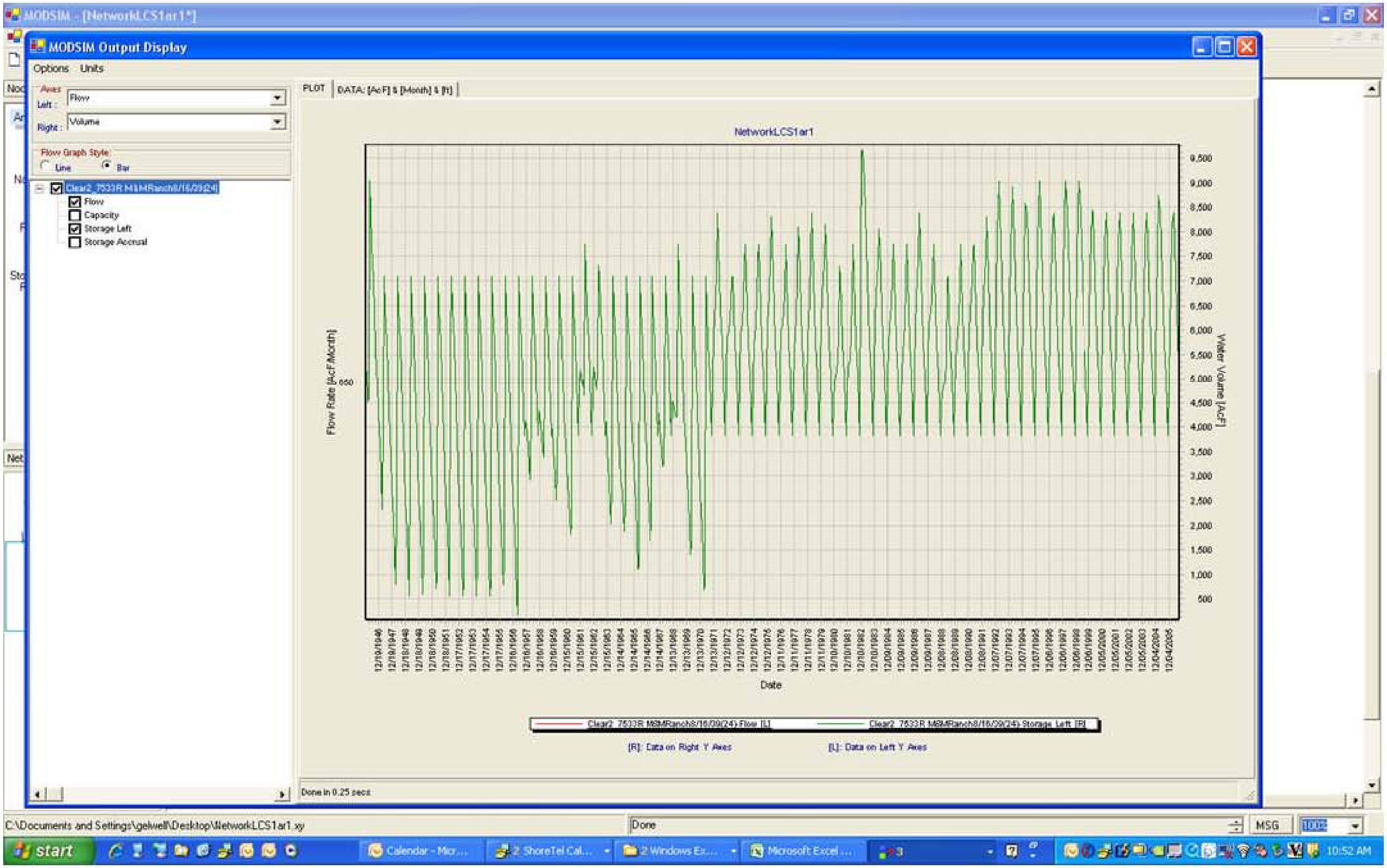
Storage permit 7533R has a volume of 11,640 acre-feet. The yield from this permit is dependent on a number of factors:

- How many of the other storage permits are being used and to what extent
- What the release schedule is
- Whether shortages are acceptable

A number of scenarios have been evaluated using MODSIM. Each of these scenarios are based on the assumptions used in previous MODSIM modeling unless otherwise specified. See Figures 17 through 21.

Alt	Intended Use	Release Schedules	Amount	Allowable Shortages	Annual Yield
1.	Municipal/Industrial	12 equal months	650 AF/month	No	7,800 AF
2.	Municipal/Industrial	12 equal months	750 AF/month	20% years	9,000 AF
3.	Municipal/Industrial	12 equal months	850 AF/month	30% years	10,200 AF
4.	Municipal/Industrial	12 equal months	950 AF/month	33% years	11,400 AF
5.	Supplemental Agriculture	July-September	3800 AF/month	No	11,400 AF
6.	Supplemental Agriculture	July-September	___AF/month	_______	__AF

Figure 17 Alternative 1 Demand 650 AF/month and Reservoir Storage Permit 7533R



MODSIM - [NetworkLCS1ar1*]

MODSIM Output Display

Axes
Left : Flow
Right : Volume

Flow Graph Style: ○ Line ● Bar

☑ Clear2_7533R M&MRanch8/16/29(24)
☑ Flow
☐ Capacity
☑ Storage Left
☐ Storage Accrual

Clear2_7533R M&MRanch8/16/29(24) Flow [L]
Clear2_7533R M&MRanch8/16/29(24) Storage Left [R]

[R]: Data on Right Y Axes
[L]: Data on Left Y Axes

Done in 0.25 secs

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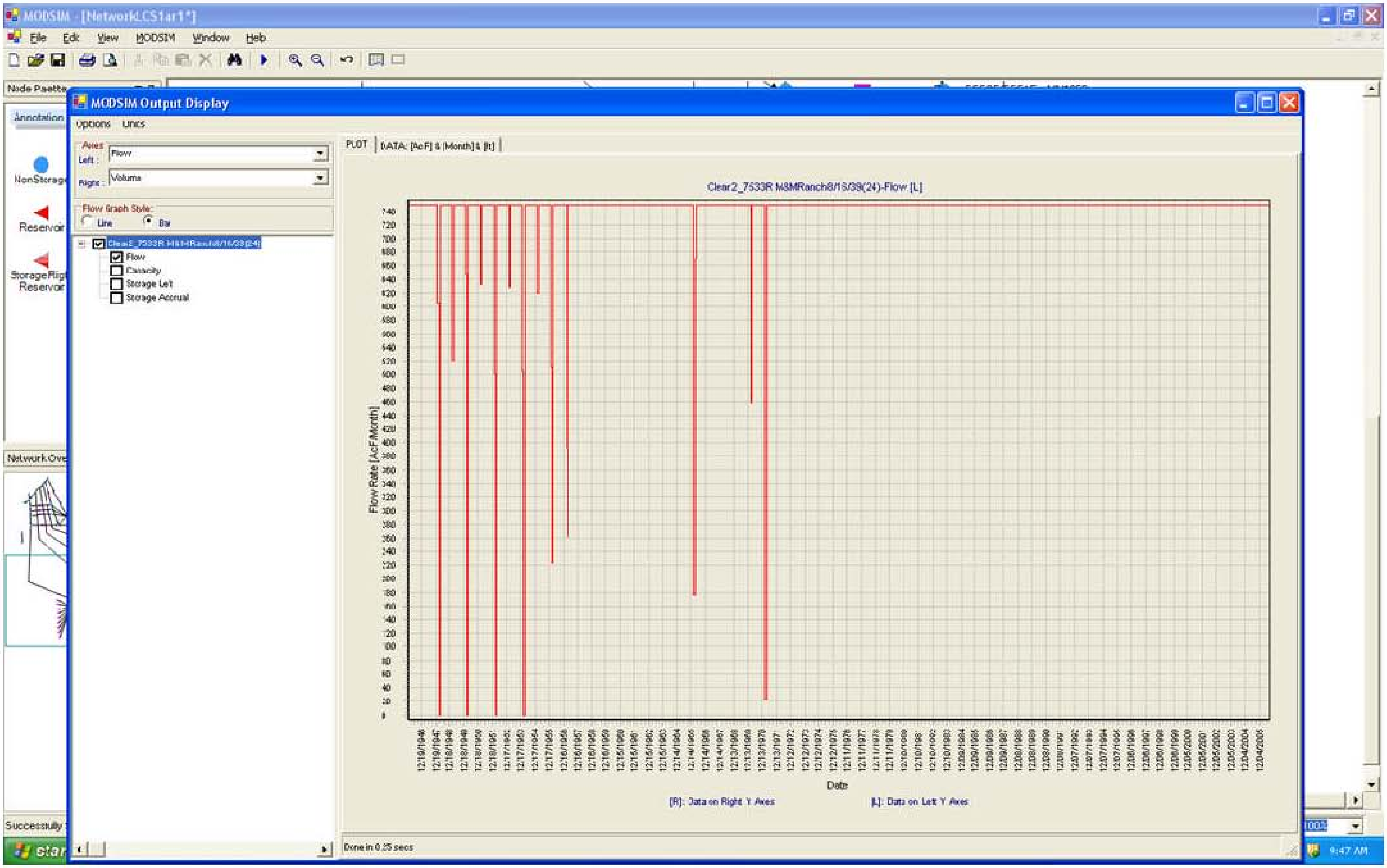
Done

Figure 18 Alternative 2 Demand 750 AF/month Permit 7533R



MODSIM - [NetworkLCS1ar1*]

MODSIM Output Display

Axes
Left : Flow
Right : Volume

Flow Graph Style:
○ Line ● Bar

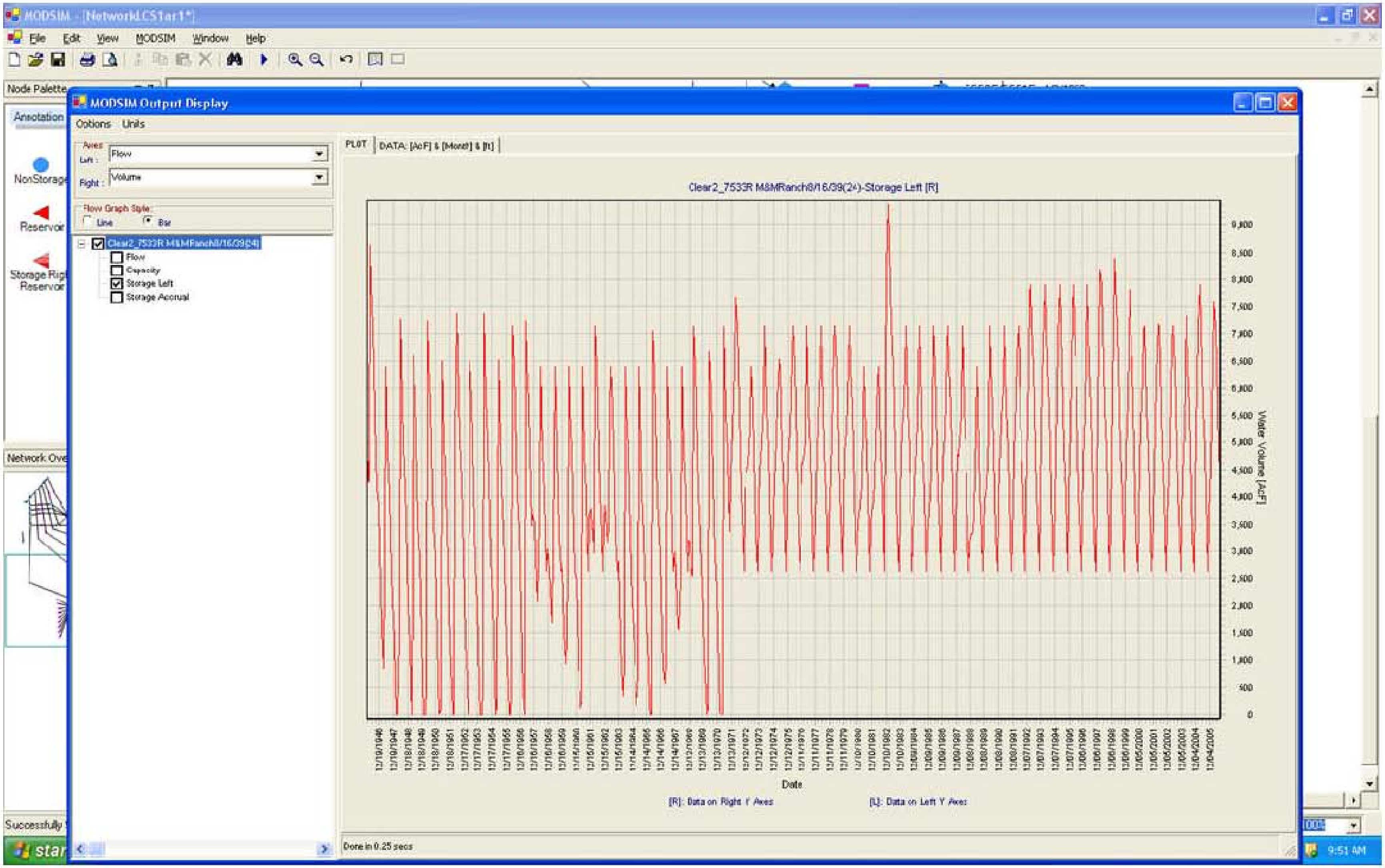
☑ Clear2_7533R M&MRanch8/16/38(24)
☑ Flow
☐ Capacity
☐ Storage Left
☐ Storage Accrual

PLOT | DATA: [AcF] & [Month] & [ft]

Clear2_7533R M&MRanch8/16/38(24)-Flow [L]

Done in 0.25 secs

Figure 19 Alternative 2 Reservoir Storage Permit 7533R



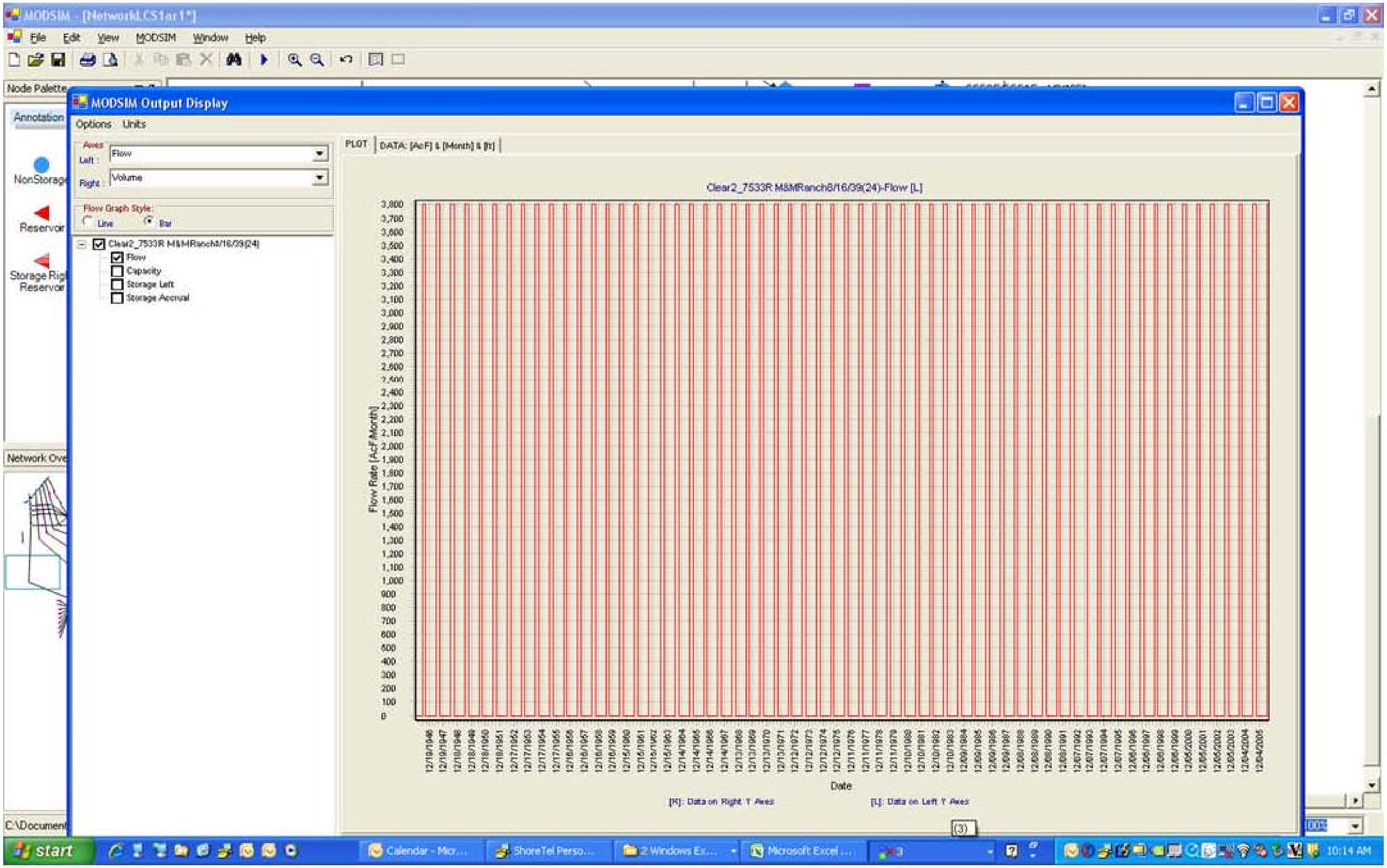
Axes
Left : Flow
Right : Volume

Flow Graph Style:
○ Line ● Bar

☑ Clear2_7533R M&MRanch8/16/39(24)
- ☐ Flow
- ☐ Capacity
- ☑ Storage Left
- ☐ Storage Accrual

Done in 0.25 secs

Figure 20 Alternative 5 Demand 3800 AF/month Permit 7533R



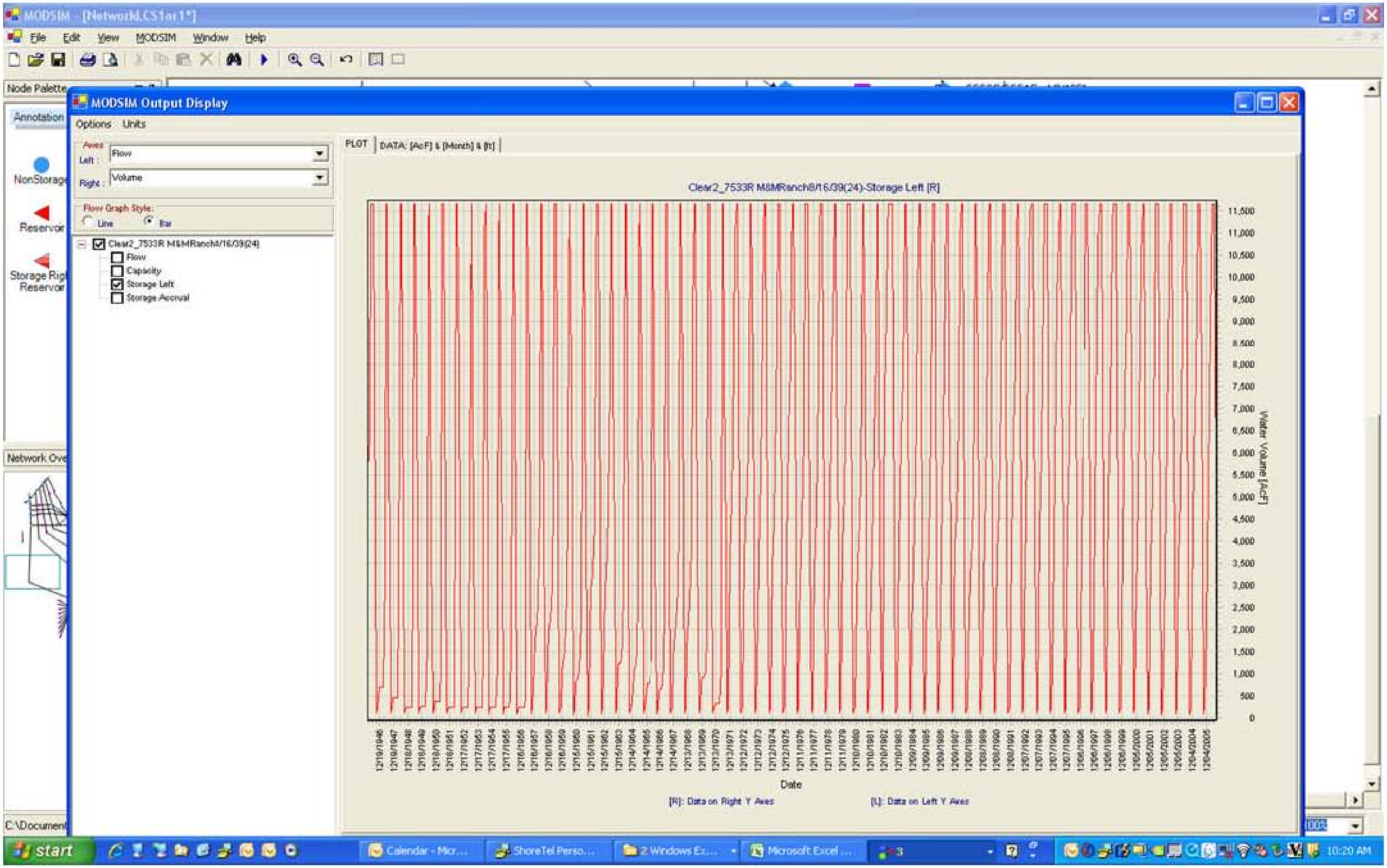
Axes
Left : Flow
Right : Volume

Flow Graph Style:
○ Line ● Bar

☑ Clear2_7533R M&MRanch8/16/39(24)
- ☑ Flow
- ☐ Capacity
- ☐ Storage Left
- ☐ Storage Accrual

Clear2_7533R M&MRanch8/16/39(24)-Flow [L]

Figure 21 Alternative 5 Reservoir Storage Permit 7533R



Axes
Left : Flow
Right : Volume

Flow Graph Style:
○ Line ● Bar

☑ Clear2_7533R M&MRanch8/16/39(24)
- ☐ Flow
- ☐ Capacity
- ☑ Storage Left
- ☐ Storage Accrual

3.9.1.4.2 Lake DeSmet Alternative

The Redman Ditch and Big Bonanza Ditch are two of the largest ditches in Clear Creek downstream of Buffalo. This alternative would consist of purchase/lease of Lake DeSmet stored water to supply these ditches, freeing up water in upper Clear Creek.

Redman Ditch

The Redman Ditch has territorial permits for direct flow diversion with a priority date of March 20, 1884. These permits are for 17.4 cfs on 658 acres. Diversion measurements are available from 1981 to the present with the first and last measurements averaging June 6 and August 31, respectively. Diversions are as follows:

Table 19 Redman Ditch Diversions (acre-feet)

	May	June	July	August	September	Total
Mean	70.5	335	406	427	188	1380
Maximum	363	762	934	1000	650	2360
Minimum	0	0	0	0	0	381

Big Bonanza Ditch

The Big Bonanza Ditch has territorial rights dated 1882-1883 for 21.71 cfs on 1000 acres. In addition, permit 6396E dated April 28, 1971 provides an additional 0.49 cfs on 33.41 acres. Diversion measurements are available from 1981 to the present with the first and last measurements averaging May 24 and September 5, respectively. Diversions are as follows:

Table 20 Big Bonanza Ditch Diversions (acre-feet)

	May	June	July	August	September	Total
Mean	448	836	1020	686	253	3250
Maximum	1430	1450	1610	1400	764	4910
Minimum	0	187	129	0	0	895

Supply from Lake DeSmet

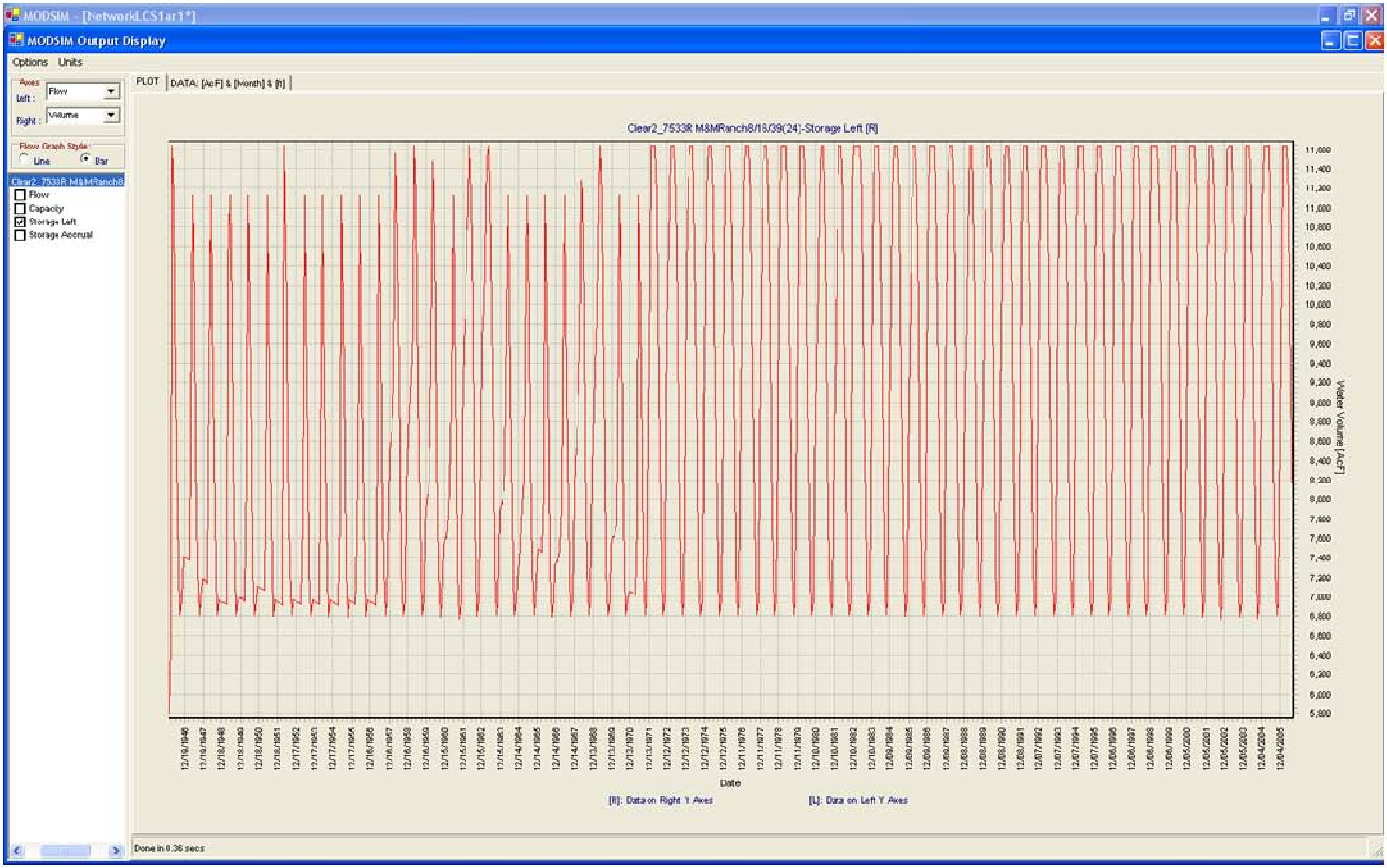
If an agreement can be reached with an owner(s) of water in Lake DeSmet, the water required to supply the combined needs of the Redman and Big Bonanza Ditches is as follows:

Table 21 Combined Demand of Redman and Big Bonanza Ditches (acre-feet)

	May	**June**	**July**	**August**	**September**	**Total**
Mean	518.5	1171	1426	1113	441	4630
Maximum	1793	2212	2544	2400	1414	7,270
Minimum	0	187	129	0	0	1,276

Storage permit 7533R owned by M&M Ranch can yield sufficient water to meet the combined demand for the Redman and Big Bonanza Ditches under historic mean, maximum and minimum demands. See Figure 22.

Figure 22 Alternative 6 Reservoir Storage Permit 7533R



Axes

Left : Flow

Right : Volume

Flow Graph Style

○ Line ● Bar

Clear2_7533R M&MRanch8

☐ Flow

☐ Capacity

☑ Storage Left

☐ Storage Accrual

Clear2_7533R M&MRanch8/16/39(24)-Storage Left [R]

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Appendix 6B
Reservoir Geotechnical Information

APPENDIX 6B RESERVOIR GEOTECHNICAL INFORMATION

This report presents the results of our reconnaissance-level geologic/geotechnical evaluation of alternative reservoir sites that are being evaluated to provide raw water storage in the Clear Creek drainage basin. The purposes of this geologic/geotechnical evaluation were to: a) identify the general geologic conditions at each site, b) identify the primary geologic conditions that are expected to impact development of a dam at each site, c) recommend a general dam type for use in the initial evaluation of alternatives, and d) identify if a geologic condition is present that could preclude development of a dam at each site.

RJH completed the following scope of services for this phase of the project:

- Collected and reviewed published geologic literature and maps.
- Participated in a site visit with the consultant team.
- Identified the primary geologic and general engineering properties of the identified geologic units at each site.
- Identified potential geologic conditions that are expected to significantly impact development of a dam at each site.
- Identified an appropriate dam type at each site.
- Prepared this report to present the results of our evaluation and our opinions.

The following sites were visited as part of this evaluation and are discussed in this report:

- 101 North Rock Creek
- 102 North Rock Creek
- 114 Sand Creek
- 116 Bench
- 119 Bull Creek
- Camp Comfort
- Upper Middle Clear Creek
- Lower Middle Clear Creek

The general locations of the eight sites and the regional geology are shown on Figures 1 and 2.

Based on data from our geologic literature review, the site visit, and our experience as geological, geotechnical, and dam engineers, we did not identify any geologic conditions that would preclude development of a dam at any of the sites included in this evaluation. Additional geologic and geotechnical evaluations, including subsurface investigations, should be completed at the sites that are carried forward into the next phase of study to evaluate key geologic and geotechnical conditions at these sites. Information related to the general geologic conditions at each site is provided in the following sections.

Seismicity

Based on seismic data published by the United States Geological Survey (USGS), the dam sites appear to have potential peak ground accelerations of between 0.29g and 0.34g with a 1 percent chance of exceedance in 50 years (4,975-year return interval). These ground motions could cause liquefaction of low density alluvial soils, impact required freeboard, and impact appurtenant structures and outlet towers.

Earthquakes located within about 10 miles of the sites have produced Modified Mercalli Intensities of II to IV within the 1920s, 1940s, and 1970s.

101 North Rock Creek

Bedrock was not identified at the ground surface; however, based on published mapping the general bedrock geology at the dam site and reservoir is likely the Cody Shale, Mesaverde Formation, Bearpaw Shale, Lance Formation and Fox Hills Sandstone. The Cody Shale is likely located on the right abutment and consists of shale interbedded with sandstone and bentonite. The Mesaverde Formation is likely located within the valley bottom and consists of sandstone with interbedded shale. The Bearpaw Shale, Lance Formation, and Fox Hills Sandstone are likely located on the left abutment. The Bearpaw Shale consists of shale with occasional siltstone, sandstone, and bentonite. The Lance Formation and Fox Hills Sandstone consist of sandstone with interbedded siltstone and shale. Surficial soils at the site include alluvium and colluvium consisting of sand, silt, clay, and gravel. A large fault-bounded landslide is located about 0.5 mile northwest of the site. The nearest mapped faults are located within 1 mile west of the site.

An appropriate dam type for the site geology would be a homogeneous or zoned earthfill dam. Geologic conditions that have the greatest potential impact to design are:

- Depth to a suitable foundation below the entire embankment footprint.
- The stability of the landslide upstream of the reservoir.
- The ability to process large rocks present onsite into riprap and riprap bedding.
- The ability to process bedrock materials into suitable fill materials.
- Thickness of terrace gravels on the right abutment and the ability to process these materials into filter and bedding materials.

102 North Rock Creek

The general bedrock geology at the dam site consists of the Fort Union Formation. This formation consists of sandstone, siltstone, coal, shale, and thin conglomerate lenses. Surficial soils at the site include alluvium and colluvium consisting of sand, silt, clay, and gravel. The nearest mapped fault is a normal fault located less than 0.5 mile south of the site that projects toward the site. A trace of a fault was identified immediately south of the right abutment as shown in Photograph 3 and may be connected with the mapped fault.

An appropriate dam type for the site geology would be a homogeneous or zoned earthfill dam. Geologic conditions that have the greatest potential impact to design are:

- The activity of the fault on the right abutment and potential seepage losses through the fault.
- The seepage and slope stability of the thin right abutment (in an upstream/downstream direction).
- A suitable source for clayey borrow materials.
- The stability of the bedrock that is steeply dipping downstream.
- A suitable source for filter materials.
- A suitable source for slope protection materials.
- Depth to a suitable foundation in the valley bottom and on the left abutment.
- The ability to process bedrock materials into suitable fill materials.

114 Sand Creek

The general bedrock geology at the dam site consists of the Wasatch Formation. The Wasatch Formation consists of sandstone, siltstone, shale, coal, and gypsum. Surficial soils at the site include alluvium, colluvium, and the Kaycee Formation. The alluvium generally consists of gravel, sand, and silt and is reported to have a maximum thickness of about 20 feet. However, bedrock was identified in the stream bottom at about the centerline of the dam and is likely less than 10 feet deep in many locations. Colluvium and the Kaycee Formation generally consist of silt, sand, and gravel and are reported to be less than about 8 feet thick.

An appropriate dam type for the site geology would be a homogeneous earthfill dam. Geologic conditions that have the greatest potential impact to design are:

- A suitable source for filter materials.
- A suitable source for slope protection materials.
- The ability to process bedrock materials into suitable fill materials.
- The stability of the bedrock that has a shallow downstream dip.
- If gypsum is present, there could be concerns with dissolutioning, which could affect seepage and seepage stability.

116 Bench

The general bedrock geology at the dam site consists of the Wasatch Formation. The Wasatch Formation consists of sandstone, siltstone, shale, coal, and gypsum. Surficial soils at the site include colluvium and the Kaycee Formation. These soils generally consist of silt, sand, and gravel and are reported to be less than about 8 feet thick. Bedrock was identified in a small drainage at the west side of the reservoir.

An appropriate dam type for the site geology would be a homogeneous earthfill dam. Geologic conditions that have the greatest potential impact to design are:

- A suitable source for filter materials.
- A suitable source for slope protection materials.
- The ability to process bedrock materials into suitable fill materials.
- If gypsum is present, there could be concerns with dissolutioning, which could affect seepage and seepage stability.

119 Bull Creek

The general bedrock geology at the dam site consists of the Wasatch Formation. The Wasatch Formation consists of sandstone, siltstone, shale, coal, and gypsum. Surficial soils at the site include alluvium in the valley bottom and terrace deposits, and colluvium and the Kaycee Formation on the abutments. The alluvium generally consists of gravel, sand, and silt and is reported to have a maximum thickness of about 20 feet. The terrace deposits include gravel, sand, and silt with boulders up to 3 feet in size. Colluvium and the Kaycee Formation generally consist of silt, sand, and gravel, and are reported to be less than about 8 feet thick. The current dam alignment is located on potentially thick surficial materials that would need to be removed. A proposed alternate dam location where bedrock was identified at the abutments is located upstream about 3,000 feet and is shown on Figures 1 and 2.

An appropriate dam type for the site geology would be a homogeneous or zoned earthfill dam. Geologic conditions that have the greatest potential impact to design are:

- The ability to process bedrock materials into suitable fill materials.
- Shallow dipping bedrock in generally a downstream direction.
- Ability to process valley bottom alluvium for riprap bedding and filter materials.
- Depth of a suitable foundation in the valley bottom.
- If gypsum is present, there could be concerns with dissolutioning, which could affect seepage and seepage stability.

Camp Comfort

The general bedrock geology at the dam site consists of Precambrian granitic gneiss with some thin dikes of aplite and pegmatite. The White River Formation is also located above the left abutment. The White River Formation consists of boulders, cobbles, and pebbles in a matrix of sandstone and bentonitic claystone. Surficial soils at the site include residuum, slopewash, and colluvium consisting of grus. A fault that generally follows the stream alignment has been mapped at the site. Alluvium was identified at the dam site in the valley bottom and is at least 20 to 30 feet thick.

An appropriate dam type for the site geology would be a roller-compacted concrete (RCC) dam. A concrete-faced rockfill dam may also be appropriate for this site; however, it would require a large excavation through an abutment for a spillway. Geologic conditions that have the greatest potential impact to design are:

- The ability to treat the wide joints identified in exposed rock to reduce seepage.

- The ability to process onsite bedrock materials for RCC, concrete aggregate, or rockfill. The rock does appear to be suitable for RCC, concrete aggregate, or rockfill.
- The depth to suitable foundation in the valley bottom and impacts to seepage control and foundation strength from the fault identified in the valley bottom.
- Stability of abutments if joints are dipping downstream.

Upper Middle Clear Creek

The general bedrock geology at the dam site consists of Precambrian granitic gneiss with some thin dikes of aplite and pegmatite. The White River Formation is also located above the left abutment. The White River Formation consists of boulders, cobbles, and pebbles in a matrix of sandstone and bentonitic claystone. Surficial soils at the site include residuum, slopewash, and colluvium consisting of grus. The nearest mapped fault is less than 2 miles southeast of the site.

An appropriate dam type for the site geology would be a roller-compacted concrete (RCC) dam. A concrete-faced rockfill dam may also be appropriate for this site; however, it would require a large excavation through an abutment for a spillway. Geologic conditions that have the greatest potential impact to design are:

- The ability to treat the wide joints identified in exposed rock to reduce seepage.
- The ability to process onsite bedrock materials for RCC, concrete aggregate, or rockfill. The rock does appear to be suitable for RCC, concrete aggregate, or rockfill.
- The depth to suitable foundation in the valley bottom.
- Stability of abutments if joints are dipping downstream.

Lower Middle Clear Creek

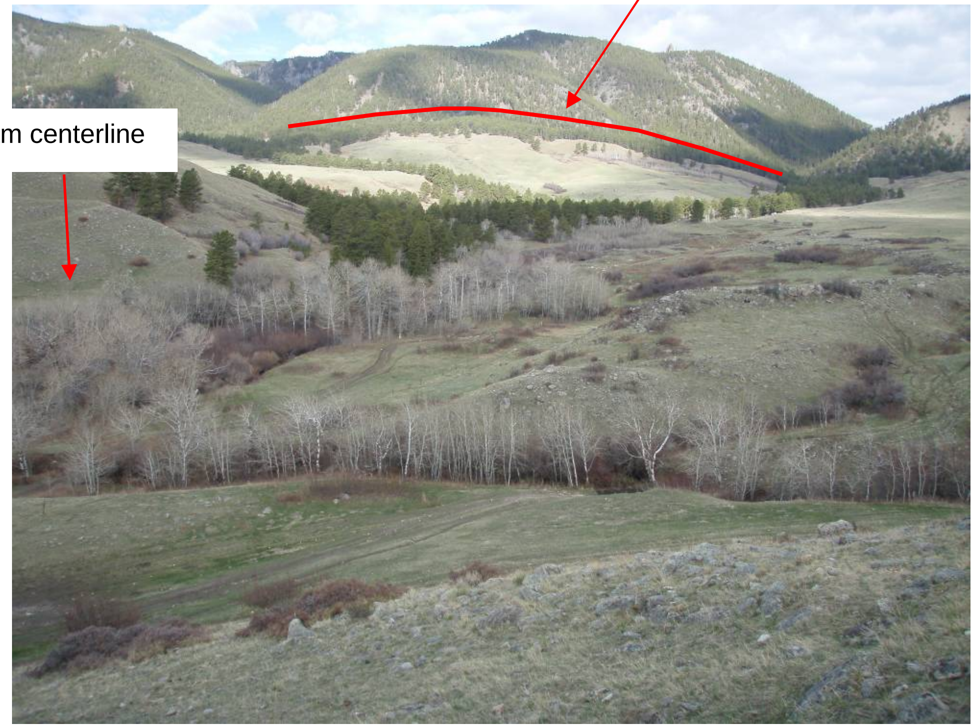
The general bedrock geology at the dam site consists of Precambrian granitic gneiss with some thin dikes of aplite and pegmatite. Surficial soils at the site include residuum, slopewash, and colluvium consisting of grus. The nearest mapped fault is less than 2 miles southeast of the site.

An appropriate dam type for the site geology would be a roller-compacted concrete (RCC) dam. A concrete-faced rockfill dam may also be appropriate for this site; however, it would require a large excavation through an abutment for a spillway. Geologic conditions that have the greatest potential impact to design are:

- The ability to treat the wide joints identified in exposed rock to reduce seepage.
- The ability to process onsite bedrock materials for RCC, concrete aggregate, or rockfill. The rock does appear to be suitable for RCC, concrete aggregate, or rockfill.
- The depth to suitable foundation in the valley bottom.
- Stability of abutments if joints are dipping downstream.

PHOTOGRAPHS

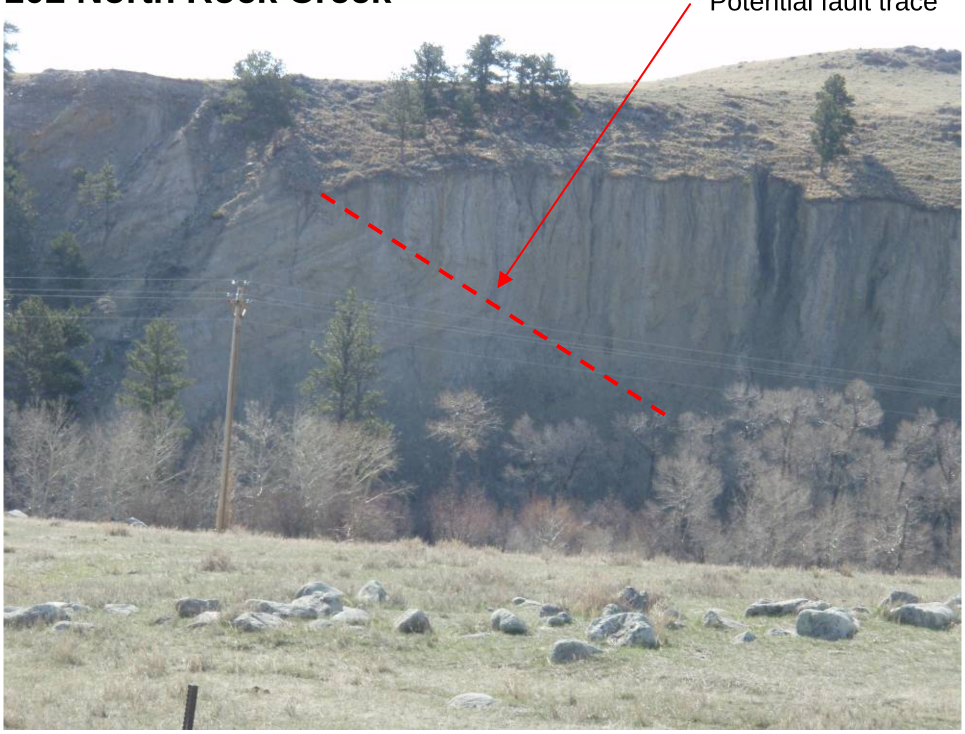
101 North Rock Creek



Photograph 1: Left abutment looking upstream. The dam centerline is on the left side of the photograph.

Photograph 2: Dam centerline in the valley bottom looking upstream.

102 North Rock Creek



Photograph 3: Reservoir basin looking downstream at the right abutment.

Photograph 4: Right abutment looking at the left abutment.

114 Sand Creek

Photograph 5: Bedrock outcrops along canal within the reservoir basin.

Photograph 6: Reservoir basin looking upstream at Wasatch Formation outcrop.

116 Bench

Photograph 7: Bedrock outcrop at Bench site.

119 Bull Creek

Photograph 8: Looking east at Wasatch Formation below terrace alluvium deposit.

Photograph 9: Proposed right abutment looking north at proposed left abutment.

Camp Comfort

Photograph 10: Dam centerline at valley bottom looking downstream at thick alluvium.

Photograph 11: Left abutment looking downstream at rock outcrops.

Upper Middle Clear Creek

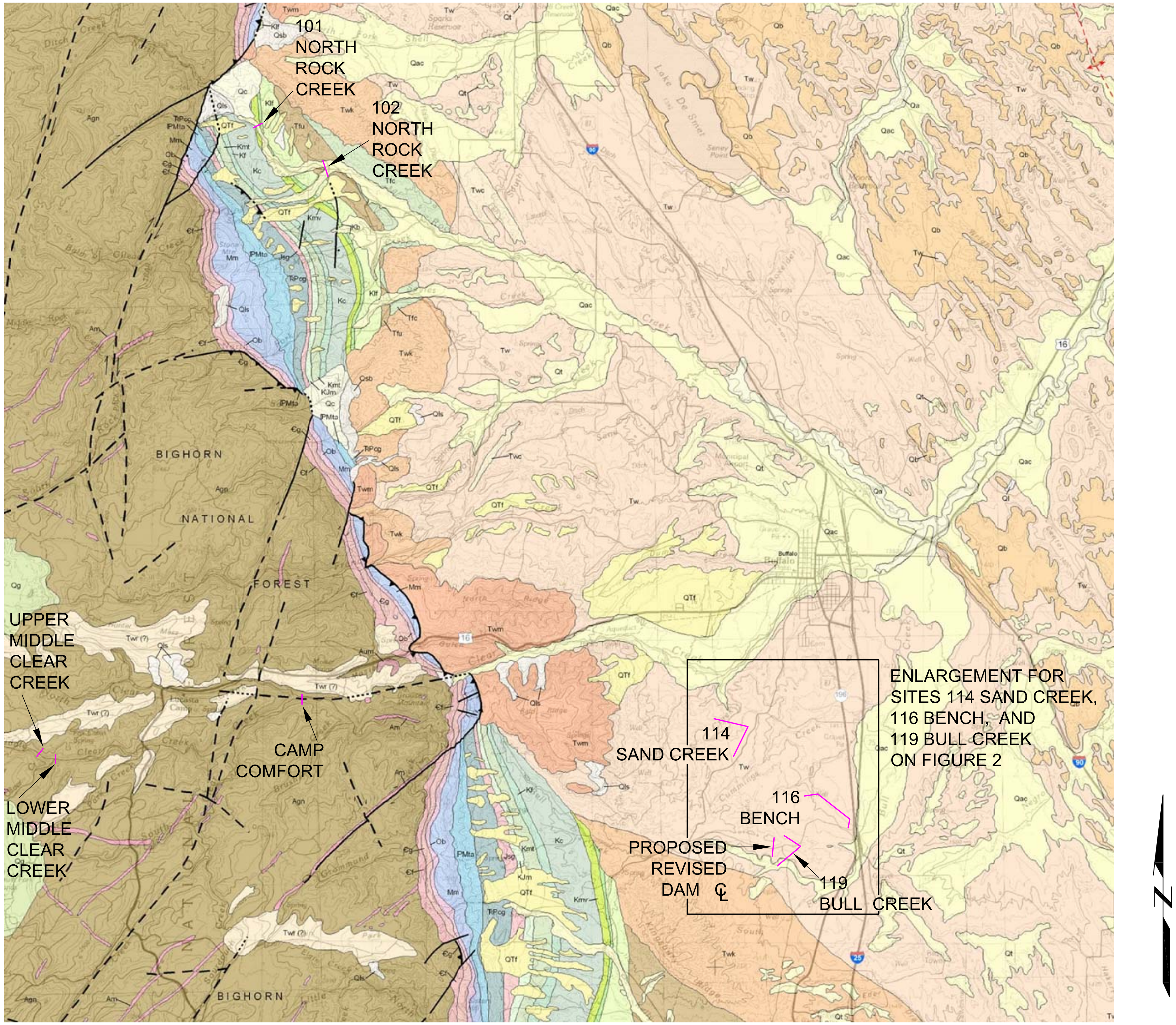
Photograph 12: Upstream of left abutment looking downstream at granitic gneiss outcrops.

Photograph 13: Reservoir basin looking downstream at dam centerline.

Lower Middle Clear Creek

Photograph 14: Left abutment looking upstream.

Photograph 15: Left abutment looking south at right abutment.



EXPLANATION (NOTE 2)

Qac	▭	MIXED ALLUVIAL AND COLLUVIAL DEPOSITS
Twr	▭	WHITE RIVER FORMATION
Tw	▭	WASATCH FORMATION
Tfu	▭	FORT UNION FORMATION
Klf	▭	LANCE AND FOX HILLS FORMATIONS
Kb	▭	BEARPAW SHALE
Kmv	▭	MESAVERDE FORMATION
Kc	▭	CODY SHALE
Agn	▭	GRANITIC GNEISS

——— APPROXIMATE DAM CENTERLINE

——— FAULT, DASHED WHERE
– – – – – APPROXIMATE, DOTTED WHERE
·········· CONCEALED

0 6000 12000 24000 36000

SCALE IN FEET

NOTES:

1. BASE MAP FROM WYOMING GEOLOGICAL SURVEY MAP SERIES 59, GEOLOGICAL MAP OF THE BUFFALO 30'x60' QUADRANGLE.
2. ONLY GEOLOGICAL UNITS WITHIN THE LIMITS OF THE DAM SITES ARE IDENTIFIED.

THIS FIGURE MUST BE REPRODUCED IN COLOR

RJH CONSULTANTS, INC.

CLEAR CREEK

SITE LOCATIONS AND REGIONAL GEOLOGY

PROJECT NO. 09115

May 2010

Figure 1

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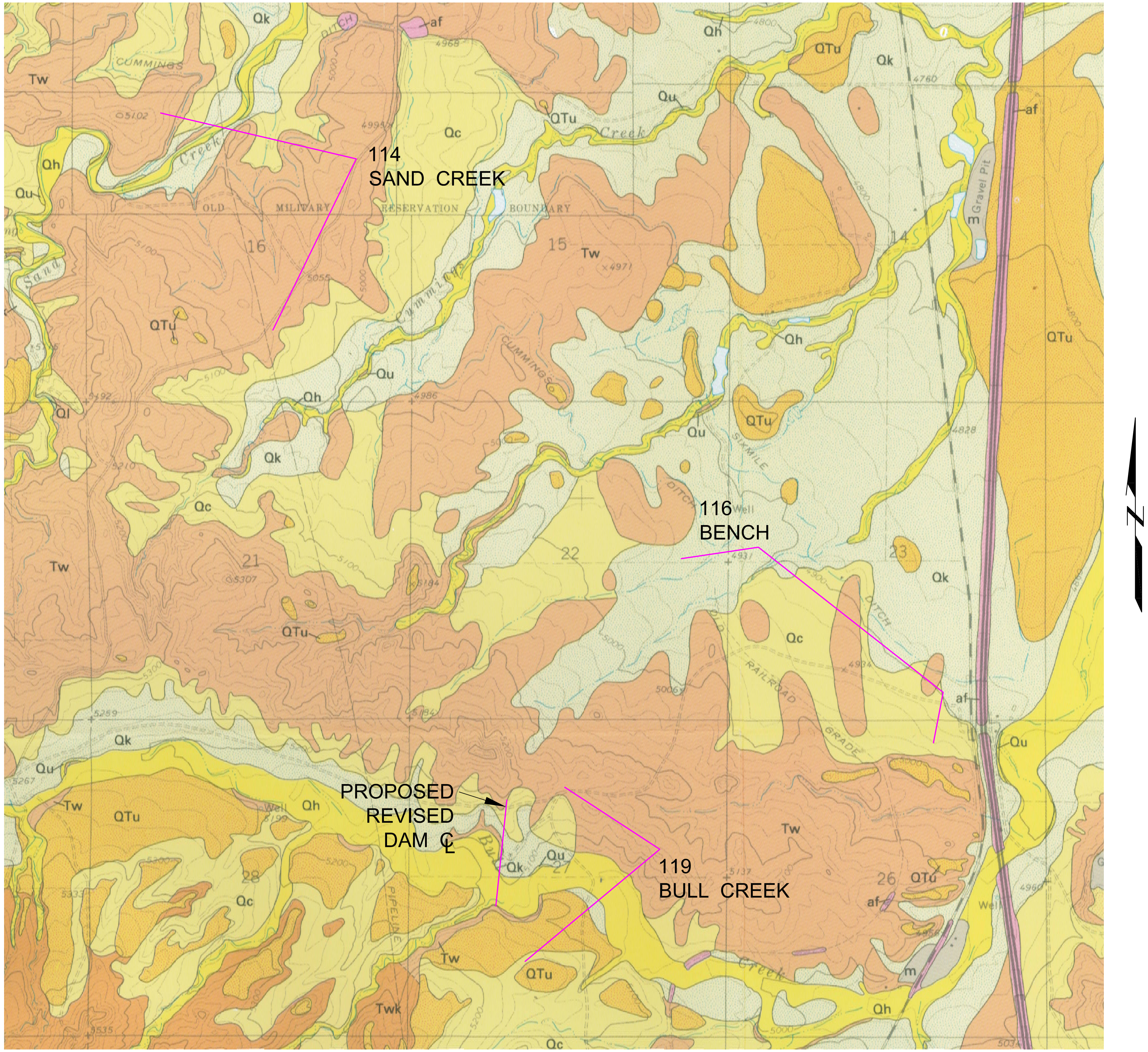


EXPLANATION (NOTE 2)

Qh	🟨	ALLUVIUM
Qk	⬜	KAYCEE FORMATION
Qc	🟨	COLLUVIUM
QTu	🟧	TERRACE ALLUVIUM, UNDIVIDED
Tw	🟧	WASATCH FORMATION
	—	APPROXIMATE DAM CENTERLINE

0 1000 2000 4000 6000

SCALE IN FEET

THIS FIGURE MUST BE REPRODUCED IN COLOR

NOTE:

1. BASE MAP FROM USGS MAP GQ–1552, GEOLOGIC MAP OF THE BUFFALO QUADRANGLE.
2. ONLY GEOLOGICAL UNITS WITHIN THE LIMITS OF THE DAM SITES ARE IDENTIFIED.

RJH
CONSULTANTS, INC.

CLEAR CREEK

REGIONAL GEOLOGY
FOR SITES 114 SAND CREEK,
116 BENCH, AND
119 BULL CREEK

PROJECT NO. 09115

May 2010

Figure 2

P:\09115 – CLEAR CREEK\CAD\FIGURES\09115 GEOLOGY MAP.DWG 5/13/2010 4:12 PM

Appendix 6C
Environmental Report

Site visit notes for Clear Creek Reservoirs

Bull Creek (Site 119)

This site is composed primarily of grassland with some small amounts of sagebrush cover. No wetlands were observed and none are on the NWI map. There are some mature cottonwoods within the riparian area that would be inundated, but most of these are decadent trees. Cottonwood gallery forest impacts would be relatively minor. One raptor nest was observed near the dam site and another was observed towards the upper end of the inundation area. No large issues with this site.

According to Wyoming Game and Fish Department data, this site is within pronghorn yearlong range and mule deer winter/yearlong range. No fish are present at this site.

Lower Bull Creek (Site 117)

One large wetland is present within the inundation area. Due to the low elevation this wetland is not likely a fen. There would also be a fairly large amount of cottonwood gallery forest inundated, which would likely require mitigation.

According to Wyoming Game and Fish Department data, this site is within pronghorn yearlong range, white-tailed deer yearlong range, and mule deer yearlong range. No fish are present at this site.

Sand Creek (Site 114)

This site is composed primarily of grassland with some small amounts of sagebrush cover. No wetlands were present on the NWI map, but two small wetlands totaling roughly 0.18 acres were observed along the channel within the inundation area. There are some mature cottonwoods within the riparian area that would be inundated, but most of these are decadent trees. Cottonwood gallery forest impacts would be relatively minor. No raptor nests were observed. No large issues with this site.

According to Wyoming Game and Fish Department data, this site is within pronghorn yearlong range, white-tailed deer yearlong range, and mule deer yearlong range. No fish are present at this site.

Bench Site (Site 116)

This site is composed primarily of grassland with some sparse sagebrush. It also would encompass some irrigated hay fields. There is one wetland present that appears to result from irrigation runoff. No large issues with this site.

According to Wyoming Game and Fish Department data, this site is within pronghorn yearlong range and mule deer yearlong range. No fish are present at this site.

Lower Middle Clear Creek (Site 108)

This site does not have any wetland based on NWI mapping but some minor amounts of wetland likely occur along the drainage. It would inundate a fairly large forested area but most of this is upland forest consisting of spruce/fir, lodgepole, and some aspen on hillsides. There is very little woody riparian habitat at this site. No large issues with this site.

According to Wyoming Game and Fish Department data, this site is within elk winter/yearlong range, moose yearlong range, and mule deer spring/summer/fall range. Middle Clear Creek is a Yellow Ribbon trout stream, meaning it is a trout fishery of regional importance with 50 – 300 lbs of trout per mile. Brook, brown, and rainbow trout are known to occur. Oliver Creek is a Green Ribbon trout stream, meaning it is a trout fishery of local importance with less than 50 lbs of trout per mile. Brook, cutthroat, and rainbow trout are known to occur, along with grayling.

Upper Middle Clear Creek (Site 109)

This site has some, but not an expansive amount of willow riparian area. It would inundate some upland forested areas. There is one small wetland (0.05 acres) near the dam that does not show on the NWI map. There is a relatively large wetland within the inundation area that may be a fen. A test pit was dug but ice was encountered after about 3-4 inches. The top 3-4 inches were composed of peat, and if the peat goes deeper then this site is a fen. Further work needs to be done to determine what type of wetland this is.

According to Wyoming Game and Fish Department data, this site is within elk winter/yearlong range and mule deer spring/summer/fall range. Middle Clear Creek is a Yellow Ribbon trout stream, meaning it is a trout fishery of regional importance with 50 – 300 lbs of trout per mile. Brook, brown, and rainbow trout are known to occur.

Camp Comfort (Site 120)

This site appears to have only a minor amount of woody riparian area, but it would inundate upland forests. There is one large wetland present, but due to high water this wetland could not be safely accessed during the site visit. Further work should be conducted to determine if this wetland might be a fen.

According to Wyoming Game and Fish Department data, this site is within elk spring/summer/fall range, white-tailed deer yearlong range, and mule deer winter/yearlong range. North Clear Creek is a Yellow Ribbon trout stream, , meaning it is a trout fishery of regional importance with 50 – 300 lbs of trout per mile. Brook, brown, and rainbow trout are known to occur. South Clear Creek is also a Yellow Ribbon trout stream, meaning it is a trout fishery of regional importance with 50 – 300 lbs of trout per mile. Brook, brown, cutthroat, and rainbow trout are known to occur.

North Rock Creek (Site 101)

This site has a fairly substantial amount of cottonwood gallery forest with an understory of willow/alder riparian area that would likely require mitigation. Although no wetlands show up on NWI maps, there are narrow wetland fringes along the stream in places and one wetland was found on a bench above the stream that is approximately 0.06 acres in size. Wetland impacts would likely be minimal.

According to Wyoming Game and Fish Department data, this site is within elk crucial winter/yearlong range and mule deer winter/yearlong range. North Fork of Rock Creek is a Green Ribbon trout steam, meaning it is a trout fishery of local importance with less than 50 lbs of trout per mile. Brook, brown, and rainbow trout are known to occur.

Rock Creek (Site 102)

There is a fairly expansive cottonwood gallery forest that would be inundated, and would likely require mitigation. Although no wetlands show up on NWI maps, wetland fringes occur along the stream. Overall wetland impacts would likely be fairly minimal.

According to Wyoming Game and Fish Department data, this site is within white-tailed deer yearlong range and mule deer winter/yearlong range. North Fork of Rock Creek is a Green Ribbon trout steam, meaning it is a trout fishery of local importance with less than 50 lbs of trout per mile. Brook, brown, and rainbow trout are known to occur. South Rock Creek is also a Green Ribbon trout stream, meaning it is a trout fishery of local importance with less than 50 lbs of trout per mile. Brook, brown, and rainbow trout, as well as longnose dace, are known to occur.

Boot Jack

Although it doesn't show up on NWI maps, virtually the entire inundation area for this site is a wetland comprised of a cattail/bulrush marsh. One raptor nest is present in the vicinity.

According to Wyoming Game and Fish Department data, this site is within pronghorn yearlong range, white-tailed deer yearlong range, and mule deer winter/yearlong range. Brook trout, black bullhead, brown trout, creek chub, longnose dace, longnose sucker, mountain sucker, rainbow trout, stonecat, and white sucker are present in Sayles Creek.

The Wyoming Game and Fish Department prefers that if a reservoir is constructed in Clear Creek watershed, it be constructed at a site that does not contain a fishery.

Appendix 6D
French Creek Alternative Analyses

6.3 Site No. 3 Preliminary Analysis

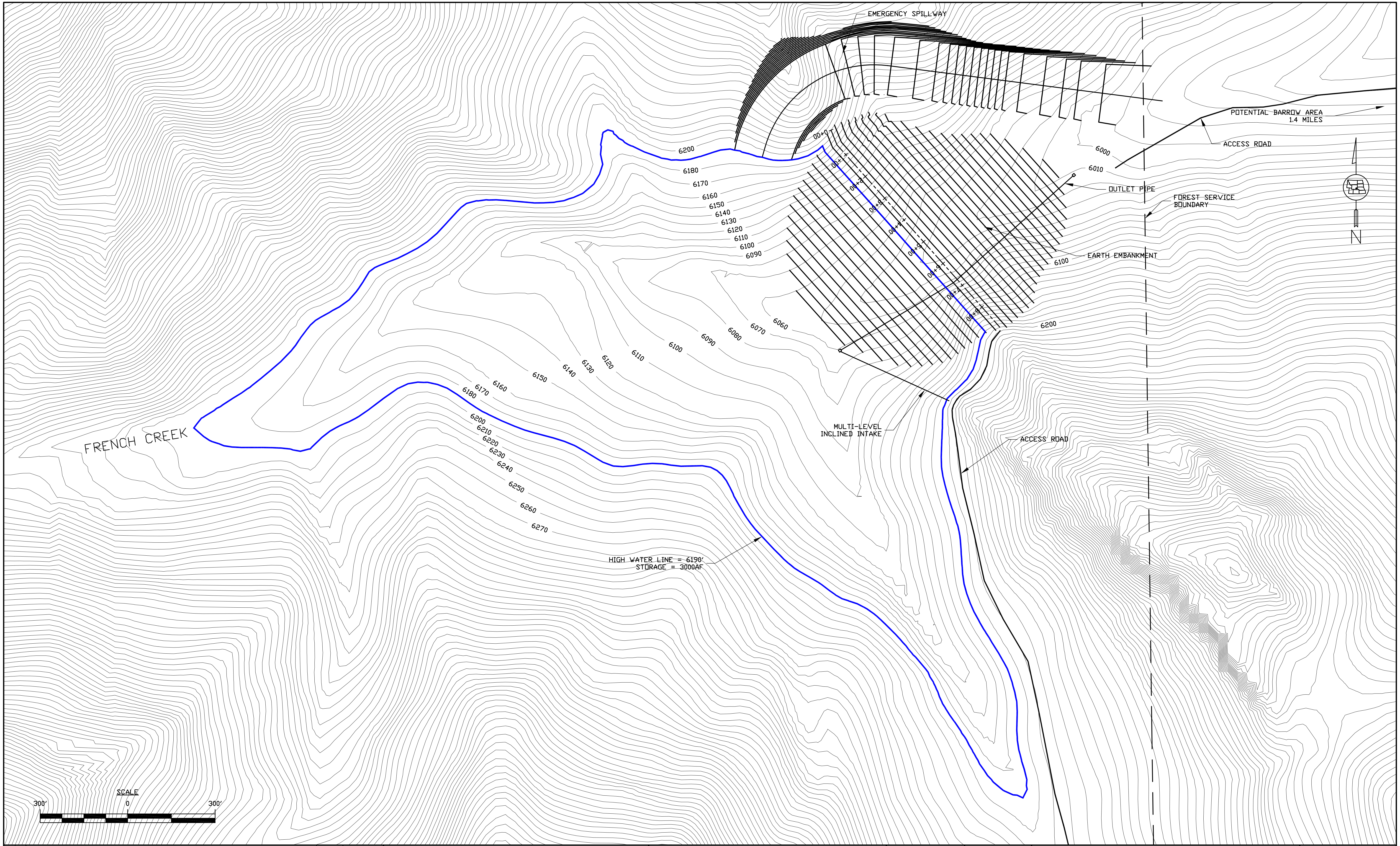
6.3.1 Introduction

Site No. 3 is located on French Creek on US Forest Service property approximately 700 feet above the boundary as shown on Figure 6.10, 6.11, 6.12 and 6.13. Site No. 3 is located in Section 32, Township 51 North, Range 83 West. The reservoir would be supplied by flows from the North Fork of Clear Creek and French Creek. 3000, 5500, 7500, and 10,000 ac-ft reservoirs were analyzed and preliminary designs and cost estimates were developed.

This site could be a multiple-use reservoir. The reservoir yield could be utilized in the French Creek, Johnson Creek, lower Rock Creek, and Clear Creek drainages for irrigation supplementary flows, municipal purposes, environmental uses, and recreation. Benefits to the Hopkins Producers ID and other downstream irrigators could be achieved with additional late season water. This water could be transferred to Clear Creek (see section 7) to be utilized for future municipal needs of the City of Buffalo and additional hydropower generation, supplemental irrigation water, and instream flows through Buffalo, and could delay regulation on the Clear Creek drainage. A minimum pool could be maintained in the reservoir to promote recreation and a fishery. Stream fishing improvements on French Creek could also be realized with the project. The analysis of the reservoir alternatives is discussed in detail in the following sections.

6.3.2 Reservoir Capacity

Elevation-area-capacity data was developed for this site. The capacity-elevation curve is shown on Figure 6.14. For this analysis, 3,000AF, 5,500AF, 7,500AF, and 10,000AF reservoirs were addressed. The reservoirs were assumed to incorporate a recreation pool of approximately 30% of the total storage. Consequently, the 3000AF reservoir would have 2,100AF of active storage and the 5,500AF, 7,500AF, and 10,000AF reservoirs would have 3,850AF, 5,250AF, and 7,000AF of active storage respectively.



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FILE NAME: SITE 3
SCALE: 1"=300'
OPERATOR: DWW
DATE: 07/08
PROJECT NO: 522-WY
TASK NO: 001-263
LOCATION: BUFFALO, WY
PROJECT: HOPKINS STORAGE
SEND TO: VICTOR E. ANDERSON
PHONE: (307) 634-7848

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RESOURCES CORPORATION

1904 E. 15th STREET
CHEYENNE, WYOMING 82001
(307) 634-7848
FAX: (307) 634-7851

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PROJECT MANAGER VEA
DATE 07/08

HOPKINS PRODUCERS ID STORAGE PROJECT

FIGURE 6.10
SITE 3 EARTH EMBANKMENT
SITE PLAN – 3000AF

REVISION △1
PROJECT 522-WY
DRAWING 6-22

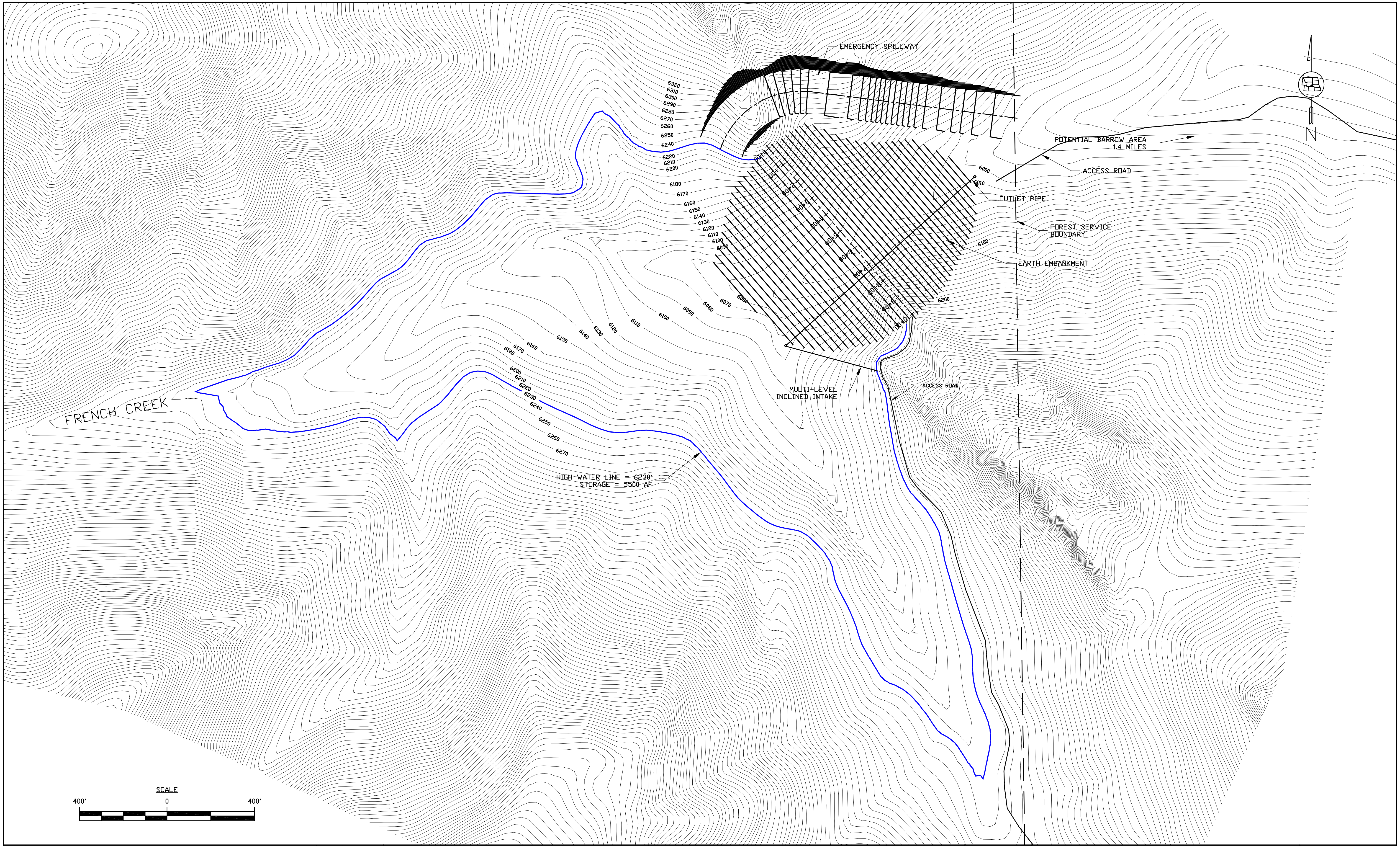

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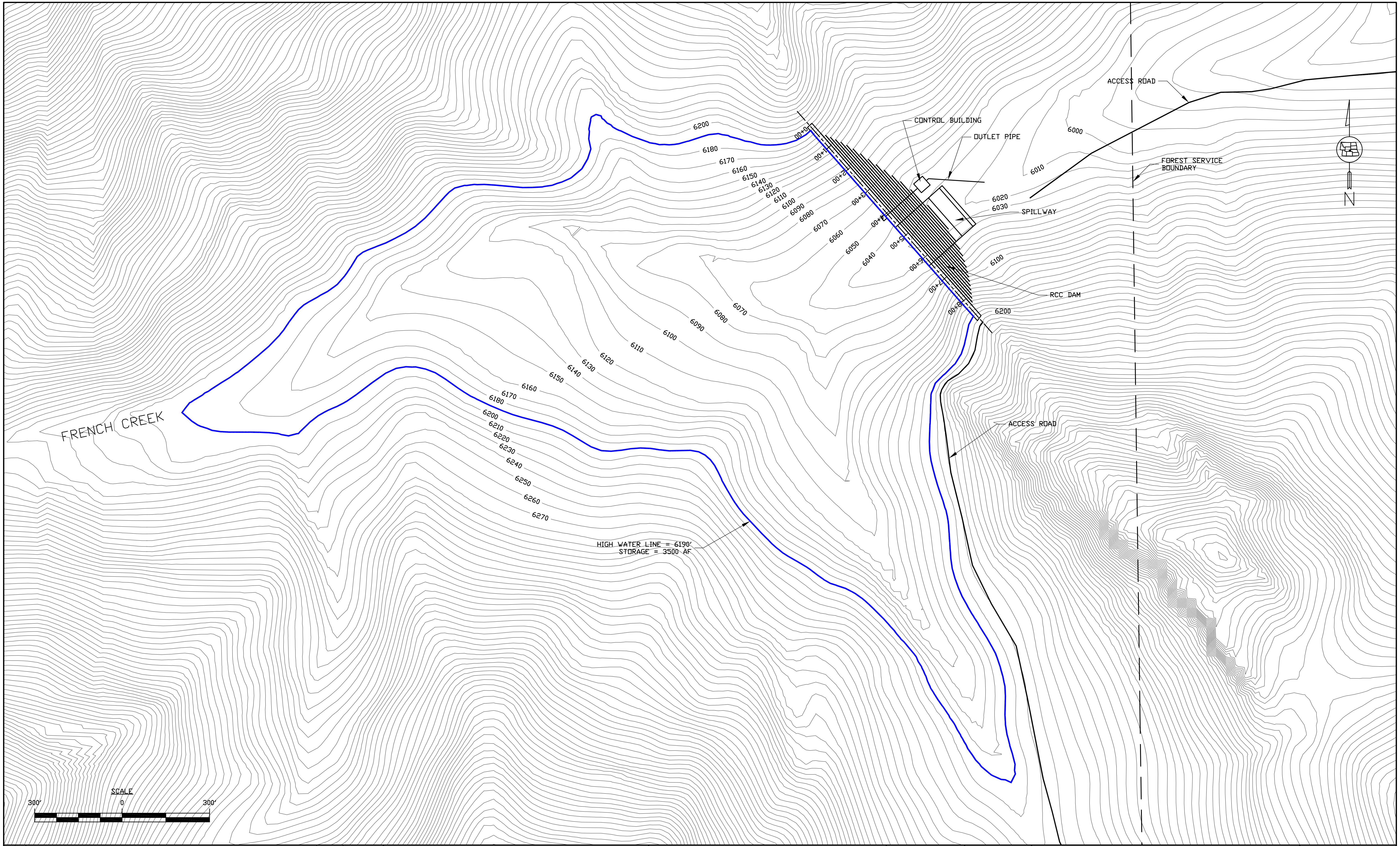
FIGURE 6.11
SITE 3 EARTH EMBANKMENT
SITE PLAN – 5500AF

REVISION 1
PROJECT 522–WY
DRAWING 6–23



FILE NAME: SITE 3	OPERATOR: DWW	PROJECT NO: 522-WY	LOCATION: BUFFALO, WY	SEND TO: VICTOR E. ANDERSON
SCALE: 1"=300'	DATE: 07/08	TASK NO: 001-263	PROJECT: HOPKINS STORAGE	PHONE: (307) 634-7848

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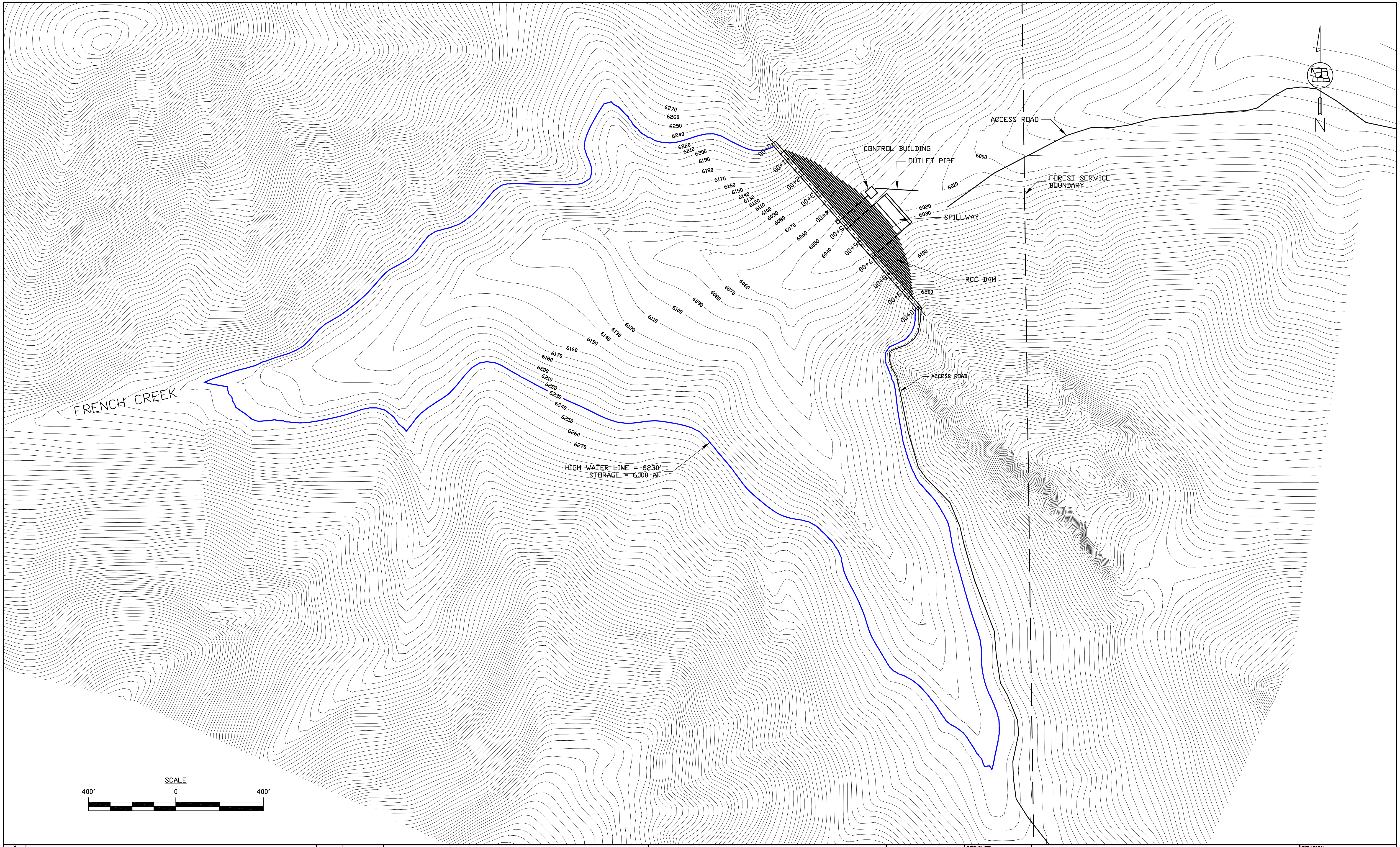
FIGURE 6.12
SITE 3 RCC SITE PLAN
3500AF

REVISION 1
PROJECT 522-WY
DRAWING 6-24



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1	PRELIMINARY DESIGN	DWW	07/08
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FIGURE 6.13
SITE 3 RCC SITE PLAN
6000AF

REVISION	1
PROJECT	522-WY
DRAWING	6-25

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OPERATOR: DWW	DATE: 07/08
PROJECT NO: 522-WY	TASK NO: 001-263
LOCATION: BUFFALO, WY	PROJECT: HOPKINS STORAGE
SEND TO: VICTOR E. ANDERSON	PHONE: (307) 634-7848

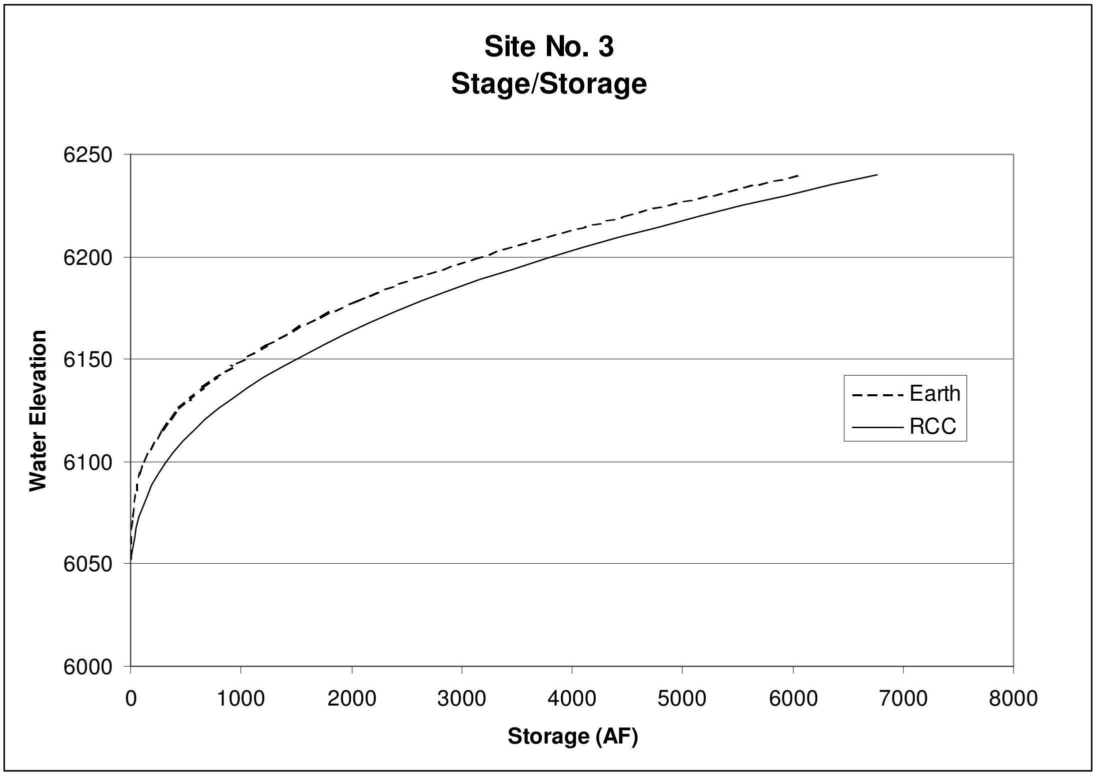


Figure 6.14 – Site No. 3 Capacity-Elevation Curve

6.3.3 Water Supply

The potential water supply for a reservoir at Site No. 3 would be from available flows on French Creek and available flows from the North Fork of Clear Creek. The North Fork of Clear Creek water supply analysis is discussed in detail in section 6. The hydrological analysis estimated the available storable flows for dry, average, and wet years as shown below:

	French Creek	North Fork Clear Creek	Total
Dry Years	200-400 AF	500-900 AF	700-1300 AF
Average Years	900-1,200 AF	2,800-3,500 AF	3,700-4,700 AF
Wet Years	1,100-1,400 AF	3,500-4,300 AF	4,600-5,700 AF

6.3.4 Reservoir Yield

The potential yield of the reservoir alternative sizes were estimated in the hydrological analysis as shown on Figure 6.15. The estimated average annual yields of the 3,000 AF reservoir with an active capacity of 2,100AF would be approximately 1,950AF. The estimated average annual yield with an active capacity of 3,850AF would be approximately 3,350AF. The estimated average annual yield with an active capacity of 5,250AF and 7,000AF would be approximately 4,000AF.

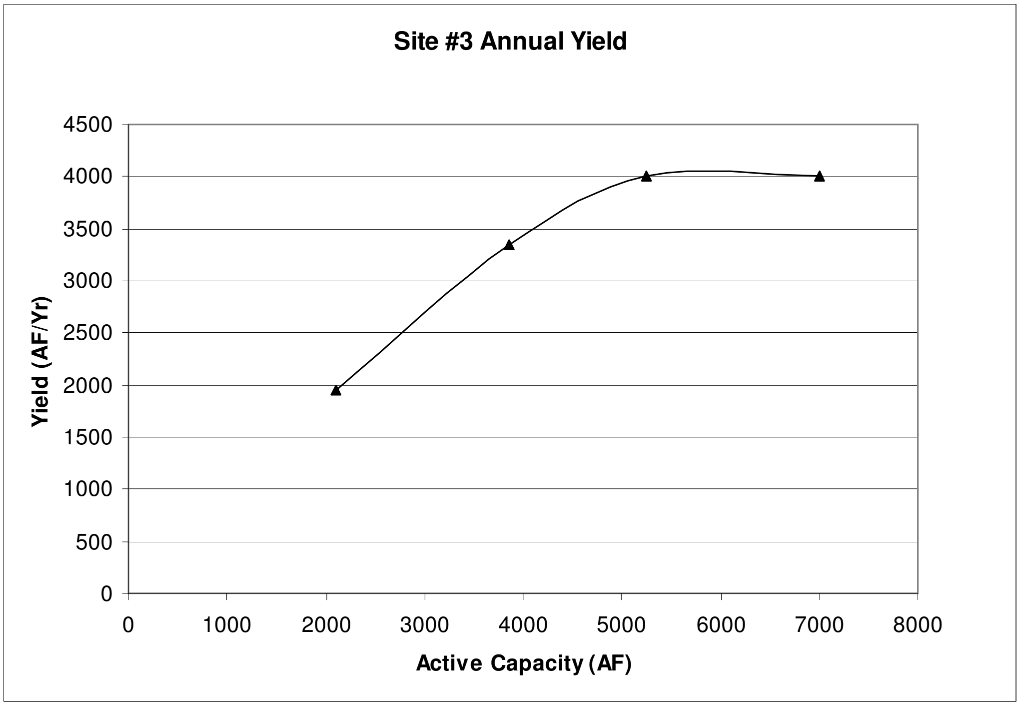


Figure 6.15 Annual yield vs. active capacity at Site No. 3

6.3.5 Geologic and Geotechnical Investigation

Site No. 3 is located in a U-shaped valley with French Creek flowing through. The bedrock is Precambrian granite. The only rock outcrops were high up on the abutments well above the reservoir high water line. Both abutments were mantled with silty sand and gravel and scattered boulders. Depth to bedrock is probably 30 feet or greater in the valley bottom and 5 feet to 15 feet on the abutments. There are several springs on the left side of the reservoir about at the reservoir high water line and above that may indicate a shallow depth of bedrock. The site has a good grass and tree cover.

A dam from 190 to 230 feet high was analyzed. At least three types of dams, homogeneous or zoned earth embankment, concrete faced rockfill, and roller compacted concrete, appear to be applicable to the site.

There would have to be a sufficient amount of fines, 10% or greater, in the granular soils in the reservoir area or downstream borrow areas to construct a homogeneous or zoned earth embankment dam. For an embankment dam, the crest width should be at least the height of the dam divided by 5 plus 10 feet. Therefore, the dam crest should be at least 46 feet wide. The exterior slopes should be 3H:1V or flatter on the upstream face and 2.5H:1V or flatter on the downstream face. If a core is used, the core should have upstream and downstream slopes of 1.5H:1V or flatter. Any of the granular soils may be used for the exterior shells and the granular soils with at least 10% fines should be used for the core. Down stream of the core, a 3-foot wide chimney drain and a 5-foot thick blanket drain should be installed. Foundation preparation should consist of excavation of the soils from beneath the entire footprint of the dam down to the bedrock. The excavation depths are estimated to be 15 feet on the abutments and 30 feet in the valley bottom. A 5-foot deep cutoff trench should be excavated below the dam centerline with a width of at least 10 feet and 1H:1V side slopes.

The site is suitable for the construction of a concrete faced rockfill dam similar in design to the Deer Creek Dam. The rock for the fill and the concrete face aggregate is available on site both as granular soils and quarried rock. The upstream and downstream slopes of the rockfill should be 1.3H:1V or flatter. The reinforced concrete facing should be at least 12 inches thick. Foundation preparation should consist of excavation of the soils from beneath the entire footprint of the dam down to the bedrock. The excavation depths are estimated to be 15 feet on the abutments and 30 feet in the valley bottom.

The site is suitable for the construction of a roller compacted concrete (RCC) dam similar in design to the Tie Hack Dam. The rock for the concrete aggregate is available on site both as granular soils and quarried rock. Foundation preparation should consist of excavation of the soils from beneath the entire footprint of the dam at least 2 feet into the sound bedrock. The excavation depths are estimated to be 20 feet on the abutments and 40 feet in the valley bottom.

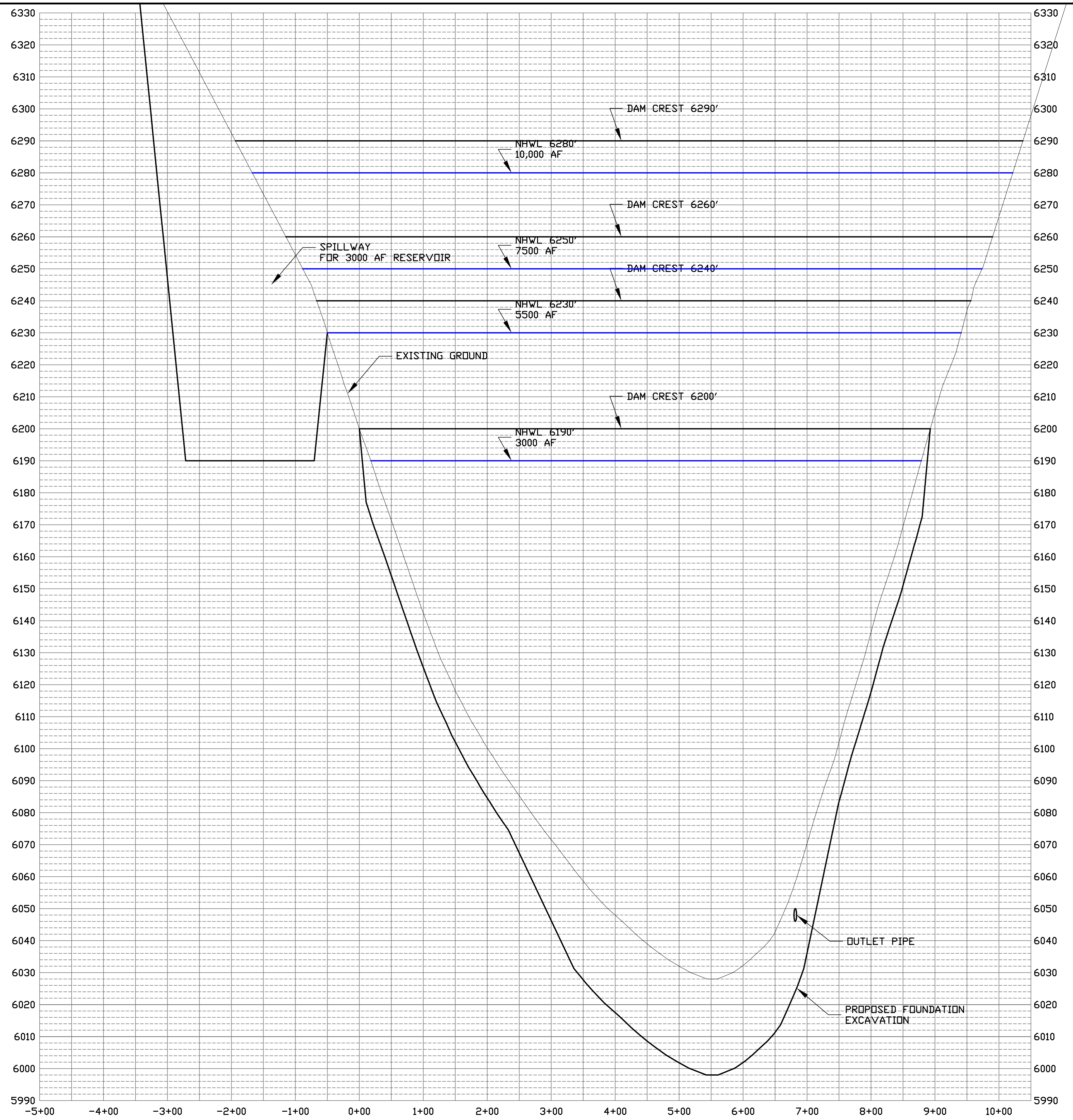
6.3.6 Dam and Reservoir Preliminary Design

Both the roller-compacted concrete (RCC) dam and earth embankment concepts were utilized for development of preliminary designs, as shown in Figures 6.16 and 6.17. The 3,500AF and 6,000AF sizes were analyzed for RCC and the 3,000AF, 5,500AF, 7,500AF, and 10,000AF sizes were analyzed for earth embankment. The concrete faced rockfill dam was not analyzed due to the history of RCC dams being more economical.

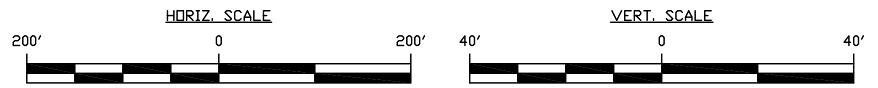
The outlet works for the RCC dam would consist of a multi-level intake attached to the upstream face of the dam, a conduit through the RCC dam, and a control valve structure located at the downstream toe of the dam. The locations of these structures are shown on Figures 6.10 and 6.11. The outlet works for the earth embankment would consist of an inclined multilevel intake structure located on the right abutment of the embankment, a conduit through the embankment, a control building and an energy dissipation structure located at the toe of the embankment. These structures are shown on Figures 6.12 and 6.13.

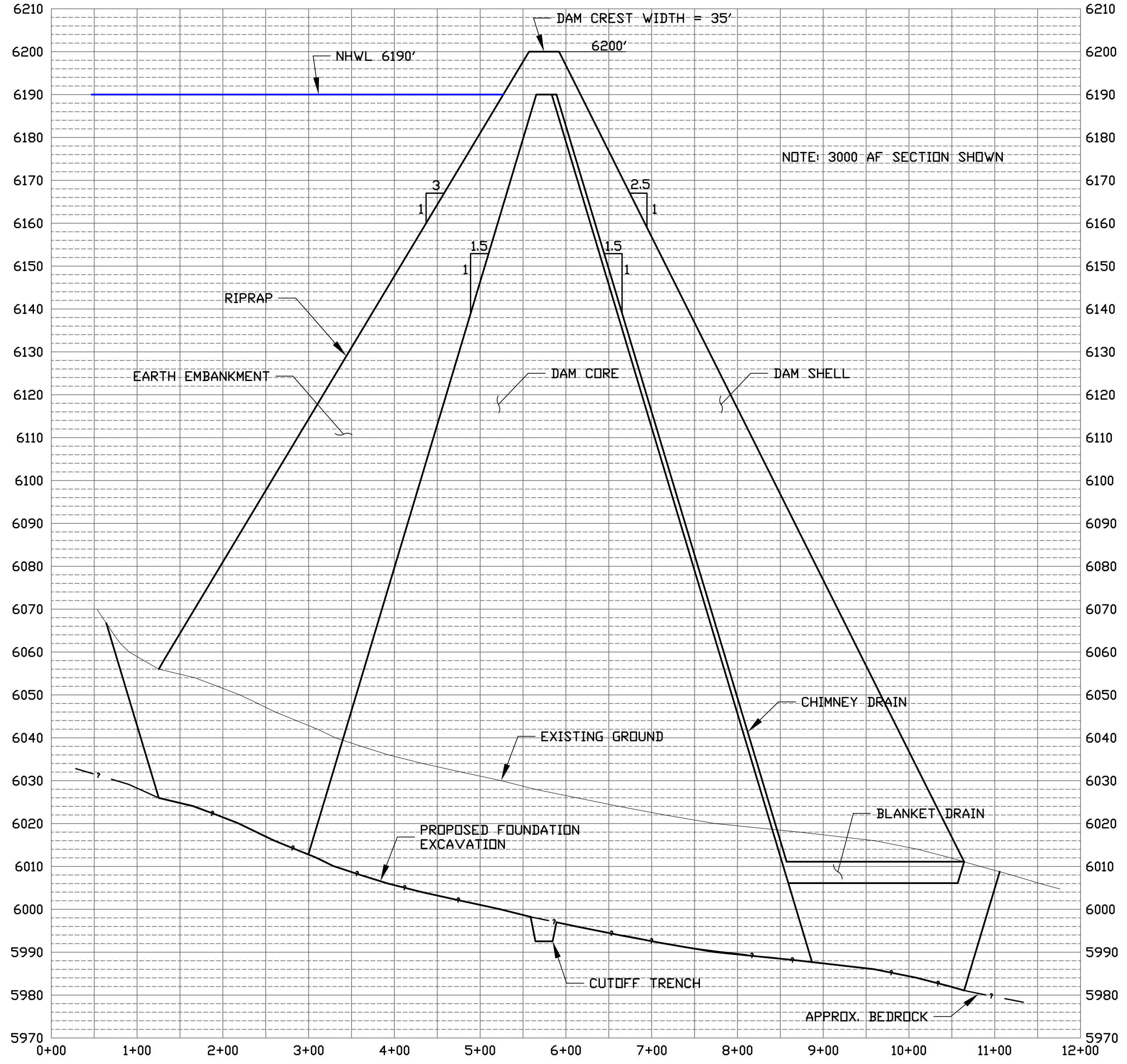
Material for the earth embankment dam could be borrowed from private land downstream of the reservoir site and from the spillway and foundation excavations. Haul distance to the off site borrow area is estimated at 1.4 miles.

Access roads would have to be constructed to the reservoir site. An existing Jeep trail located on Forest Service and private property could be improved to serve this purpose. This route would require 1.5 miles of improvements. Access from downstream along French Creek across private land is also an option. Approximately 2.5 mile of



PROPOSED DAM CENTERLINE PROFILE
EARTH EMBANKMENT





PROPOSED DAM MAXIMUM SECTION
EARTH EMBANKMENT

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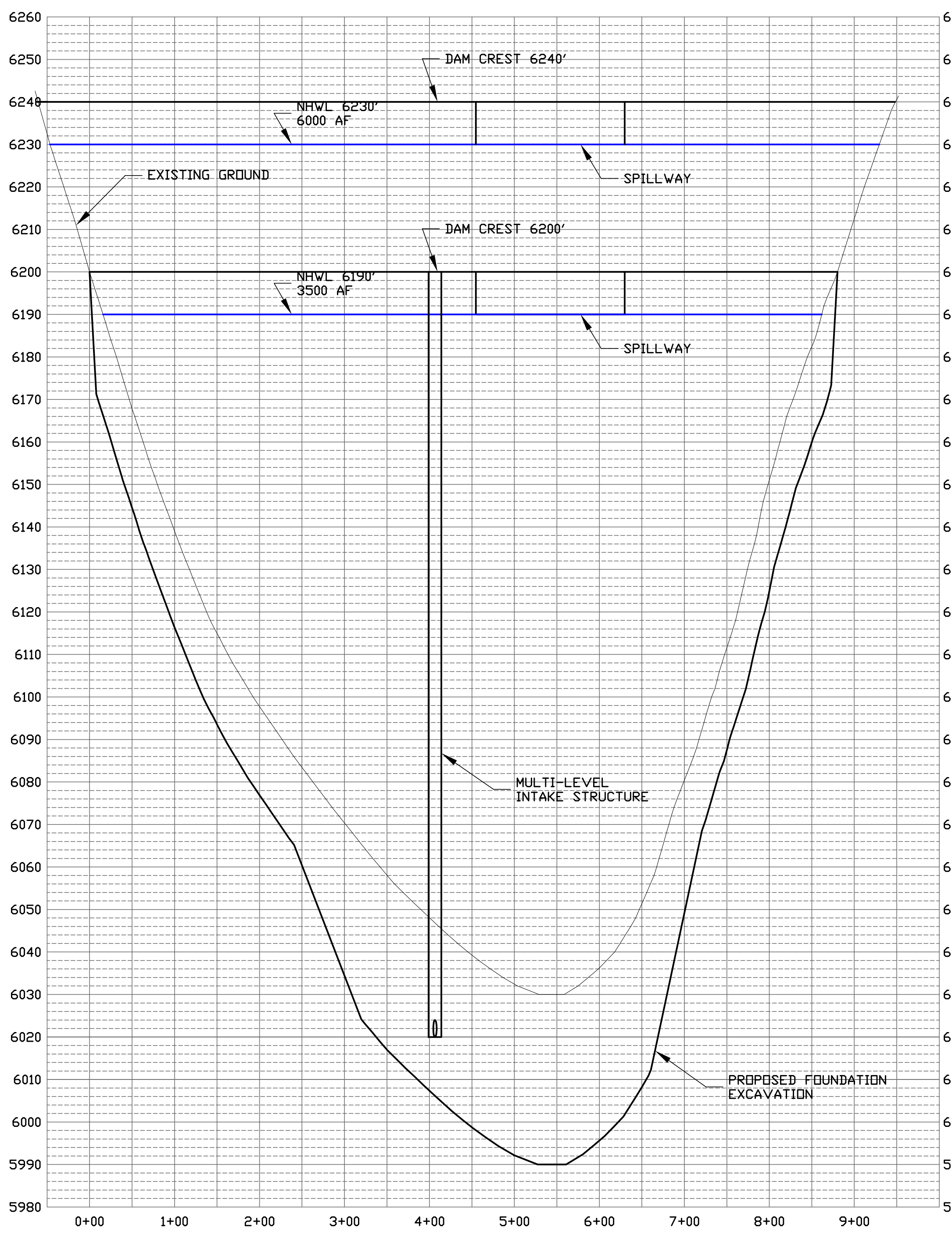
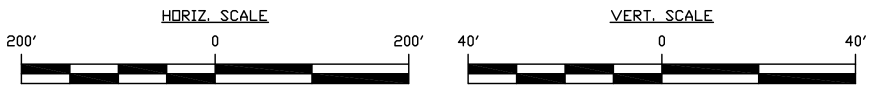
FIGURE 6.16
SITE 3 EARTH EMBANKMENT
SECTIONS – 3000AF

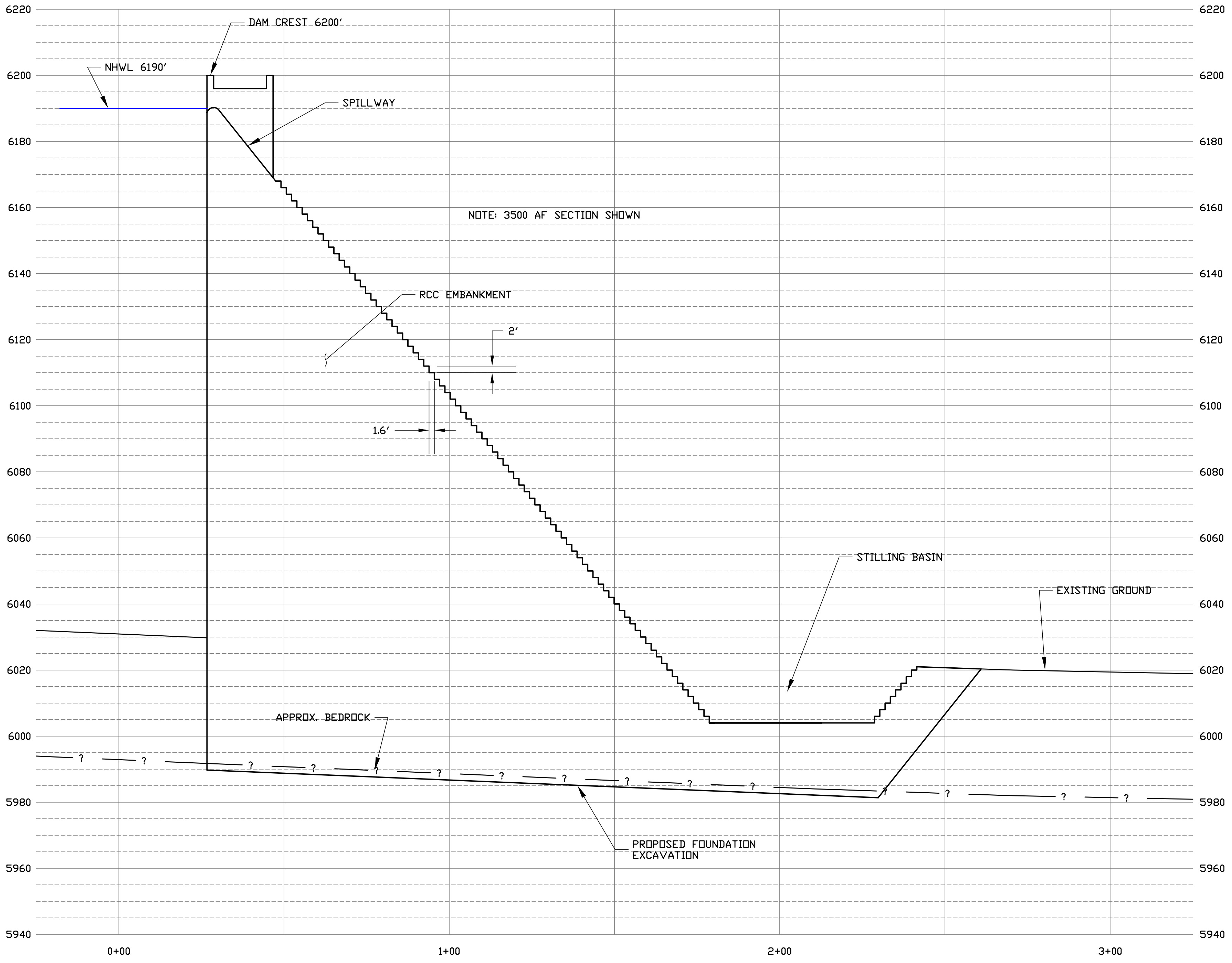
REVISION 1
PROJECT 522-WY
DRAWING 6-29

FILE NAME: SITE 3
SCALE: 1"=200'
OPERATOR: DWW
DATE: 07/08
PROJECT NO: 522-WY
TASK NO: 001-263
LOCATION: BUFFALO, WY
PROJECT: HOPKINS STORAGE
SEND TO: VICTOR E. ANDERSON
PHONE: (307) 634-7848



PROPOSED DAM CENTERLINE PROFILE
RCC EMBANKMENT - 3500AF





PROPOSED DAM MAXIMUM SECTION
RCC EMBANKMENT - 3500AF

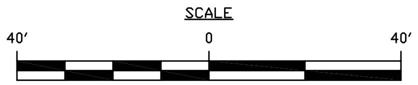


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FIGURE 6.17
SITE 3 RCC
SECTIONS - 3500AF

REVISION 1
PROJECT 522-WY
DRAWING 6-30

FILE NAME: SITE 3
SCALE: 1"=200'
OPERATOR: DWW
DATE: 07/08
PROJECT NO: 522-WY
TASK NO: 001-263
LOCATION: BUFFALO, WY
PROJECT: HOPKINS STORAGE
SEND TO: VICTOR E. ANDERSON
PHONE: (307) 634-7848

improvements would be required for access from the east. Total road improvements would be approximately four miles.

With Site No. 3's close proximity to the Forest Service boundary, there is potential for a land swap with the Forest Service.

6.3.7 Emergency Spillway

Conceptual design for the emergency spillway was developed. Spillway capacity must be designed according to the inflow design flood requirements, in this case the Probable Maximum Flood. Generation of the PMF begins with the development of the Probable Maximum Precipitation (PMP) using Hydrometeorological Report No. 55A. The PMP was generated for the local storm. The local storm generated higher peak flows and is characteristic of this region's intense isolated storm events. The index 1 hr 1 mi^2 PMP estimate adjusted for mean drainage elevation was determined. Then the depth-duration curve for 1 mi^2 was generated using the 1 mi^2 factors for durations up to six hours. Next the areal reduction factors were applied. The result was the PMP depth-duration curve for the drainage basin above Site 3.

The Natural Resources Conservation Service classifies soils into four Hydrologic Soil Groups based on the soil's potential for runoff. The four Hydrologic Soil Groups are A, B, C, and D. HSG A soils generally have the least runoff potential and HSG D soils have the greatest. Details for these classifications can be found in 'Urban Hydrology for Small Watersheds', Soil Conservation Service Technical Release 55 (June 1986). The drainage basin above Site 3 consists of HSG B. The soils in the basin are deep and well drained with moderate infiltration rates when thoroughly wetted. Runoff is generally slow to moderate. The drainage basin is comprised of woods and forest and range lands. Land cover is good and generally consisting of grasses and forbs and conifer and deciduous trees. The resulting pre-development Soil Conservation Service Curve Number based on land cover type, Hydrologic condition, and Hydrologic Soil Group is 60.

Hydrologic modeling of the drainage basin above Site 3 was completed to determine the PMF. Stormwater runoff simulation was completed using U.S. Army Corps of Engineers developed HEC-HMS 2.2.2 hydrologic modeling system. The Soil Conservation Service (SCS) Unit Hydrograph method was used to generate the basin outflow hydrograph. The PMP depth-duration curve along with the drainage basin area, basin lag time, and drainage basin curve number were required input parameters. Basin lag time can be related to time of concentration for ungaged watersheds by:

$$t_{lag} = 0.6\ t_c \tag{1}$$

Time of concentration is the time it takes for the most distant point in the watershed to contribute runoff at the design point. Runoff is assumed to travel as either sheet flow, shallow concentrated flow, and channel flow. Time of concentration is estimated as the sum of the travel times of these three types of flow. Flow velocities and basin geometry determine the time of concentration for the basin. The basin lag time was calculated to be 50 minutes. The drainage area for the basin is 11.9 mi^2.

The local storm PMF is estimated to generate 3050 ac-ft of water with a peak flow of 14,132 cfs at this site. This flood would be passed over the RCC dam through a spillway section as shown on Figure 6.17. For the earth embankment dam, the flood would be passed around the embankment through a 200' wide emergency spillway. The emergency spillway would be excavated into the rock adjacent to the left abutment of the embankment and discharge into the drainage below the toe of the dam as shown on Figure 6.16. This spillway could also act as the principal spillway.

6.3.8 Permitting

Site 3 would require filing an application for a permit to appropriate surface water with the State Engineer (SEO). This site would require Form S.W. 3 reservoir permit. In addition, the Wyoming SEO would, prior to construction, need to review the plans and specifications for dam safety approval and to provide approval to construct the proposed facility.

In addition to the Wyoming SEO permits and approval, there are additional permits and approvals required for new dam construction. The Army Corp of Engineers regulates activities involving the waters of the United States. It is anticipated that an Individual Section 404 Permit would be required. This would require that an Environmental Impact Statement be prepared and submitted along with the Section 404 application. These include a Wyoming Department of Environmental Quality National Pollution Discharge Elimination System (NPDES) permit and Section 401 Certification. This permit controls the discharge of stormwater pollutants associated with construction activities. The Section 401 Certification is the State's approval to ensure that the proposed activities meet state water quality standards and do not degrade water quality. A Forest Service Special Use permit would be required to construct a reservoir on Forest Service property. U.S. Fish and Wildlife Service Endangered Species Act Compliance (Section 7) would be required. Coordination with the U.S. Department of Interior Advisory Council on Historic Preservation (Section 106), which protects cultural and historic resources, would be required. State of Wyoming Historic Preservation Office (SHPO) archaeological clearance which determines significance of cultural resources potentially affected by ground disturbing activities would be required.

6.3.9 Wetland Impacts

Site No. 3 has very minimal amounts of wetlands. Wetlands are limited to narrow fringes one to two feet wide in places along the stream. Most wetlands are wet meadows with little shrub cover. The presence of a cobble stream bottom and steep banks along the channel limit wetland formation in this area. Total wetland impacts at this site would likely be less than 0.5 acres. These impacts would have to be mitigated. They could possibly be mitigated downstream of the dam.

6.3.10 Sensitive Species, Migratory Birds, Riparian Areas, and Big Game Habitat Impacts

The presence of federally-listed species does not appear to be a major issue for Site No. 3. Several sensitive wildlife and plant species occur in the area, and some of these species may be present on the reservoir site. As this reservoir is located on the Bighorn National Forest, surveys for sensitive species would likely be required. Impacts to sensitive species, if present, can likely be mitigated.

No raptor nests were observed during the site visit, but this site is partially forested and nests would have been difficult to detect. Surveys would likely be required for raptor nests prior to construction activities. These surveys may include broadcasting taped calls to locate nest of such species as northern goshawk.

This site has some woody riparian areas along the stream within the inundation area. In general, these woody riparian areas are fairly narrow and there are no extensive areas of wood riparian vegetation. Common species include cottonwood, aspen, alder, and mountain maple. Mitigation for woody riparian areas may be required.

This site occurs in an area designated as crucial winter range for elk. The Wyoming Game and Fish Department may request mitigation if a reservoir is constructed on elk crucial winter range. Portions of Site 3 are within moose winter-yearlong range. Site 3 is within mule deer winter-yearlong range, but not crucial winter range.

6.3.11 Cultural Impacts

A class I cultural resource survey of the Site No. 3 Reservoir was performed by the Office of the Wyoming State Archaeologist. The purposes of the class I survey are to document all previously recorded sites and to provide an assessment of the potential for cultural resources in the reservoir area. A file search of the Wyoming State Historical Preservation Office (SHPO), Cultural Records Office database in Laramie, Wyoming, was conducted on September 13, 2007. Previously recorded historical sites at this reservoir site include 48JO1603, the Fort McKinney Wood Reservation Road which has been recommended as not eligible to the National Register of Historic Places (NRHP), and 48JO3777, a historic mining site which has also been recommended as not eligible to the National Register of Historic Places. These historical sites are shown on Figure 2. Given the results of the SHPO file search, the overall topographic setting, and evidence of prior ground disturbance, it is possible to predict with some confidence the density and kinds of cultural sites that may be found in the proposed development areas. Prehistoric sites are expected along the valley of French Creek and its major tributaries. The potential number of prehistoric sites is expected to be small, however. This is due to the small size of the reservoir sites, relatively narrow valleys cut by French Creek and its tributaries, and expected dense vegetation in the reservoir site. Surface artifact scatters are the type of prehistoric sites expected.

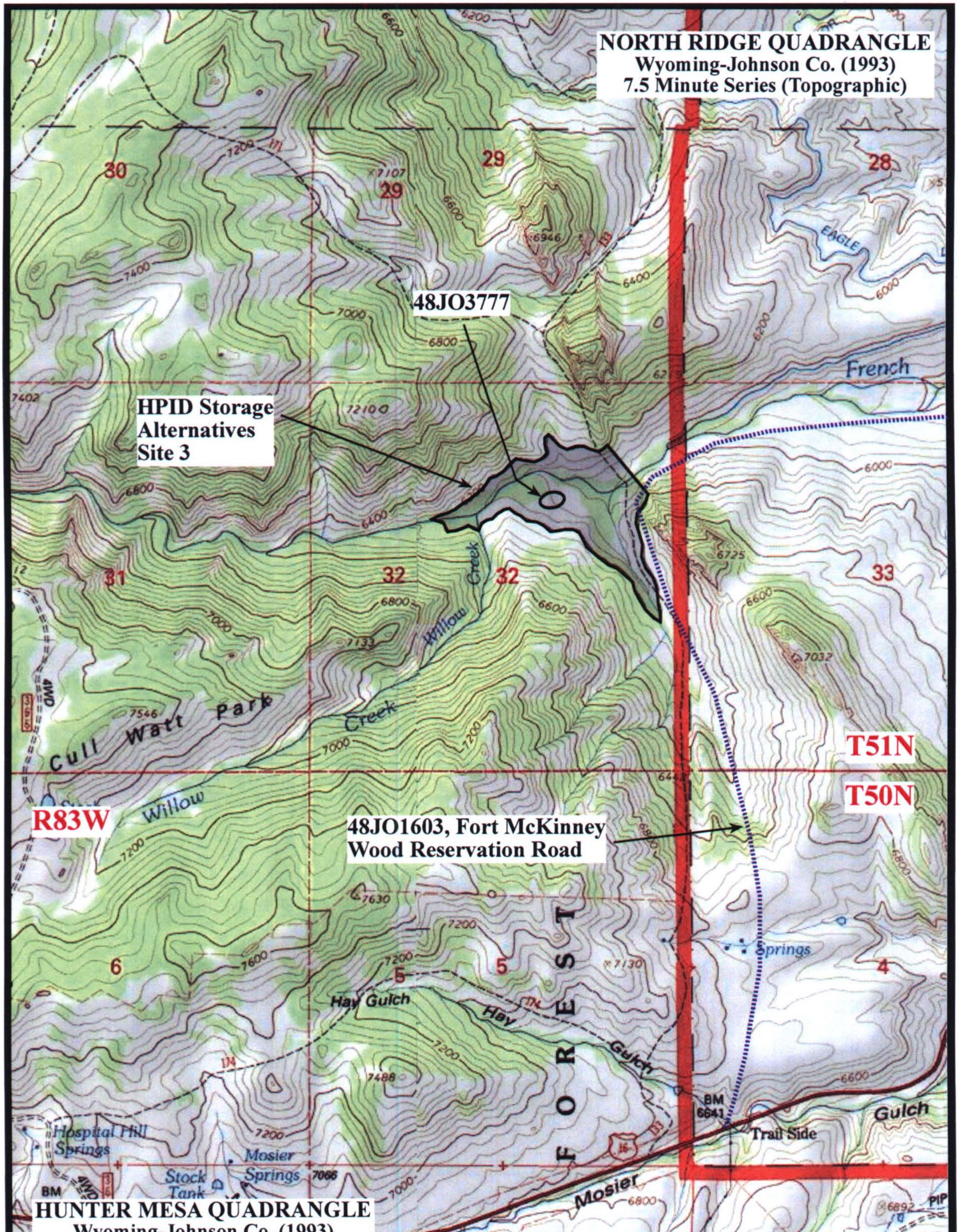


Figure 2. Map of project area and sites, HPID Storage Alternatives, Site 3.

6.3.12 Fishery Impacts

Construction of a reservoir at Site No. 3 would inundate approximately 0.7 miles of stream. In this reach, French Creek is classified as a Class 3 fishery, which is considered important trout waters and a fishery of regional importance. French Creek is a non-native fishery containing mostly brook and rainbow trout. Impacts to the stream would be required to be mitigated. As discussed in section 6, French Creek fishery habitats both above and below the dam site could be improved as mitigation.

6.3.13 Public Involvement

If further study of this project is pursued, all parties that could benefit or be affected should be involved. This includes the Hopkins Producers ID, other irrigators on French Creek, Clear Creek, Johnson Creek, and Rock Creek, the City of Buffalo, and the National Forest Service. A key component in the success of any project is keeping affected parties and stakeholders informed and involved on project activities. This project will need to have public support in order to come to fruition.

6.3.14 Preliminary Cost Estimates

Preliminary cost estimates were developed for the two alternative dam types and three alternative reservoir sizes at Reservoir Site No. 3. The cost estimates were developed utilizing the standard format to estimate the total project costs. The cost estimates are shown in Tables 6.9, 6.10, 6.11, 6.12, and 6.13. The information is presented in graphical form in Figure 6.18. This figure allows for cost estimates comparisons of other sizes of reservoirs.

Table 6.9 - Site Number 3 - Earth Embankment - 3000 ac-ft, Crest Elev: 6200', NHWL: 6190'

No.	Item	Units	Estimated Quantity	Unit Cost	Cost
1	Mobilization	L.S.	--	--	$1,600,000
2	Clearing	Ac.	50	$2,000.00	$100,000
3	Stream Diversion	L.S.	--	--	$200,000
4	Dewatering	L.S.	--	--	$250,000
5	Foundation Excavation, Earth	C.Y.	575,000	$4.00	$2,300,000
6	Foundation Excavation, Key Trench	C.Y.	5,000	$20.00	$100,000
8	Embankment	C.Y.	2,200,000	$7.50	$16,500,000
9	Outlet Works	L.S.	--	--	$3,000,000
10	Emergency Spillway	C.Y.	500,000	$10.00	$5,000,000
11	Access Road Construction	Mi.	4.0	$100,000.00	$400,000
12	Wetlands Mitigation	Ac.	1.00	$100,000.00	$100,000
13	Riparian Mitigation	Ac.	15	$50,000.00	$750,000
14	Fishery Mitigation	L.S.	--	--	$250,000
15	Revegetation	Ac.	60	$2,000.00	$120,000
16	N. Clear Creek Diversion and Pipeline	L.S.	--	--	$2,390,000
	Construction Cost Sub-Total:				**$33,060,000**
	10% Engineering:				$3,306,000
	Sub-Total:				**$36,366,000**
	15% Contingency:				$5,454,900
	CONSTRUCTION COST TOTAL:				**$41,820,900**
	Preparation of Final Designs and Specifications:				$1,600,000
	Permitting:				$500,000
	Legal Fees:				$100,000
	Acquisition of Access and Rights of Way:				$200,000
	TOTAL PROJECT COST:				**$44,220,900**
	USE:				**$43.3M**

Table 6.10 - Site Number 3 - RCC - 3500 ac-ft, Crest Elev: 6200', NHWL: 6190'

No.	Item	Units	Estimated Quantity	Unit Cost	Cost
1	Mobilization	L.S.	--	--	$1,900,000
2	Clearing	Ac.	50	$2,000.00	$100,000
3	Stream Diversion	L.S.	--	--	$200,000
4	Dewatering	L.S.	--	--	$250,000
5	Foundation Excavation, Earth	C.Y.	100,000	$4.00	$400,000
6	Foundation Excavation, Rock	C.Y.	7,500	$10.00	$75,000
7	Foundation Prep and Grouting	L.S.	--	--	$2,000,000
8	Dam RCC	C.Y.	300,000	$90.00	$27,000,000
9	Outlet Works	L.S.	--	--	$2,000,000
10	Spillway	L.S.	--	--	$850,000
11	Access Road Construction	Mi.	4.0	$100,000.00	$400,000
12	Wetllands Mitigation	Ac.	1.00	$100,000.00	$100,000
13	Riparian Mitigation	Ac.	15	$50,000.00	$750,000
14	Fishery Mitigation	L.S.	--	--	$250,000
15	Revegetation	Ac.	20	$2,000.00	$40,000
16	N. Clear Creek Diversion and Pipeline	L.S.	--	--	$2,390,000
				Construction Cost Sub-Total:	**$38,705,000**
				10% Engineering:	$3,870,500
				Sub-Total:	**$42,575,500**
				15% Contingency:	$6,386,325
				CONSTRUCTION COST TOTAL:	**$48,961,825**
				Preparation of Final Designs and Specifications:	$1,900,000
				Permitting:	$500,000
				Legal Fees:	$100,000
				Acquisition of Access and Rights of Way:	$200,000
				TOTAL PROJECT COST:	**$51,661,825**
				USE:	**$50.7M**

Table 6.11 - Site Number 3 - Earth Embankment - 5500 ac-ft, Crest Elev: 6240', NHWL: 6230'

No.	Item	Units	Estimated Quantity	Unit Cost	Cost
1	Mobilization	L.S.	--	--	$2,200,000
2	Clearing	Ac.	60	$2,000.00	$120,000
3	Stream Diversion	L.S.	--	--	$200,000
4	Dewatering	L.S.	--	--	$250,000
5	Foundation Excavation, Earth	C.Y.	800,000	$4.00	$3,200,000
6	Foundation Excavation, Key Trench	C.Y.	6,000	$20.00	$120,000
8	Embankment	C.Y.	3,500,000	$7.50	$26,250,000
9	Outlet Works	L.S.	--	--	$2,500,000
10	Emergency Spillway	C.Y.	550,000	$10.00	$5,500,000
11	Access Road Construction	Mi.	4.0	$100,000.00	$400,000
12	Wetlands Mitigation	Ac.	1.50	$100,000.00	$150,000
13	Riparian Mitigation	Ac.	20	$50,000.00	$1,000,000
14	Fishery Mitigation	L.S.	--	--	$250,000
15	Revegetation	Ac.	70	$2,000.00	$140,000
16	N. Clear Creek Diversion and Pipeline	L.S.	--	--	$2,390,000
Construction Cost Sub-Total:					**$44,670,000**
10% Engineering:					$4,467,000
Sub-Total:					**$49,137,000**
15% Contingency:					$7,370,550
CONSTRUCTION COST TOTAL:					**$56,507,550**
Preparation of Final Designs and Specifications:					$2,200,000
Permitting:					$500,000
Legal Fees:					$100,000
Acquisition of Access and Rights of Way:					$200,000
TOTAL PROJECT COST:					**$59,507,550**
USE:					**$58.2M**

Table 6.12 - Site Number 3 - RCC - 6000 ac-ft, Crest Elev: 6240, NHWL: 6230'

No.	Item	Units	Estimated Quantity	Unit Cost	Cost
1	Mobilization	L.S.	--	--	$2,700,000
2	Clearing	Ac.	60	$2,000.00	$120,000
3	Stream Diversion	L.S.	--	--	$200,000
4	Dewatering	L.S.	--	--	$250,000
5	Foundation Excavation, Earth	C.Y.	130,000	$4.00	$520,000
6	Foundation Excavation, Rock	C.Y.	10,000	$10.00	$100,000
7	Foundation Prep and Grouting	L.S.	--	--	$2,000,000
8	Dam RCC	C.Y.	470,000	$80.00	$37,600,000
9	Outlet Works	L.S.	--	--	$2,500,000
10	Spillway	L.S.	--	--	$1,000,000
11	Access Road Construction	Mi.	4.0	$100,000.00	$400,000
12	Wetlands Mitigation	Ac.	1.50	$100,000.00	$150,000
13	Riparian Mitigation	Ac.	20	$50,000.00	$1,000,000
14	Fishery Mitigation	L.S.	--	--	$250,000
15	Revegetation	Ac.	25	$2,000.00	$50,000
16	N. Clear Creek Diversion and Pipeline	L.S.	--	--	$2,390,000
	Construction Cost Sub-Total:				**$51,230,000**
	10% Engineering:				$5,123,000
	Sub-Total:				**$56,353,000**
	15% Contingency:				$8,452,950
	CONSTRUCTION COST TOTAL:				**$64,805,950**
	Preparation of Final Designs and Specifications:				$2,700,000
	Permitting:				$500,000
	Legal Fees:				$100,000
	Acquisition of Access and Rights of Way:				$200,000
	TOTAL PROJECT COST:				**$68,305,950**
	USE:				**$72.9M**

Table 6.13 - Site Number 3 - Earth Embankment - 7500 ac-ft, Crest Elev: 6260', NHWL: 6250'

No.	Item	Units	Estimated Quantity	Unit Cost	Cost
1	Mobilization	L.S.	--	--	$2,500,000
2	Clearing	Ac.	70	$2,000.00	$140,000
3	Stream Diversion	L.S.	--	--	$200,000
4	Dewatering	L.S.	--	--	$250,000
5	Foundation Excavation, Earth	C.Y.	900,000	$4.00	$3,600,000
6	Foundation Excavation, Key Trench	C.Y.	7,000	$20.00	$140,000
8	Embankment	C.Y.	4,500,000	$7.50	$33,750,000
9	Outlet Works	L.S.	--	--	$2,750,000
10	Emergency Spillway	C.Y.	600,000	$10.00	$6,000,000
11	Access Road Construction	Mi.	4.0	$100,000.00	$400,000
12	Wetlands Mitigation	Ac.	2.00	$100,000.00	$200,000
13	Riparian Mitigation	Ac.	25	$50,000.00	$1,250,000
14	Fishery Mitigation	L.S.	--	--	$300,000
15	Revegetation	Ac.	80	$2,000.00	$160,000
16	N. Clear Creek Diversion and Pipeline	L.S.	--	--	$2,390,000
				Construction Cost Sub-Total:	**$54,030,000**
				10% Engineering:	$5,403,000
				Sub-Total:	**$59,433,000**
				15% Contingency:	$8,914,950
				CONSTRUCTION COST TOTAL:	**$68,347,950**
				Preparation of Final Designs and Specifications:	$2,500,000
				Permitting:	$500,000
				Legal Fees:	$100,000
				Acquisition of Access and Rights of Way:	$200,000
				TOTAL PROJECT COST:	**$71,647,950**
				USE:	**$71.6M**

6.3.15 Reservoir Alternative Size Comparison

The reservoir size alternatives analyzed for Site 3 are compared in Table 6.14. As indicated, the 10,000 AF earth reservoir has the lower unit cost per acre-foot of storage. The comparison of the unit cost per acre-foot of yield indicates that the 5,500-7,500 AF reservoir size range has the lowest unit cost as shown on Figure 6.19. This site would be most economically developed at the 5,500-7,500 AF size range alternative.

Table 6.14 - Site No. 3 Alternatives Comparison

Dam Type	Total Capacity	Est. Cost	Storage Unit Cost	Active Capacity	Est. Yield	Unit Cost Yield
	AF	$Mil	$/AF	AF	AF/Yr	$/AF Yield
RCC	3,500	$51.7	$14,761	2450	2230	$23,167
RCC	6,000	$68.3	$11,384	4200	3630	$18,817
Earth	3,000	$44.2	$14,740	2100	1950	$22,677
Earth	5,500	$59.5	$10,820	3850	3350	$17,763
Earth	7,500	$71.6	$9,553	5250	4000	$17,912
Earth	10,000	$86.9	$8,690	7000	4000	$21,725

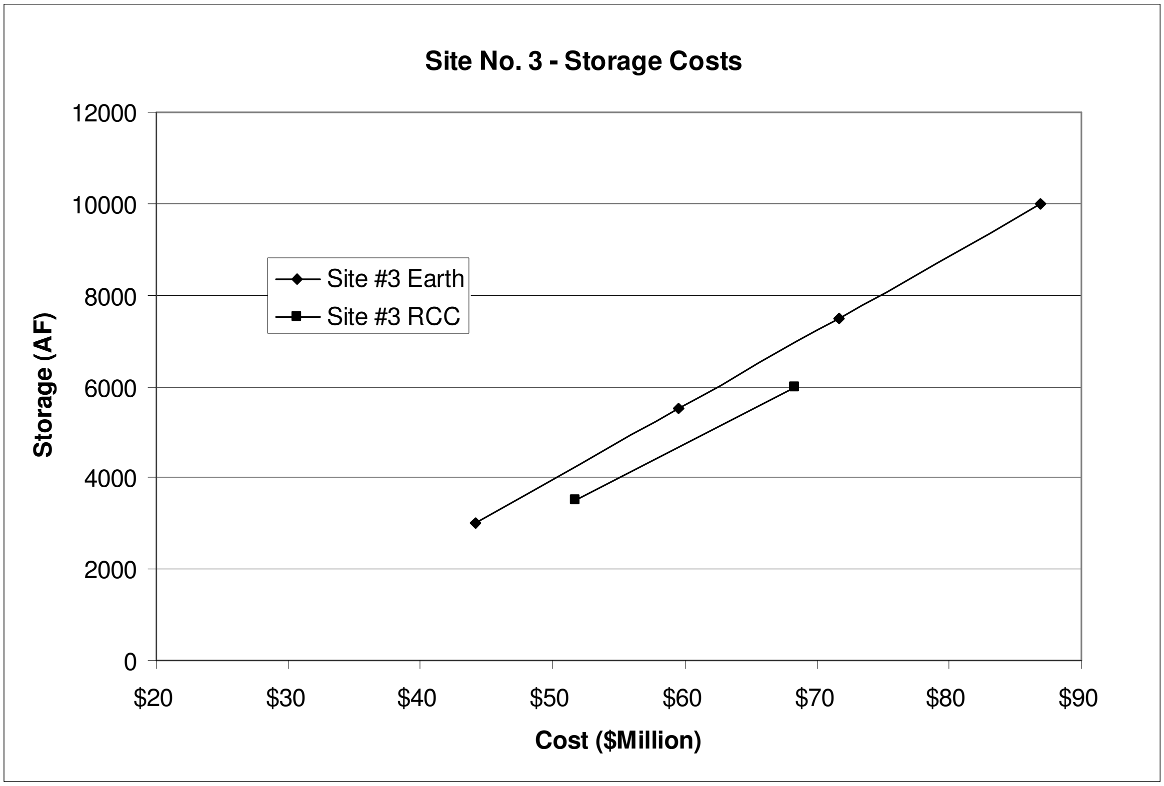


Figure 6.18 Site #3 Storage Costs

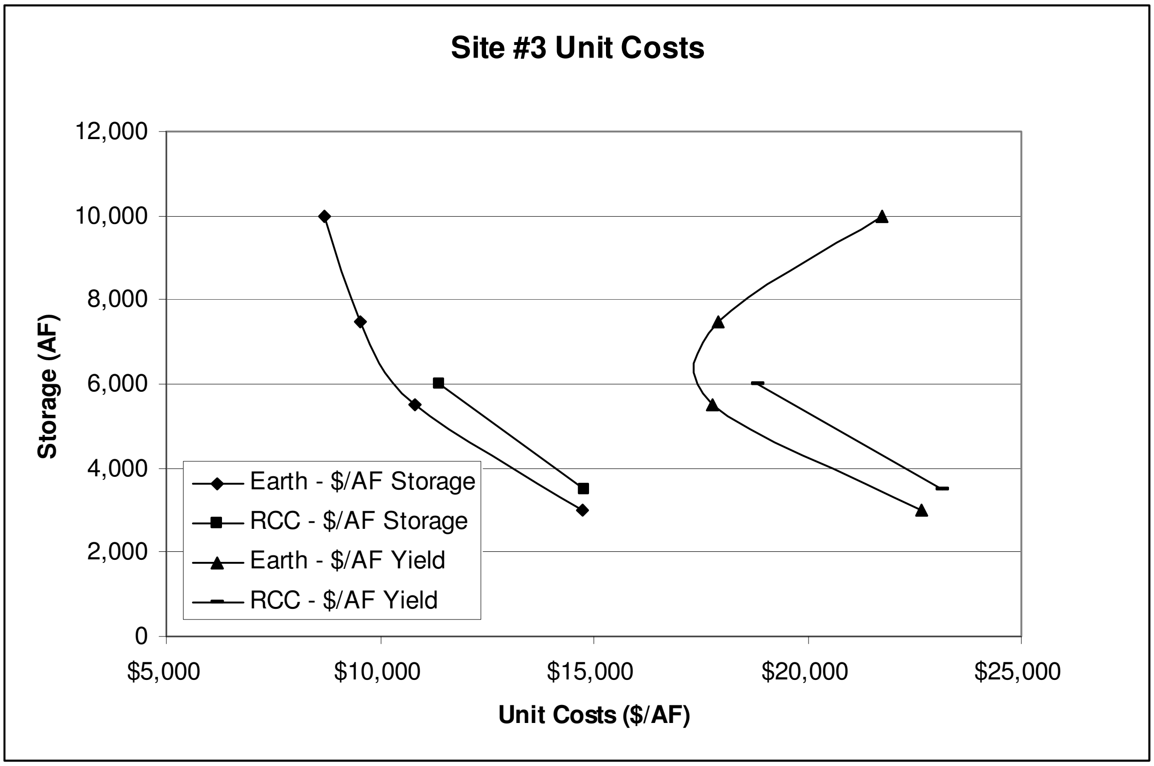


Figure 6.19 Site No. 3 Unit Costs

6.3.16 Project Financing

The current financing package offered by the Wyoming Water Development Commission is 67% grant, 33% loan at 4% for a case specific term not to exceed 50 years. The Commission has the ability in their criteria to grant up to 75%. The Commission has the authority with Wyoming Legislature approval to grant 100% of the total project costs. In order to achieve this level of financing the project would have to give significant benefit to the State of Wyoming. Additional funding sources may include the NRCS.

Assuming a 67% WWDC grant and 33% loan at 4% for 50 years, the annual repayment would be as follows:

Table 6.15 - Site No. 3 Annual Repayment

Dam Type	Total Capacity	Est. Cost	Annual Repayment
	AF	$Mil	$/Yr
RCC	3500	$51.7	$802,400
RCC	6000	$68.3	$1,060,913
Earth	3000	$44.2	$686,829
Earth	5500	$59.5	$924,258
Earth	7500	$71.6	$1,112,820
Earth	10000	$86.9	$1,349,712

6.3.17 Summary

Site No. 3 would be a multipurpose facility located on the Bighorn National Forest. Site No. 3 is most efficient based on the water availability and project cost in the 5,500-7,500 AF range. With the anticipated availability of fine grain material, an earth embankment at this location would be the most economical dam. The cultural resources in the vicinity are likely not fatal flaws but may require mitigation. Wetland impacts at this site are minimal but will likely require mitigation. Riparian impacts are present at this site and will likely require mitigation. This site is within crucial winter range for elk which will likely require mitigation. The design flood at this site is relatively large requiring a relatively substantial spillway. Access to the site requires improvement of an existing Forest Service road and improvement of a private road. The reservoir is sited on the Bighorn National Forest which will require a special use permit and will likely be more difficult to permit. This site is recommended for further study if any alternatives are pursued.

6.8 Site No. 8 Preliminary Analysis

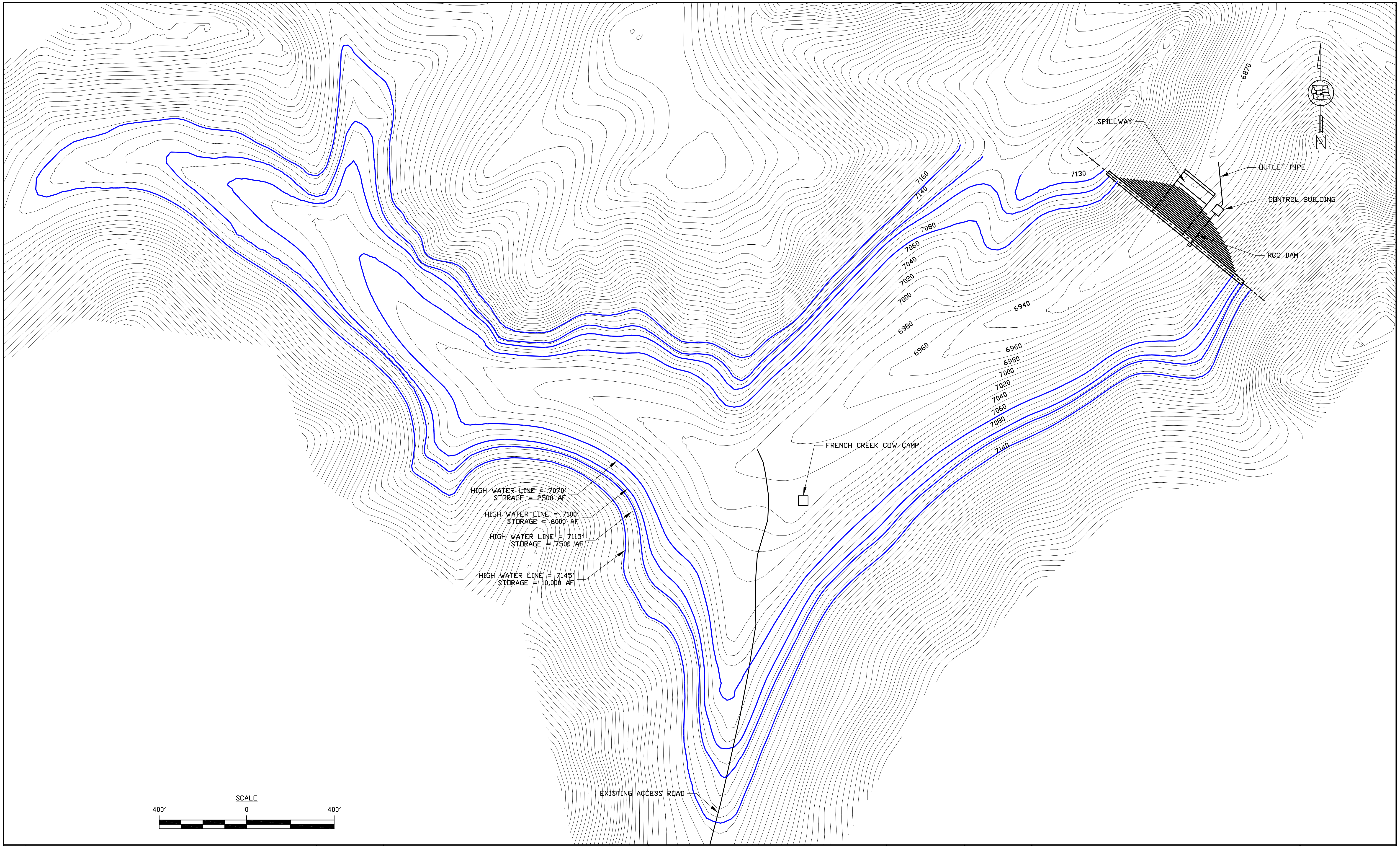
6.8.1 Introduction

Site No. 8 is located on French Creek on US Forest Service property as shown on Figure 6.33 and 6.34. Site No. 8 is located in Section 36, Township 51 North, Range 84 West. The reservoir would be supplied by flows from the North Fork of Clear Creek and French Creek. 2500, 5500, 7500 and 10,000 ac-ft reservoirs were analyzed and preliminary designs and cost estimates were developed.

This site could be a multiple-use reservoir. The reservoir yield could be utilized in the French Creek, Johnson Creek, lower Rock Creek, and Clear Creek drainages for irrigation supplementary flows, municipal purposes, environmental uses, and recreation. Benefits to the Hopkins Producers ID and other downstream irrigators could be achieved with additional late season water. This water could be transferred to Clear Creek (see section 7) to be utilized for future municipal needs of the City of Buffalo and additional hydropower generation, supplemental irrigation water, and instream flows through Buffalo, and could delay regulation on the Clear Creek drainage. A minimum pool could be maintained in the reservoir to promote recreation and a fishery. Stream fishing improvements on French Creek could also be realized with the project. The analysis of the reservoir alternatives is discussed in detail in the following sections.

6.8.2 Reservoir Capacity

Elevation-area-capacity data was developed for this site. The capacity-elevation curve is shown on Figure 6.35. For this analysis, 2,500AF, 5,500AF, 7,500AF, and 10,000AF reservoirs were addressed. The reservoirs were assumed to incorporate a recreation pool of approximately 30% of the total storage. Consequently, the 2500AF reservoir would have 1,750AF of active storage and the 5,500AF, 7,500AF, and 10,000AF reservoirs would have 3,850AF, 5,250AF, and 7,000AF of active storage respectively.



REV	DESCRIPTION OF REVISION	BY	DATE
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△			
△			
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1	PRELIMINARY DESIGN	DWW	07/08

FILE NAME: SITE 3
SCALE: 1"=300'
OPERATOR: DWW
DATE: 07/08
PROJECT NO: 522–WY
TASK NO: 001–263
LOCATION: BUFFALO, WY
PROJECT: HOPKINS STORAGE
SEND TO: VICTOR E. ANDERSON
PHONE: (307) 634–7848

STATES WEST WATER
RESOURCES CORPORATION

1904 E. 15th STREET
CHEYENNE, WYOMING 82001
(307) 634–7848
FAX: (307) 634–7851

WARNING

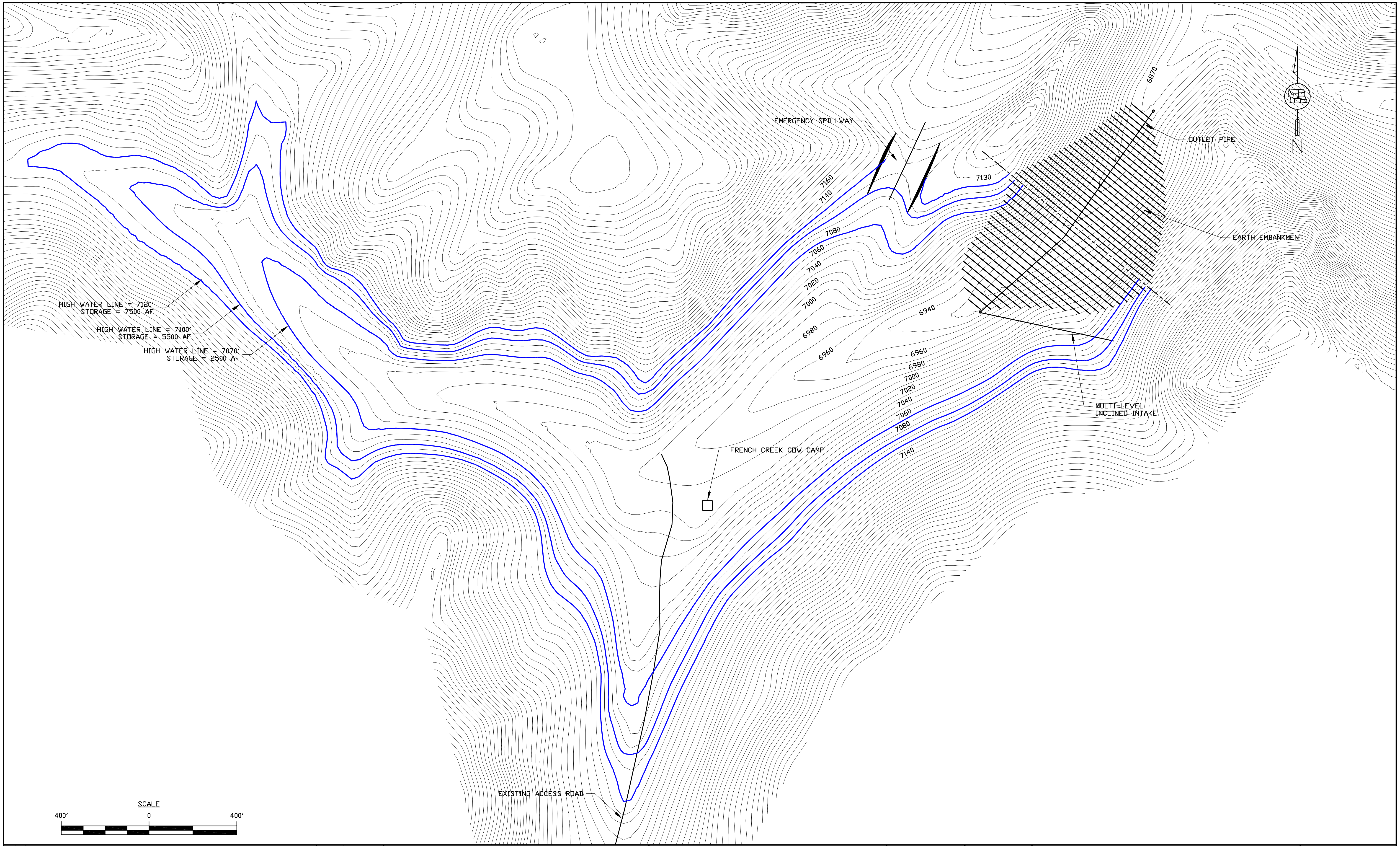
IF THIS BAR DOES
NOT MEASURE 1/2"
THEN DRAWING IS
NOT TO SCALE

DESIGNED DWW
DRAWN DWW
CHECKED VEA
PEER REVIEWED VEA
PROJECT MANAGER VEA
DATE 07/08

HOPKINS PRODUCERS ID STORAGE PROJECT

FIGURE 6.33
SITE 8 RCC
SITE PLAN – 6000AF

REVISION 1
PROJECT 522–WY
DRAWING 6–80



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1	PRELIMINARY DESIGN	DWW	07/08
REV	DESCRIPTION OF REVISION	BY	DATE

STATES WEST WATER
RESOURCES CORPORATION

1904 E. 15th STREET
CHEYENNE, WYOMING 82001
(307) 634-7848
FAX: (307) 634-7851

WARNING

IF THIS BAR DOES
NOT MEASURE 1/2"
THEN DRAWING IS
NOT TO SCALE

DESIGNED	DWW
DRAWN	DWW
CHECKED	VEA
PEER REVIEWED	VEA
PROJECT MANAGER	VEA
DATE	07/08

HOPKINS PRODUCERS ID STORAGE PROJECT

FIGURE 6.34
SITE 8 EARTH EMBANKMENT
SITE PLAN – 5500AF

REVISION 1
PROJECT 522-WY
DRAWING 6-81

FILE NAME: SITE 3	OPERATOR: DWW	PROJECT NO: 522-WY	LOCATION: BUFFALO, WY	SEND TO: VICTOR E. ANDERSON
SCALE: 1"=300'	DATE: 07/08	TASK NO: 001-263	PROJECT: HOPKINS STORAGE	PHONE: (307) 634-7848

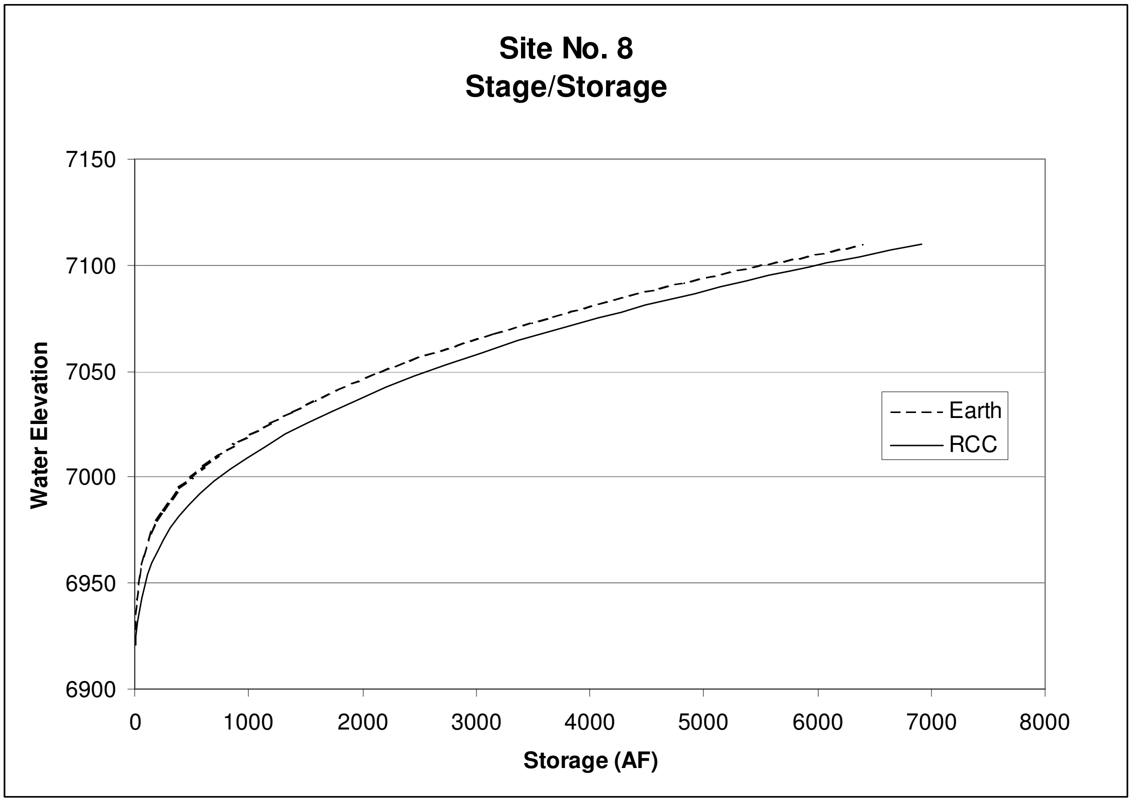


Figure 6.35 – Site No. 8 Capacity-Elevation Curve

6.8.3 Water Supply

The potential water supply for a reservoir at Site No. 8 would be from available flows on French Creek and available flows from the North Fork of Clear Creek. The North Fork of Clear Creek water supply analysis is discussed in detail in section 6. The hydrological analysis estimated the available storable flows for dry, average, and wet years as shown below:

	French Creek	North Fork Clear Creek	Total
Dry Years	100-250 AF	500-900 AF	600-1150 AF
Average Years	300-700 AF	2800-3500 AF	3100-4200 AF
Wet Years	400-800 AF	3500-4300 AF	3900-5100 AF

6.8.4 Reservoir Yield

The potential yield of the reservoir alternative sizes were estimated in the hydrological analysis as shown on Figure 6.36. The estimated average annual yields of the 2,500 AF reservoir with an active capacity of 1,750AF would be approximately 1,630AF. The estimated average annual yield with an active capacity of 3,850AF would be approximately 3,310AF. The estimated average annual yield with an active capacity of 5,250AF and 7,000AF would be approximately 3,590AF.

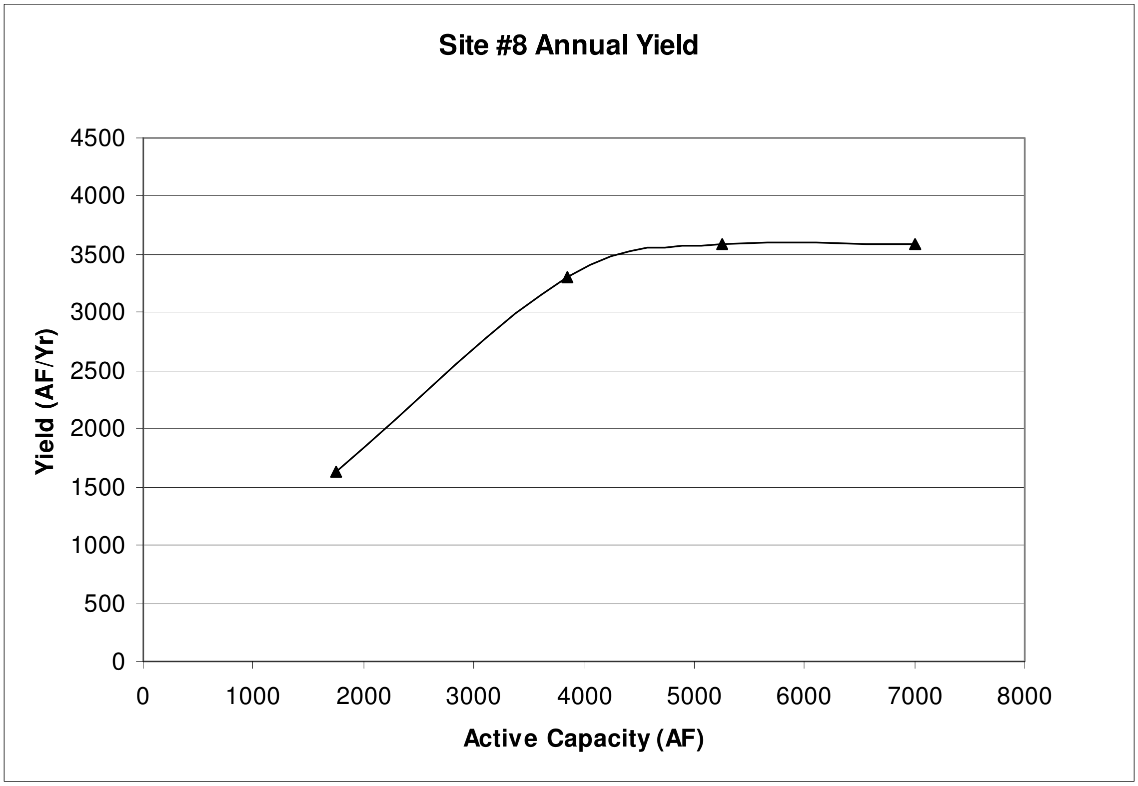


Figure 6.36 Annual yield vs. active capacity at Site No. 8

6.8.5 Geologic and Geotechnical Investigation

Site No. 8 is located in a narrow, very steep V-shaped valley with French Creek flowing through. The bedrock is Precambrian granite. The valley bottom was filled with silty sand and gravel and numerous boulders. Depth to bedrock is probably 30 feet or greater in the valley bottom and 5 feet to 15 feet on the abutments. The site has a heavy tree cover.

A dam from 190 to 230 feet high was analyzed. At least three types of dams, homogeneous or zoned earth embankment, concrete faced rockfill, and roller compacted concrete, appear to be applicable to the site.

There would have to be a sufficient amount of fines, 10% or greater, in the granular soils in the reservoir area to construct a homogeneous or zoned earth embankment dam. For an embankment dam, the crest width should be at least the height of the dam divided by 5 plus 10 feet. Therefore, the dam crest should be at least 56 feet wide. The exterior slopes should be 3H:1V or flatter on the upstream face and 2.5H:1V or flatter on the downstream face. If a core is used, the core should have upstream and downstream slopes of 1.5H:1V or flatter. Any of the granular soils may be used for the exterior shells and the granular soils with at least 10% fines should be used for the core. Down stream of the core, a 3-foot wide chimney drain and a 5-foot thick blanket drain should be installed. Foundation preparation should consist of excavation of the soils from beneath the entire footprint of the dam down to the bedrock. The excavation depths are estimated to be 15 feet on the abutments and 30 feet in the valley bottom. A 5-foot deep cutoff trench should be excavated below the dam centerline with a width of at least 10 feet and 1H:1V side slopes.

The site is suitable for the construction of a concrete faced rockfill dam similar in design to the Deer Creek Dam. The rock for the fill and the concrete face aggregate is available on site both as granular soils and quarried rock. The upstream and downstream slopes of the rockfill should be 1.3H:1V or flatter. The reinforced concrete facing should be at least 12 inches thick. Foundation preparation should consist of excavation of the soils from beneath the entire footprint of the dam down to the bedrock. The excavation depths are estimated to be 15 feet on the abutments and 30 feet in the valley bottom.

The site is suitable for the construction of a roller compacted concrete (RCC) dam similar in design to the Tie Hack Dam. The rock for the concrete aggregate is available on site both as granular soils and quarried rock. Foundation preparation should consist of excavation of the soils from beneath the entire footprint of the dam at least 2 feet into the sound bedrock. The excavation depths are estimated to be 20 feet on the abutments and 40 feet in the valley bottom.

6.8.6 Dam and Reservoir Preliminary Design

Both the roller-compacted concrete (RCC) dam and earth embankment concepts were utilized for development of preliminary designs, as shown in Figures 6.33 and 6.34. The 2,500AF, 5,500AF, 7,500AF, and 10,000AF sizes were analyzed for RCC, and the 2,500AF, 5,500AF, and 7,500AF sizes were analyzed for earth embankment. It is unknown if adequate fill material is available at the site for the earth embankment concept. The concrete faced rockfill dam was not analyzed due to the history of RCC dams being more economical.

The outlet works for the RCC dam would consist of a multi-level intake attached to the upstream face of the dam, a conduit through the RCC dam, and a control valve structure located at the downstream toe of the dam. The locations of these structures are shown on Figure 6.33. The outlet works for the earth embankment would consist of an inclined multilevel intake structure, a conduit through the embankment, a control building and an energy dissipation structure located at the toe of the embankment. These structures are shown on Figure 6.34.

Access to the reservoir site could be via an existing road located on Forest Service property. The route would require approximately 2 miles of improvements.

6.8.7 Emergency Spillway

Conceptual design for the emergency spillway was developed. Spillway capacity must be designed according to the inflow design flood requirements, in this case the Probable Maximum Flood. Generation of the PMF begins with the development of the Probable Maximum Precipitation (PMP) using Hydrometeorological Report No. 55A. The PMP was generated for the local storm. The local storm generated higher peak flows and is characteristic of this region's intense isolated storm events. The index 1 hr 1 mi^2 PMP estimate adjusted for mean drainage elevation was determined. Then the depth-duration curve for 1 mi^2 was generated using the 1 mi^2 factors for durations up to six hours. Next the areal reduction factors were applied. The result was the PMP depth-duration curve for the drainage basin above Site 8.

The Natural Resources Conservation Service classifies soils into four Hydrologic Soil Groups based on the soil's potential for runoff. The four Hydrologic Soil Groups are A, B, C, and D. HSG A soils generally have the least runoff potential and HSG D soils have the greatest. Details for these classifications can be found in 'Urban Hydrology for Small Watersheds', Soil Conservation Service Technical Release 55 (June 1986). The drainage basin above Site 8 consists of HSG B. The soils in the basin are deep and well drained with moderate infiltration rates when thoroughly wetted. Runoff is generally slow to moderate. The drainage basin is comprised of woods and forest and range lands. Land cover is good and generally consisting of grasses and forbs and conifer and deciduous trees. The resulting pre-development Soil Conservation Service Curve Number based on land cover type, Hydrologic condition, and Hydrologic Soil Group is 60.

Hydrologic modeling of the drainage basin above Site 8 was completed to determine the PMF. Stormwater runoff simulation was completed using U.S. Army Corps of Engineers developed HEC-HMS 2.2.2 hydrologic modeling system. The Soil Conservation Service (SCS) Unit Hydrograph method was used to generate the basin outflow hydrograph. The PMP depth-duration curve along with the drainage basin area, basin lag time, and drainage basin curve number were required input parameters. Basin lag time can be related to time of concentration for ungaged watersheds by:

$$t_{lag} = 0.6\ t_c \tag{1}$$

Time of concentration is the time it takes for the most distant point in the watershed to contribute runoff at the design point. Runoff is assumed to travel as either sheet flow, shallow concentrated flow, and channel flow. Time of concentration is estimated as the sum of the travel times of these three types of flow. Flow velocities and basin geometry determine the time of concentration for the basin. The basin lag time was calculated to be 40 minutes. The drainage area for the basin is 6.5 mi^2.

The local storm PMF is estimated to generate 1630 ac-ft of water with a peak flow of 9,100 cfs at this site. This flood would be passed over the RCC dam through a spillway section as shown on Figure 6.33. For the earth embankment dam, the flood would be passed around the embankment through a 200' wide emergency spillway. The emergency spillway would be excavated into the rock in a swale adjacent to the left abutment of the embankment and discharge into a drainage north of the embankment as shown on Figure 6.34.

6.8.8 Permitting

Site 3 would require filing an application for a permit to appropriate surface water with the State Engineer (SEO). This site would require Form S.W. 3 reservoir permit. In addition, the Wyoming SEO would, prior to construction, need to review the plans and specifications for dam safety approval and to provide approval to construct the proposed facility.

In addition to the Wyoming SEO permits and approval, there are additional permits and approvals required for new dam construction. The Army Corp of Engineers regulates activities involving the waters of the United States. It is anticipated that an Individual Section 404 Permit would be required. This would require that an Environmental Impact Statement be prepared and submitted along with the Section 404 application. These include a Wyoming Department of Environmental Quality National Pollution Discharge Elimination System (NPDES) permit and Section 401 Certification. This permit controls the discharge of stormwater pollutants associated with construction activities. The Section 401 Certification is the State’s approval to ensure that the proposed activities meet state water quality standards and do not degrade water quality. A Forest Service Special Use permit would be required to construct a reservoir on Forest Service property. U.S. Fish and Wildlife Service Endangered Species Act Compliance (Section 7) would be required. Coordination with the U.S. Department of Interior Advisory Council on Historic Preservation (Section 106), which protects cultural and historic resources, would be required. State of Wyoming Historic Preservation Office (SHPO) archaeological clearance which determines significance of cultural resources potentially affected by ground disturbing activities would be required.

6.8.9 Wetland Impacts

Site No. 8 has narrow wetland fringes along the stream. No extensive areas of off-channel wetlands are present and wetland impacts would likely be less than 1.0 acre. These impacts would have to be mitigated. They could possibly be mitigated downstream of the dam.

6.8.10 Sensitive Species, Migratory Birds, Riparian Areas, and Big Game Habitat Impacts

The presence of federally-listed species does not appear to be a major issue for Site No. 8. Several sensitive wildlife and plant species occur in the area, and some of these species may be present on the reservoir site. As this reservoir is located on the Bighorn National Forest, surveys for sensitive species would likely be required. Impacts to sensitive species, if present, can likely be mitigated.

Surveys would likely be required for raptor nests prior to construction activities. These surveys may include broadcasting taped calls to locate nest of such species as northern goshawk.

This site has some woody riparian areas along the stream within the inundation area. In general, these woody riparian areas are fairly narrow and there are no extensive areas of wood riparian vegetation. Common species include cottonwood, aspen, alder, and mountain maple. Mitigation for woody riparian areas may be required.

This site occurs in an area designated as crucial winter range for elk. The Wyoming Game and Fish Department may request mitigation if a reservoir is constructed on elk crucial winter range. Site 8 is within moose and mule deer winter-yearlong range, but not crucial winter range.

6.8.11 Cultural Impacts

The French Creek Cow Camp is located within the inundation area of Site 8. This site is a recorded historical site (48JO3778) and is suggested that the site be considered eligible for nomination to the National Register of Historic Places. This cultural structure would likely require mitigation and is potentially a fatal flaw. This historical site is shown on Figure 6.33. Additional descriptions of this site are included in Appendix C. It is predicted that prehistoric sites are expected along the valley of French Creek and its major tributaries. The potential number of prehistoric sites is expected to be small, however. This is due to the small size of the reservoir sites, relatively narrow valleys cut by French Creek and its tributaries, and expected dense vegetation in the reservoir site. Surface artifact scatters are the type of prehistoric sites expected.

6.8.12 Fishery Impacts

Construction of a reservoir at Site No. 8 would inundate approximately 1.0 mile of stream. In this reach, French Creek is classified as a Class 3 fishery, which is considered important trout waters and a fishery of regional importance. French Creek is a non-native fishery containing mostly brook and rainbow trout. Impacts to the stream would be required to be mitigated. As discussed in section 6, French Creek fishery habitats both above and below the dam site could be improved as mitigation.

6.8.13 Public Involvement

If further study of this project is pursued, all parties that could benefit or be affected should be involved. This includes the Hopkins Producers ID, other irrigators on French Creek, Clear Creek, Johnson Creek and Rock Creek, the City of Buffalo, and the National Forest Service. A key component in the success of any project is keeping affected parties and stakeholders informed and involved on project activities. This project will need to have public support in order to come to fruition.

6.8.14 Preliminary Cost Estimates

Preliminary cost estimates were developed for the two alternative dam types and alternative reservoir sizes at Reservoir Site No. 8. The cost estimates were developed utilizing the standard format to estimate the total project costs. The cost estimates are shown in Tables 6.25 and 6.26. The information is presented in graphical form in Figure 6.35. This figure allows for cost estimates comparisons of other sizes of reservoirs.

Table 6.25 - Site Number 8 - RCC - 6000 ac-ft, Crest Elev: 7110, NHWL: 7100'

No.	Item	Units	Estimated Quantity	Unit Cost	Cost
1	Mobilization	L.S.	--	--	$2,200,000
2	Clearing	Ac.	100	$2,000.00	$200,000
3	Stream Diversion	L.S.	--	--	$200,000
4	Dewatering	L.S.	--	--	$250,000
5	Foundation Excavation, Earth	C.Y.	96,000	$4.00	$384,000
6	Foundation Excavation, Rock	C.Y.	7,100	$10.00	$71,000
7	Foundation Prep and Grouting	L.S.	--	--	$2,000,000
8	Dam RCC	C.Y.	350,000	$80.00	$28,000,000
9	Outlet Works	L.S.	--	--	$2,500,000
10	Spillway	L.S.	--	--	$1,000,000
11	Access Road Construction	Mi.	2.0	$100,000.00	$200,000
12	Wetlands Mitigation	Ac.	1.50	$100,000.00	$150,000
13	Riparian Mitigation	Ac.	20	$50,000.00	$1,000,000
14	Fishery Mitigation	L.S.	--	--	$250,000
15	Revegetation	Ac.	25	$2,000.00	$50,000
16	N. Clear Creek Diversion and Pipeline	L.S.	--	--	$2,390,000
Construction Cost Sub-Total:					**$40,845,000**
10% Engineering:					$4,084,500
Sub-Total:					**$44,929,500**
15% Contingency:					$6,739,425
CONSTRUCTION COST TOTAL:					**$51,668,925**
Preparation of Final Designs and Specifications:					$2,700,000
Permitting:					$500,000
Legal Fees:					$100,000
Acquisition of Access and Rights of Way:					$200,000
TOTAL PROJECT COST:					**$55,168,925**
USE:					**$55.2M**

Table 6.26 - Site Number 8 - Earth Embankment - 5500 ac-ft, Crest Elev: 7110', NHWL: 7100'

No.	Item	Units	Estimated Quantity	Unit Cost	Cost
1	Mobilization	L.S.	--	--	$1,400,000
2	Clearing	Ac.	100	$2,000.00	$200,000
3	Stream Diversion	L.S.	--	--	$200,000
4	Dewatering	L.S.	--	--	$250,000
5	Foundation Excavation, Earth	C.Y.	550,000	$4.00	$2,200,000
6	Foundation Excavation, Key Trench	C.Y.	5,000	$20.00	$100,000
8	Embankment	C.Y.	2,400,000	$7.50	$18,000,000
9	Outlet Works	L.S.	--	--	$2,500,000
10	Emergency Spillway	C.Y.	20,000	$10.00	$200,000
11	Access Road Construction	Mi.	2.0	$100,000.00	$200,000
12	Wetlands Mitigation	Ac.	1.50	$100,000.00	$150,000
13	Riparian Mitigation	Ac.	20	$50,000.00	$1,000,000
14	Fishery Mitigation	L.S.	--	--	$250,000
15	Revegetation	Ac.	70	$2,000.00	$140,000
16	N. Clear Creek Diversion and Pipeline	L.S.	--	--	$2,390,000
				Construction Cost Sub-Total:	**$29,180,000**
				10% Engineering:	$2,918,000
				Sub-Total:	**$32,098,000**
				15% Contingency:	$4,814,700
				CONSTRUCTION COST TOTAL:	**$36,912,700**
				Preparation of Final Designs and Specifications:	$2,200,000
				Permitting:	$500,000
				Legal Fees:	$100,000
				Acquisition of Access and Rights of Way:	$200,000
				TOTAL PROJECT COST:	**$39,912,700**
				USE:	**$40.0M**

6.8.15 Reservoir Alternative Size Comparison

The reservoir size alternatives analyzed for Site 8 are compared in Table 6.27. As indicated, the 10,000 AF earth reservoir has the lower unit cost per acre-foot of storage. The comparison of the unit cost per acre-foot of yield indicates that the 5,500-7,500 AF reservoir size range has the lowest unit cost as shown on Figure 6.36. This site would be most economically developed at the 5,500-7,500 AF size range alternative.

Table 6.27 - Site No. 8 Alternatives Comparison

Dam Type	Total Capacity AF	Est. Cost $Mil	Storage Unit Cost $/AF	Active Capacity AF	Est. Yield AF/Yr	Unit Cost Yield $/AF Yield
RCC	2500	$32.1	$12,840	1750	1630	$19,693
RCC	6000	$55.2	$9,195	4200	3590	$15,367
RCC	7500	$65.4	$8,720	5250	3590	$18,217
RCC	10000	$82.0	$8,200	7000	3590	$22,841
Earth	2500	$21.9	$8,760	1750	1630	$13,436
Earth	5500	$39.9	$7,257	3850	3310	$12,058
Earth	7500	$52.4	$6,987	5250	3590	$14,596

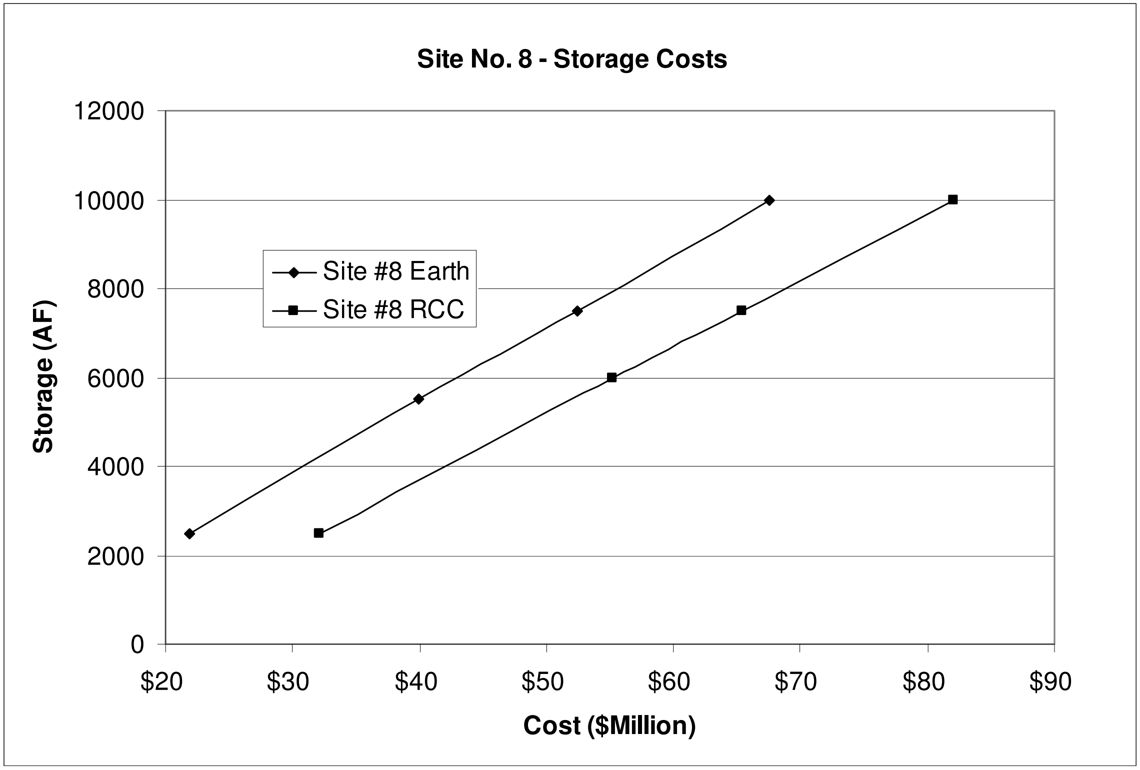


Figure 6.35 Site #8 Storage Costs

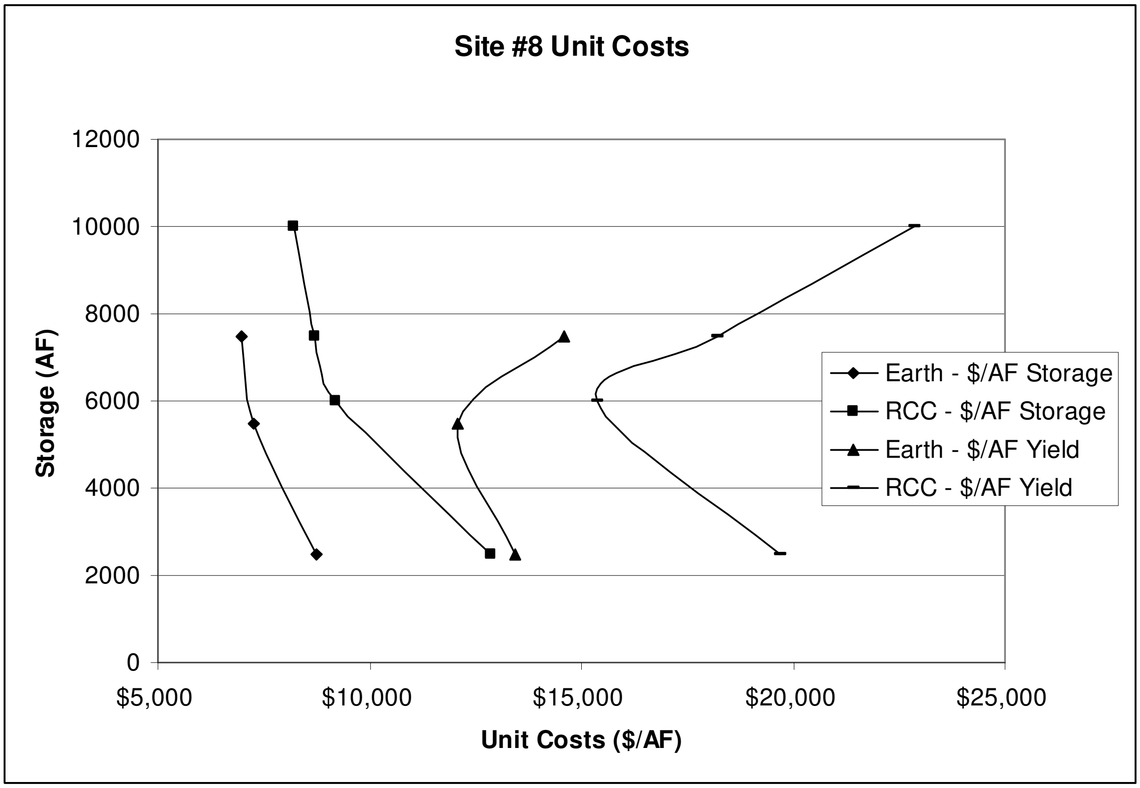


Figure 6.36 Site No. 8 Unit Costs

6.8.16 Project Financing

The current financing package offered by the Wyoming Water Development Commission is 67% grant, 33% loan at 4% for a case specific term not to exceed 50 years. The Commission has the ability in their criteria to grant up to 75%. The Commission has the authority with Wyoming Legislature approval to grant 100% of the total project costs. In order to achieve this level of financing the project would have to give significant benefit to the State of Wyoming. Additional funding sources may include the NRCS.

Assuming a 67% WWDC grant and 33% loan at 4% for 50 years, the annual repayment would be as follows:

Table 6.28 - Site No. 8 Annual Repayment

Dam Type	Total Capacity	Est. Cost	Annual Repayment
	AF	$Mil	$/Yr
RCC	2500	$32.1	$498,570
RCC	6000	$55.2	$856,872
RCC	7500	$65.4	$1,015,778
RCC	10000	$82.0	$1,273,606
Earth	2500	$21.9	$340,146
Earth	5500	$39.9	$619,915
Earth	7500	$52.4	$813,865

6.8.17 Summary

Site No. 8 would be a multipurpose facility located on the Bighorn National Forest. Site No. 8 is most efficient based on the water availability and project cost in the 5,500-7,500 AF range. Both RCC and earth embankment were analyzed. With the anticipated lack of fine grain material availability, an RCC embankment at this location is likely the most economical dam. The French Creek Cow Camp cultural resource is potentially a fatal flaw. Mitigation of this structure will likely be required. Wetland impacts at this site are minimal but will likely require mitigation. Riparian impacts are present at this site and will likely require mitigation. This site is within crucial winter range for elk which will likely require mitigation. The design flood at this site is relatively large requiring a relatively substantial spillway. Access to the site requires improvement of an existing Forest Service road. The reservoir is sited on the Bighorn National Forest which will require a special use permit and will likely be more difficult to permit. This site is recommended for further study if any alternatives are pursued.

7. French Creek to Clear Creek Pipeline

7.1 Introduction

Storage water from Sites No. 3, 4, 5, and 8 could be diverted from French Creek to Clear Creek as shown on Figures 7.1 and 7.2. A diversion structure could be constructed below the US Forest Service (USFS) boundary and water diverted by gravity to Clear Creek. This water could be utilized for future municipal needs of the City of Buffalo, supplemental irrigation water, and instream flows through Buffalo, and could delay regulation on the Clear Creek drainage. Senior water right demands below the City of Buffalo typically call for regulation of most other water rights in the basin. Storage water could be utilized to satisfy these rights and allow water usage throughout the basin for a longer time period for the more junior water rights.

7.2 Preliminary Design

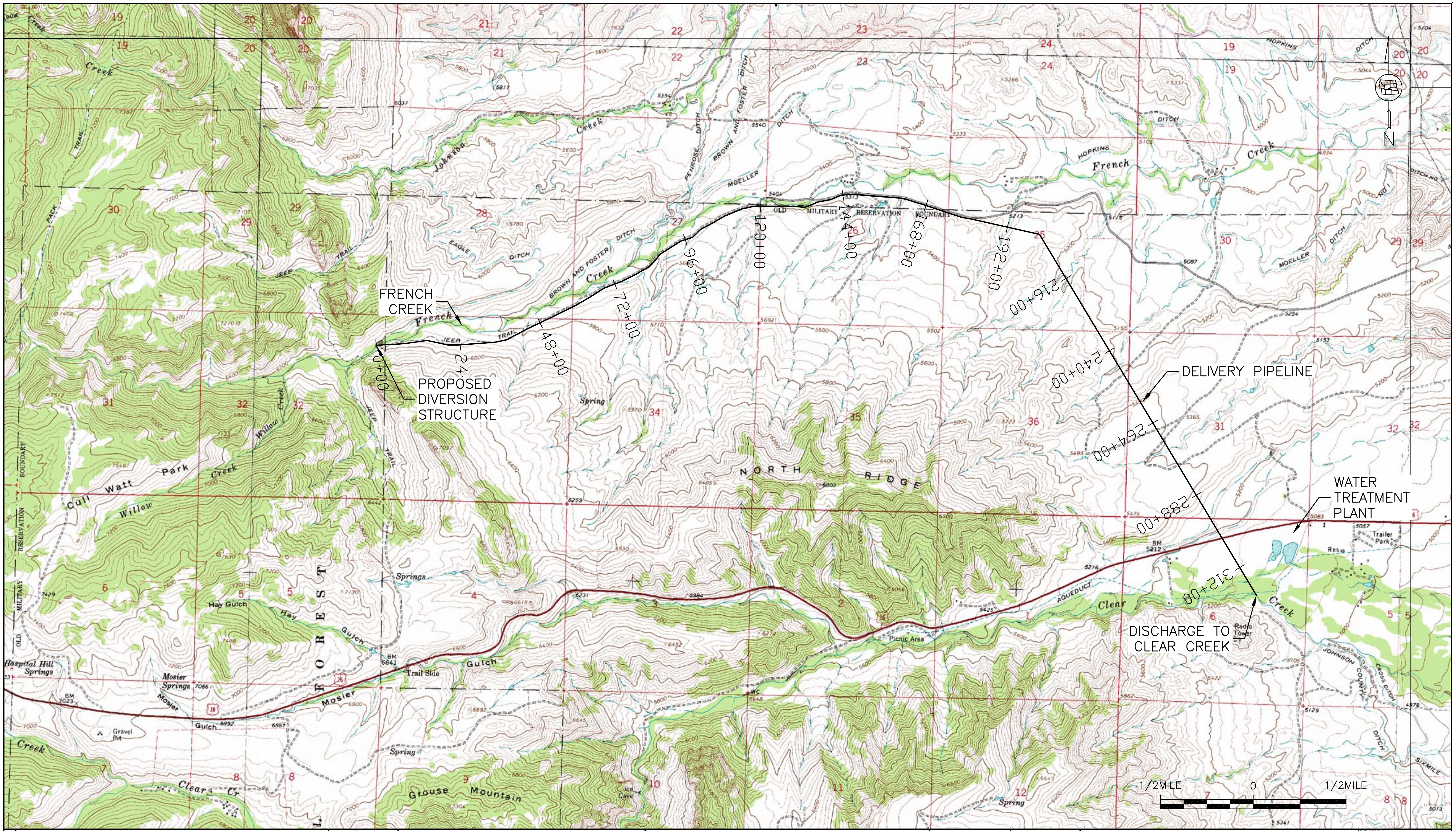
A diversion structure, headgate, and flow measurement device could be constructed below the USFS boundary as shown on Figure 7.3. This installation could discharge to a PVC pipeline approximately 32,250 feet in length that would discharge to Clear Creek. Water could also be delivered to the Buffalo Water Treatment Plant. There is potential for hydropower production with the head available and flow rate. A 24-inch pipeline could deliver approximately 40cfs.

7.3 Cost Estimates

A preliminary cost estimate was developed for the French Creek to Clear Creek Pipeline system. The cost estimate was developed utilizing the WWDC standard format and is shown on Table 7.1. The estimated cost for the 24-inch pipeline to deliver 40cfs is approximately $6.0 million.

Table 7.1 - French Ck to Clear Ck Pipeline

No.	Item	Units	Estimated Quantity	Unit Cost	Cost
1	Mobilization	L.S.	--	--	$200,000
2	Diversion Structure	L.S.	--	--	$200,000
3	Stream Gage	L.S.	--	--	$50,000
4	24" Pipeline	L.F.	32,250	$100.00	$3,225,000
5	Pipeline Appurtenances	L.S.	--	--	$250,000
6	Air-Vac Structures	Ea.	6	$20,000.00	$120,000
8	Blow-offs	Ea.	6	$5,000.00	$30,000
9	Highway Bore	L.F.	100	$1,000.00	$100,000
10	Drainage Crossings	Ea.	10	$10,000.00	$100,000
11	Energy Dissipation Structure	L.S.	--	--	$50,000
				Construction Cost Sub-Total:	**$4,325,000**
				10% Engineering:	$432,500
				Sub-Total:	**$4,757,500**
				15% Contingency:	$713,625
				CONSTRUCTION COST TOTAL:	**$5,471,125**
				Preparation of Final Designs and Specifications:	$300,000
				Permitting:	$50,000
				Legal Fees:	$25,000
				Acquisition of Access and Rights of Way:	$100,000
				TOTAL PROJECT COST:	**$5,946,125**
				USE:	**$6.0M**



FILE NAME FIGURES	PLOT SCALE 1:1
OPER. JMR	DATE 2008JUNE17
PROJ. # 522WY	TASK # CONCEP. DESIGN
LOC. BUFFALO, WY	PROJ. HOPKINS STUDY
SEND TO JENNIFER RUSSELL	PHONE (307) 634-7848

REV	DESCRIPTION OF REVISION	BY	DATE
△			
△			
△			
△			
△			
1	CONCEPTUAL DESIGN	JMR	06/17/08

STATES WEST WATER
RESOURCES CORPORATION

1904 EAST 15th STREET
CHEYENNE, WYOMING 82001
(307) 634-7848
FAX: (307) 634-7851

WARNING

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DESIGNED	VEA/JMR
DRAWN	JMR
CHECKED	
PEER REVIEWED	
PROJECT MANAGER	VEA
DATE	JUNE 2008

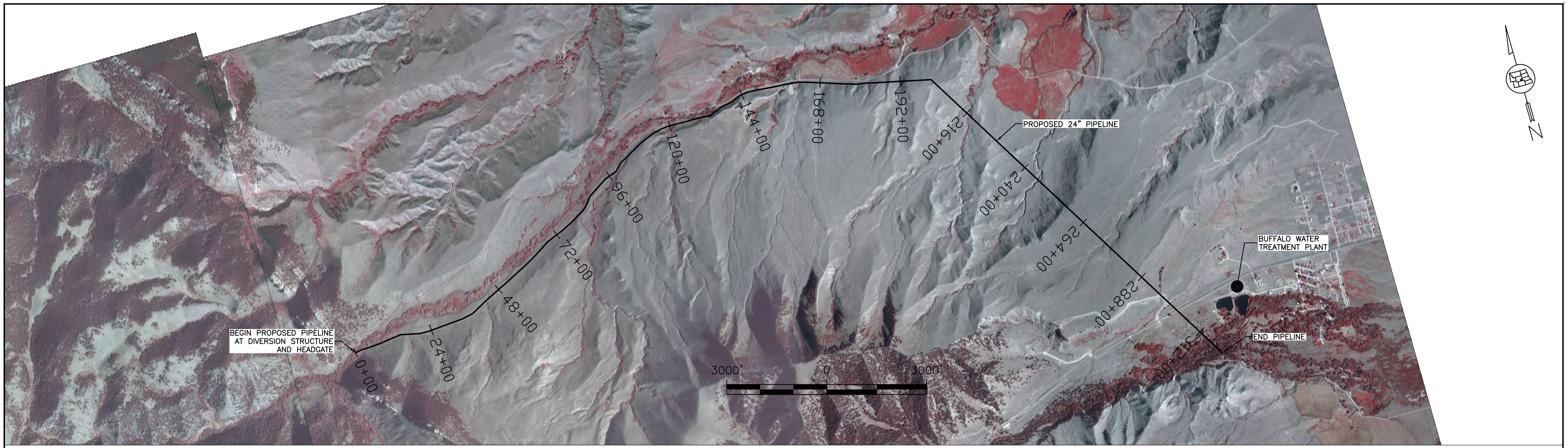
HOPKINS PRODUCERS ID STORAGE PROJECT

FIGURE 7.1
FRENCH CREEK TO CLEAR CREEK PIPELINE – PLAN VIEW

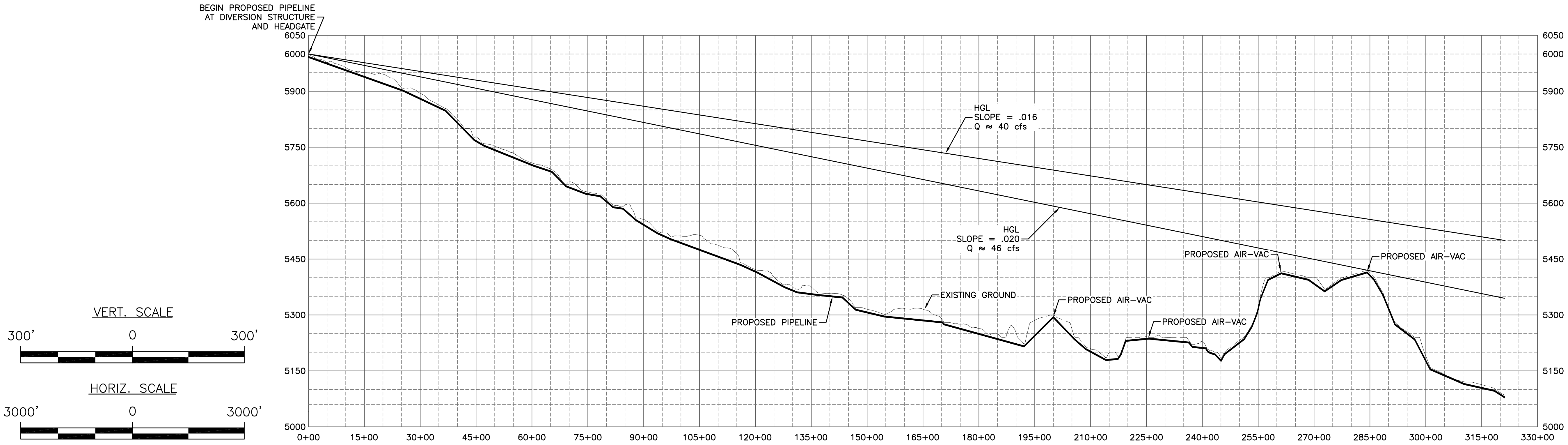
REVISION 1

PROJECT 522-WY

7-2



PROPOSED PIPELINE PLAN



PROPOSED PIPELINE PROFILE

FILE NAME FIGURES	OPER. JMR	PROJ. # 522WY	LOC. BUFFALO, WY	SEND TO JENNIFER RUSSELL
PLOT SCALE 1:1	DATE 2008JUNE17	TASK # CONCEP. DESIGN	PROJ. HOPKINS STUDY	PHONE (307) 634-7848

REV	DESCRIPTION OF REVISION	BY	DATE
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1	CONCEPTUAL DESIGN	JMR	06/17/08

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PROJECT MANAGER	VEA
DATE	JUNE 2008

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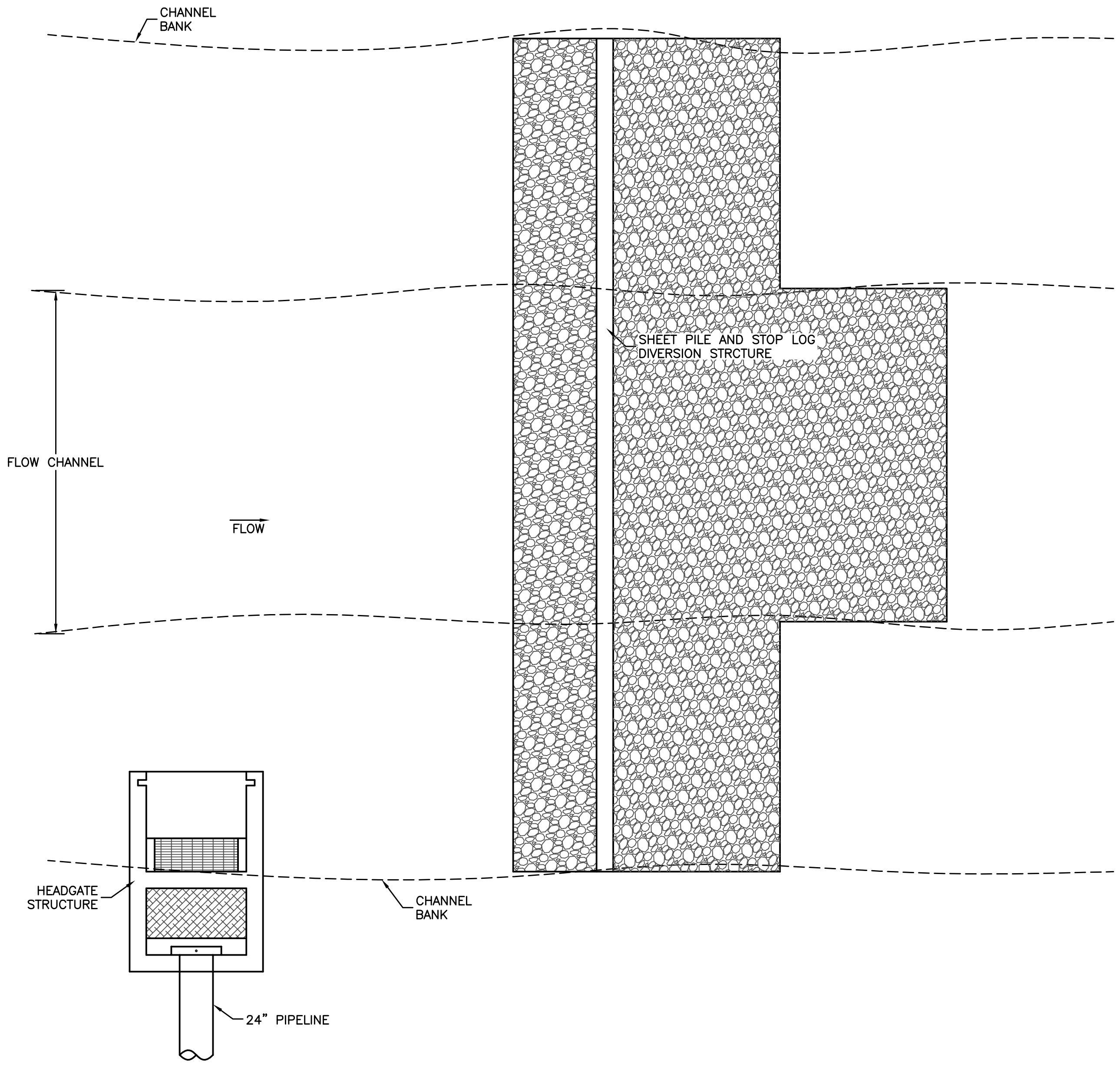
FIGURE 7.2
FRENCH CK TO CLEAR CK
PIPELINE PLAN AND PROFILE

REVISION △
PROJECT 522-WY

7-3



NOT TO SCALE

FILE NAME FIGURES
PLOT SCALE 1:1
OPER. JMR
DATE 2008JUNE17
PROJ. # 522WY
TASK # CONCEP. DESIGN
LOC. BUFFALO, WY
PROJ. HOPKINS STUDY
SEND TO JENNIFER RUSSELL
PHONE (307) 634-7848

REV	DESCRIPTION OF REVISION	BY	DATE
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1	CONCEPTUAL DESIGN	JMR	06/17/08

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FIGURE 7.3
DIVERSION DAM PLAN

REVISION 1
PROJECT 522-WY

5. North Fork of Clear Creek Diversion Rehabilitation

5.1 Introduction

The existing Four Lakes and French Creek Ditch Diversion diverts water by gravity from the North Fork of Clear Creek to French Creek. This system diverts an average of 7,773 AF per year with historic maximum of 12,409 AF and minimum of 2,088 AF. The average first diversion is June 7 with historic extremes of May 7 to July 13. The system has an approximate capacity of 75 cfs. The average shut off date is September 23 with historic extremes of August 1 to September 30.

The diversion system consists of the head gate with two steel gates, a parshall measurement flume, and an approximately 5,000 foot long ditch to French Creek.

Preliminary hydrology has indicated the availability of additional water from the North Fork of Clear Creek. This water could be transferred and stored in a reservoir facility on French Creek. This system, to capture additional water, would require modification to the existing facilities including a water right enlargement. Preliminary design and cost estimates of these modifications have been developed.

5.2 Water Supply

Preliminary hydrology has indicated the availability of additional water from the North Fork of Clear Creek. This additional water could be transferred to French Creek and stored in a reservoir facility on French Creek. The hydrological analysis estimated the additional divertable flows in the North Fork of Clear Creek at the Four Lakes Diversion for dry, average, and wet years as shown below:

	North Fork of Clear Creek
Dry Years	500-900 AF
Average Years	2800-3500 AF
Wet Years	3500-4300 AF

5.3 Preliminary Design

A concrete diversion structure, new headgate, wasteway, and flow measurement device could be constructed as shown on Figures 5.1 and 5.2. Snow and ice keeps the existing ditch inoperable until early May when a minimum flow is diverted to clear the ditch. A pipeline from the diversion to French Creek is proposed to allow early diversions if water is available. The system capacity would be increased to take advantage of larger available flows in normal and wet years. The diversion would discharge to a 36” pipeline to convey a maximum of 140 cfs 5,000 feet to the French Creek drainage. A stream gauge should be installed on North Clear Creek near the diversion to keep record of flows.

5.4 French Creek Channel Erosion Control / Rehabilitation

The French Creek channel has demonstrated erosion problems currently due to the introduced flows from the North Fork of Clear Creek. With increased flows, the erosion issues would be increased as discussed in Section 3.3. In addition, stream losses at a potential storage facility would require mitigation. It is proposed to rehabilitate and protect the French Creek channel from the North Fork diversions to the reservoir site. Figure 5.3 shows a typical detail of a boulder drop structure used to reduce channel slope, provide stream bed grade control, and create a pool for enhancement of aquatic habitat. Where bank stabilization is required, structural protection may be best suited along the toe of the slopes while bioengineering protection may be more appropriate along the upper slopes of the bank. Long-term stability is often facilitated by the integration and placement of both structural and bioengineered stability measures.

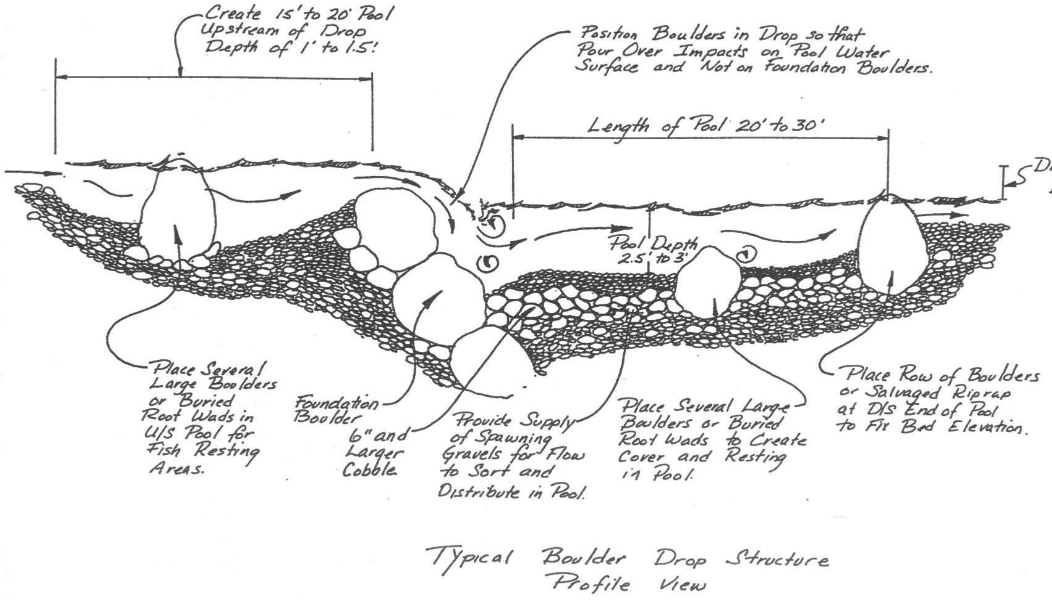


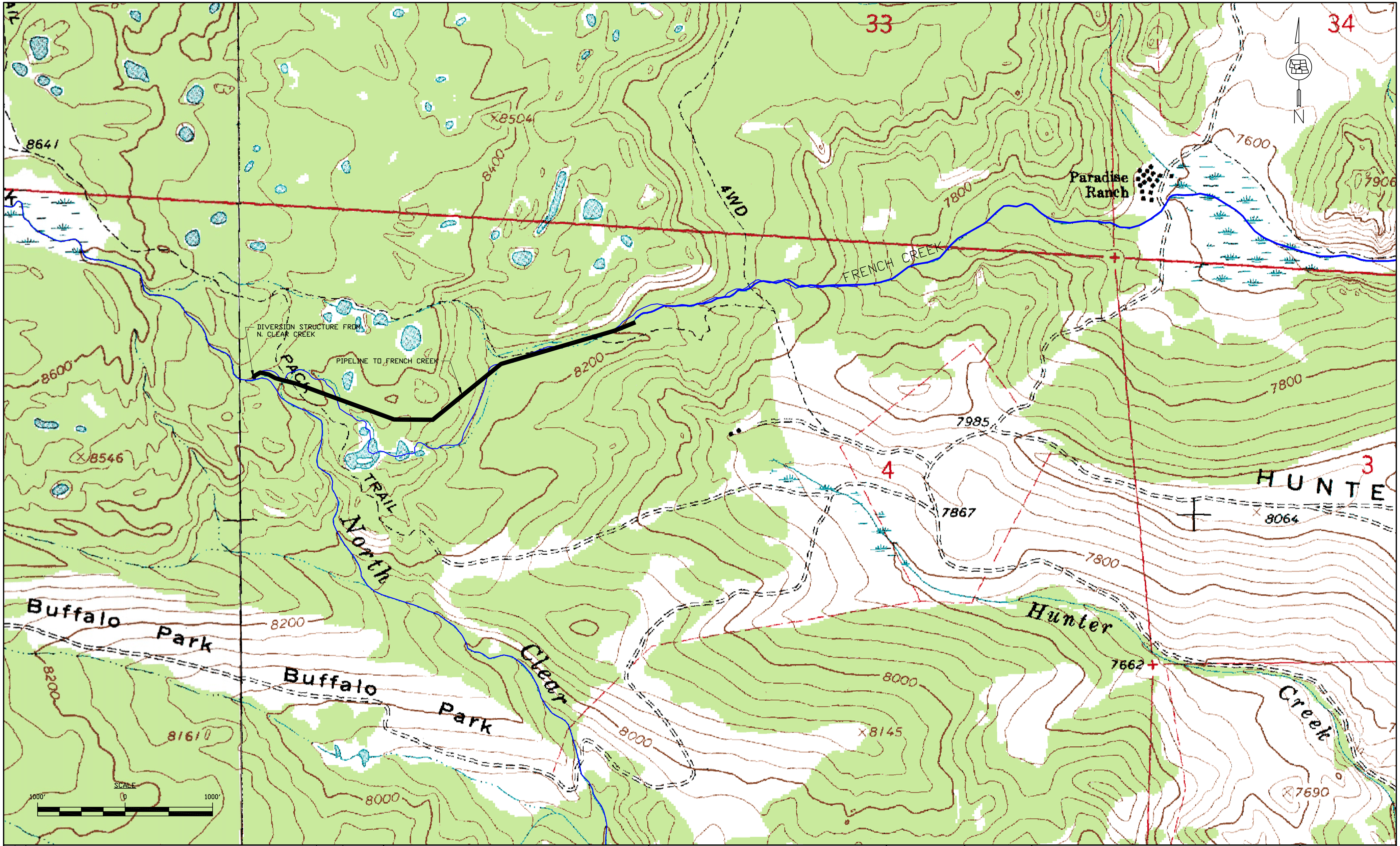
Figure 5.3 – Typical Boulder Drop Structure

5.5 Cost Estimates

A preliminary construction cost estimate was developed for the North Fork of Clear Creek water supply to French Creek. The cost estimate was developed utilizing the standard format and is shown on Table 5.1. The estimated construction cost for the system is approximately $2.4 million.

Table 5.1 - N. Clear to French Creek Pipeline and Diversion

No.	Item	Units	Estimated Quantity	Unit Cost	Cost
1	Clearing	Ac.	10	$2,000.00	$20,000
2	Diversion Structure	L.S.	--	--	$200,000
3	Flow Meter	L.S.	--	--	$50,000
4	Stream Gauge	L.S.	--	--	$50,000
5	36" Pipeline	L.F.	5,000	$200.00	$1,000,000
6	Energy Disipation Structure	L.S.	--	--	$50,000
7	Stream Stabilization on French Ck.	E.A.	40	$25,000.00	$1,000,000
8	Revegetation	Ac.	10	$2,000.00	$20,000
				Construction Cost:	**$2,390,000**



FILE NAME: SITE 3	OPERATOR: DWW	PROJECT NO: 522-WY	LOCATION: BUFFALO, WY	SEND TO: VICTOR E. ANDERSON
SCALE: 1"=300'	DATE: 07/08	TASK NO: 001-263	PROJECT: HOPKINS STORAGE	PHONE: (307) 634-7848

REV	DESCRIPTION OF REVISION	BY	DATE
△			
△			
△			
△			
△			
1	PRELIMINARY DESIGN	DWW	07/08

STATES WEST WATER
RESOURCES CORPORATION

1904 E. 15th STREET
CHEYENNE, WYOMING 82001
(307) 634-7848
FAX: (307) 634-7851

WARNING

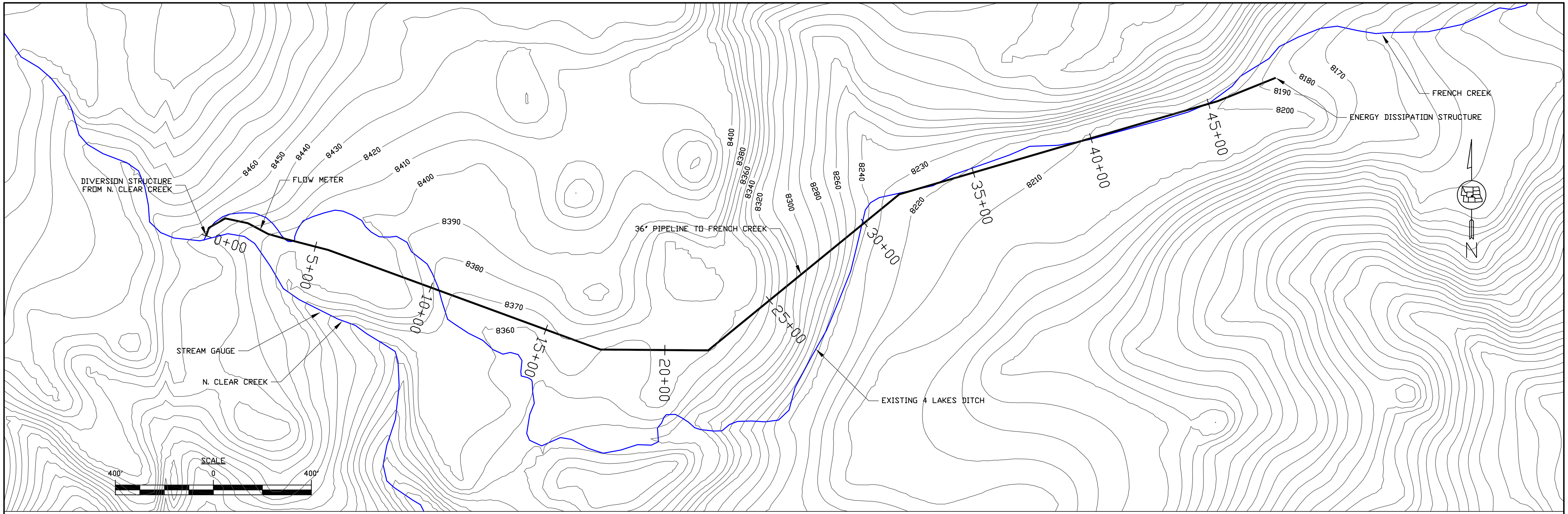
IF THIS BAR DOES NOT MEASURE 1/2" THEN DRAWING IS NOT TO SCALE

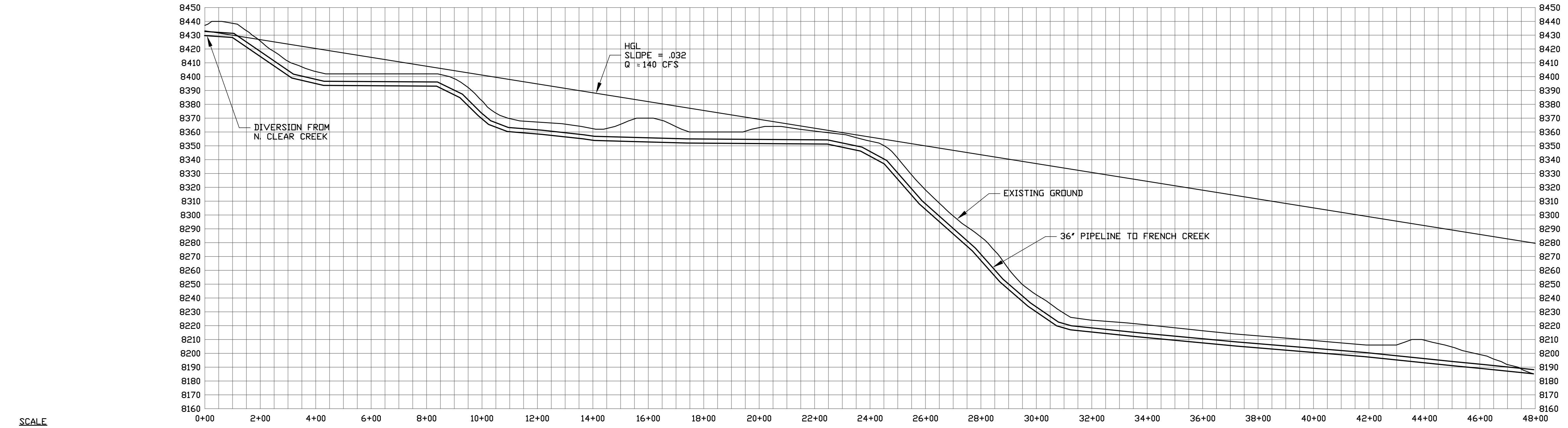
DESIGNED	DWW
DRAWN	DWW
CHECKED	VEA
PEER REVIEWED	VEA
PROJECT MANAGER	VEA
DATE	07/08

HOPKINS PRODUCERS ID STORAGE PROJECT

FIGURE 5.1
NORTH CLEAR CREEK DIVERSION
SITE PLAN

REVISION 1
PROJECT 522-WY
DRAWING 5-3





DIVERSION AND PIPELINE
FROM N. CLEAR CREEK TO FRENCH CREEK

REV	DESCRIPTION OF REVISION	BY	DATE
△			
△			
△			
△			
△			
△1	PRELIMINARY DESIGN	DWW	07/08

FILE NAME: SITE 3
SCALE: 1"=300'
OPERATOR: DWW
DATE: 07/08
PROJECT NO: 522-WY
TASK NO: 001-263
LOCATION: BUFFALO, WY
PROJECT: HOPKINS STORAGE
SEND TO: VICTOR E. ANDERSON
PHONE: (307) 634-7848

STATES WEST WATER
RESOURCES CORPORATION

1904 E. 15th STREET
CHEYENNE, WYOMING 82001
(307) 634-7848
FAX: (307) 634-7851

WARNING

IF THIS BAR DOES
NOT MEASURE 1/2"
THEN DRAWING IS
NOT TO SCALE

DESIGNED DWW
DRAWN DWW
CHECKED VEA
PEER REVIEWED VEA
PROJECT MANAGER VEA
DATE 07/08

HOPKINS PRODUCERS ID STORAGE PROJECT

FIGURE 5.2
NORTH CLEAR CREEK
DIVERSION AND PIPELINE

REVISION △1
PROJECT 522-WY
DRAWING 5-4

Appendix 6E
Reservoir Conceptual Design

Appendix 6E – Reservoir Site Conceptual Designs

3.1 General

Based on the data collected from our geologic literature search, data from our site visit, and our experience as geotechnical and dam engineers, we developed a conceptual design concept for a dam at Sand Creek and Bull Creek. These concepts were developed without the benefit of site-specific geotechnical data and engineering analyses and are based primarily on our experience and judgment. Changes to these concepts should be anticipated after site-specific geotechnical and geological data is collected and completion of preliminary engineering analyses.

3.2 Sand Creek

Selection of a dam type and configuration was based on the following primary items:

- Dam site geology and foundation conditions.
- Availability and types of construction materials in and near the reservoir basin. The majority of materials that appear to be present within the reservoir basin and near the dam site are clayey materials.
- Economics of dam construction methods.
- Performance of similar dam types.

In our opinion, a practical dam type for the foundation conditions at the site would be an earthfill dam. For this evaluation we selected an earthfill dam with an upstream zone of clayey materials and a downstream zone of random materials, which would include sandy and clayey materials. A chimney and blanket drain would also be included to manage seepage.

A plan of the embankment and reservoir for a dam with a crest at El. 5050 is shown on Figure 3.1. A representative embankment section near the maximum dam height is shown on Figure 3.2 and a profile along the dam crest is shown on Figure 3.3. The dam crest would be 24 feet wide and the side slopes would be 3H:1V. A saddle dam would also be required near the right abutment. We assumed that the saddle dam would have a similar geometry to the main embankment.

Foundation preparation would consist of excavating a minimum 20-foot-wide cutoff trench below the centerline of the dam that would extend at least 5 feet into bedrock. For this level of study we assumed that surficial soil beneath the embankment could remain in place except for within the cutoff trench alignment.

For this level of study we included a grout curtain for the entire length of embankment. We assumed the following for the grout curtain:

- A double row of grout holes spaced every 10 feet.
- One-half of the grout curtain would require confirmation holes spaced every 5 feet.

- The grout curtain would extend to about two-thirds of the embankment height (about 67 feet at the maximum dam height) into bedrock.

A chimney drain that is connected to a blanket drain would be included downstream of the crest centerline and the cutoff trench to manage seepage through the embankment and provide protection against internal erosion. The chimney drain would be 6 feet wide, primarily for constructability reasons, and the blanket drain would be 4 feet thick. The chimney drain would consist primarily of sand and it is likely that the blanket drain would consist of a layer of fine gravel with a layer of sand above and below the gravel. Seepage collected in the chimney and blanket would be discharged to the downstream toe of the embankment using PVC pipes.

Upstream slope protection would consist of riprap over bedding. The riprap slope protection was included from the crest to the toe of the embankment. If during future phases of design there is a requirement to maintain a permanent dead pool, the limits of slope protection could likely be raised to extend to only several feet below the permanent dead pool. For this phase of design we selected a combined thickness of riprap and bedding of 3 feet.

3.3 Bull Creek

Selection of a dam type and configuration was based on the following primary items:

- Dam site geology and foundation conditions.
- Availability and types of construction materials in and near the reservoir basin. These appear to consist of both clayey and sandy materials.
- Economics of dam construction methods.
- Performance of similar dam types.

In our opinion, a practical dam type for the foundation conditions at the site would be an earthfill dam. For this evaluation we selected an earthfill dam with a central low permeable (clayey) core, with upstream and downstream sandy shells. A chimney drain would be located downstream of the chimney and a blanket drain would be located below the downstream shell.

A plan of the embankment and reservoir for a dam with a crest at El. 5210 is presented on Figure 3.1. A representative embankment section near the maximum dam height is shown on Figure 3.4 and a profile along the dam crest is shown on Figure 3.5. The dam crest should be 28 feet wide and the side slopes should be 3H:1V.

Foundation preparation would consist of excavating a minimum 20-foot-wide cutoff trench below the centerline of the dam that would extend at least 5 feet into bedrock. For this level of study, we assumed that surficial soil beneath the embankment could remain in place except for within the cutoff trench alignment.

For this level of study, we included a grout curtain for the entire length of embankment. We assumed the following for the grout curtain:

- A double row of grout holes spaced every 10 feet.
- One-half of the grout curtain will require confirmation holes spaced every 5 feet.
- The grout curtain will extend about two-thirds of the embankment height (about 80 feet at the maximum dam height) into bedrock.

A chimney drain that is connected to a blanket drain would be included downstream of the core and the cutoff trench to manage seepage through the embankment and provide protection against internal erosion. The chimney drain would be 6 feet wide, primarily for constructability reasons, and the blanket drain would be 4 feet thick. The chimney drain would consist primarily of sand and it is likely that the blanket drain would consist of a layer of fine gravel with a layer of sand above and below the gravel. Seepage collected in the chimney and blanket would be discharged to the downstream toe of the embankment using PVC pipes.

Upstream slope protection would consist of riprap over bedding. The riprap slope protection was included from the crest to the toe of the embankment. If during future phases of design there is a requirement to maintain a permanent dead pool, the limits of slope protection could likely be raised to extend to only several feet below the permanent dead pool. For this phase of design we selected a combined thickness of riprap and bedding of 3 feet.

Section 4 – Quantities and Costs

We developed estimates of the quantities and costs of the various earthen materials that would be required to construct the Sand Creek embankment as illustrated on Figures 3.2 and 3.3 and the Bull Creek embankment as illustrated on Figures 3.4 and 3.5. Our estimated quantities and costs are presented in Table 4.1 for Sand Creek and in Table 4.2 for Bull Creek. Calculations are provided in the Project Notebook.

Table 4.1
Estimated Quantities and Costs for Sand Creek Embankment

Item	Quantity	Units	Cost per Unit ($)	Cost ($)
Clearing and Grubbing	150,500	SY	0.50	75,250.00
Reclamation	23	AC	3,000.00	69,000.00
Aggregate Base Course	2,640	CY	25.00	66,000.00
Clayey Fill	1,216,200	CY	2.50	3,040,500.00
Random Fill	547,800	CY	2.00	1,095,600.00
Drain	119,100	CY	35.00	4,168,500.00
Riprap and Riprap Bedding	66,200	CY	50.00	3,310,000.00
Core Trench Soil Excavation	34,200	CY	0.25	8,550.00
Core Trench Bedrock Excavation	48,100	CY	1.00	48,100.00
Foundation Treatment - Grouting	61,900	LF	50.00	3,095,000.00
Subtotal				14,976,500.00
20 Percent Contingency				2,995,300.00
Total Cost				17,971,800.00

Table 4.2
Estimated Quantities and Costs for Bull Creek Embankment

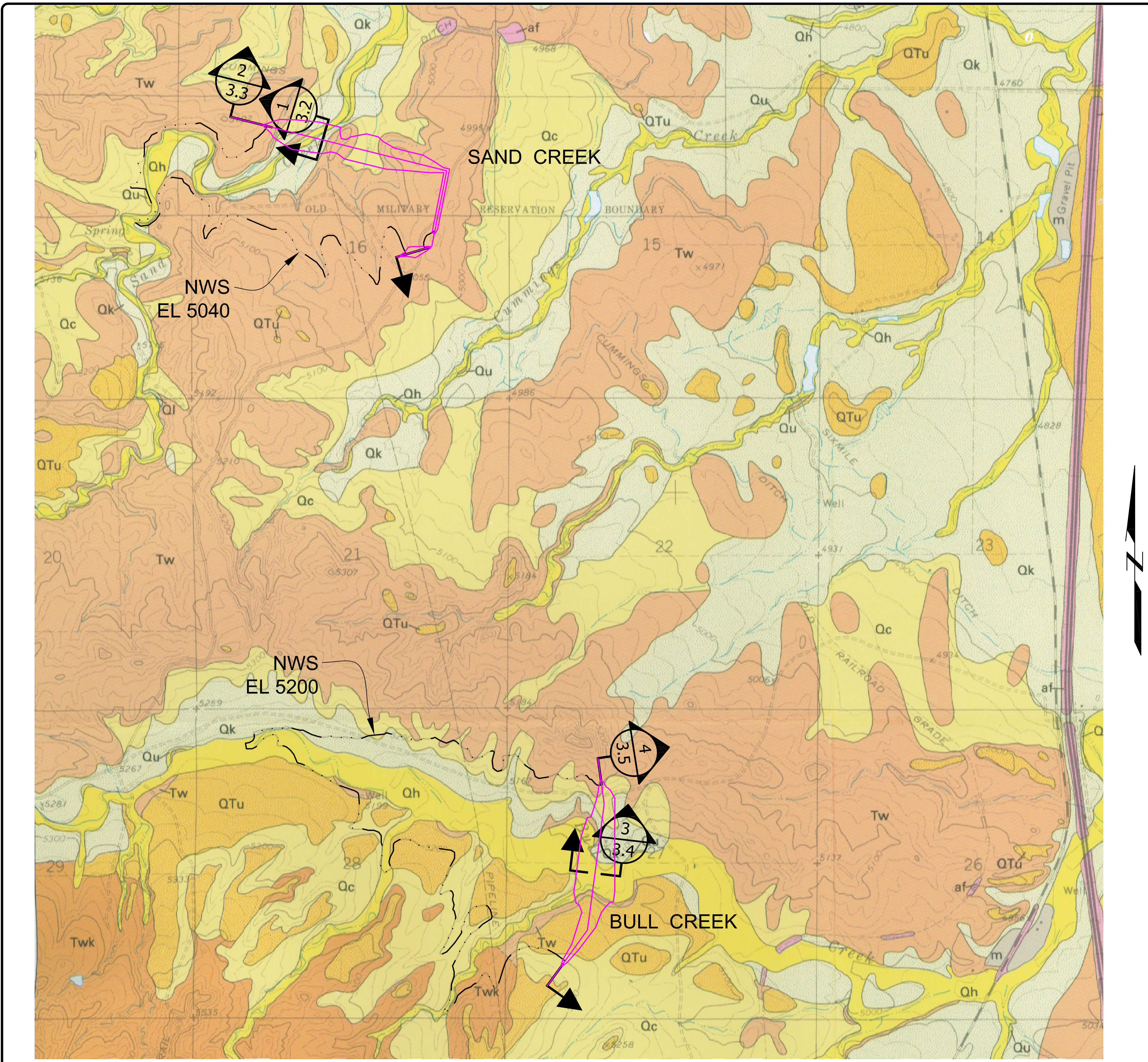
Item	Quantity	Units	Cost per Unit ($)	Cost ($)
Clearing and Grubbing	148,100	SY	0.50	74,050.00
Reclamation	20	AC	3,000.00	60,000.00
Aggregate Base Course	1,720	CY	25.00	43,000.00
Clayey Fill (Core)	542,500	CY	2.50	1,356,250.00
Random Fill (Shells)	1,690,000	CY	2.00	3,380,000.00
Drain	120,000	CY	35.00	4,200,000.00
Riprap and Riprap Bedding	62,900	CY	50.00	3,145,000.00
Core Trench Soil Excavation	202,900	CY	0.25	50,725.00
Core Trench Bedrock Excavation	32,000	CY	1.00	32,000.00
Foundation Treatment - Grouting	53,300	LF	50.00	2,665,000.00
Subtotal				15,006,025.00
20 Percent Contingency				3,001,205.00
Total Cost				18,007,230.00

Section 5 – Future Study

The following tasks should be completed during the next phase of study:

1. Site-specific topography should be obtained for the reservoir, dam site, and surrounding area. This is required to provide an adequate base map for preliminary design-level geologic mapping and engineering evaluations.
2. Site-specific geologic mapping of the dam and reservoir site should be performed to identify and characterize the geologic units and any geologic hazards that may be present.
3. Subsurface investigations should be performed. Subsurface investigations should include the following items:
    a. Test pits should be excavated within the dam footprint and borrow areas to investigate shallow subsurface structure and collect bulk samples for laboratory testing.
    b. Borings should be advanced within the dam footprint to: 1) investigate depths deeper than can be obtained from test pits, 2) collect undisturbed samples of surficial materials and bedrock, and 3) collect geotechnical data that is only obtainable from drilling methods (i.e., standard penetration tests (SPT) and bedrock rock quality designation (RQD)).
    c. Packer permeability tests should be performed within the borings to estimate the hydraulic conductivity of the bedrock, which can be used to approximate reservoir seepage losses and identify general foundation treatment requirements.
4. Laboratory tests should be performed on soil and bedrock samples collected during the subsurface investigation to identify index, strength, and dispersion properties of the foundation and available borrow materials.

5. Seismic evaluations should be performed to estimate the peak ground accelerations at the site.
6. Borrow sources should be identified based on the findings of the geologic mapping, subsurface investigation, and laboratory testing.
7. The internal embankment geometry presented in this report should be refined as necessary based on the available borrow material identified during the subsurface investigation and laboratory testing.
8. Material properties should be developed for the foundation and embankment fill materials based on the results of laboratory testing and published correlations for similar materials.
9. Static slope stability analyses should be performed for the maximum embankment section to confirm that the embankment slopes provide adequate stability. The embankment slopes presented in this report should be refined as necessary.
10. Seismic deformation analyses should be performed to estimate the permanent embankment crest deformation that would result from the design peak ground acceleration. The embankment freeboard presented in this report should be refined as necessary to provide adequate residual freeboard.
11. Preliminary geotechnical evaluations should be performed for spillway excavations and other ancillary facilities.
12. The construction material quantities presented in this report should be refined based on the foundation conditions identified during the subsurface investigation and any revisions to the embankment geometry.



EXPLANATION (NOTE 2)

Qh	🟨	ALLUVIUM
Qk	▭	KAYCEE FORMATION
Qc	🟨	COLLUVIUM
QTu	🟧	TERRACE ALLUVIUM, UNDIVIDED
Tw	🟧	WASATCH FORMATION

——— APPROXIMATE DAM OUTLINE

— · · · — APPROXIMATE RESERVOIR WATER SURFACE

0 1000 2000 4000 6000

SCALE IN FEET

THIS FIGURE MUST BE REPRODUCED IN COLOR

NOTE:

1. BASE MAP FROM USGS MAP GQ–1552, GEOLOGIC MAP OF THE BUFFALO QUADRANGLE.
2. ONLY GEOLOGICAL UNITS WITHIN THE LIMITS OF THE DAM SITES ARE IDENTIFIED.

RJH CONSULTANTS, INC.

CLEAR CREEK

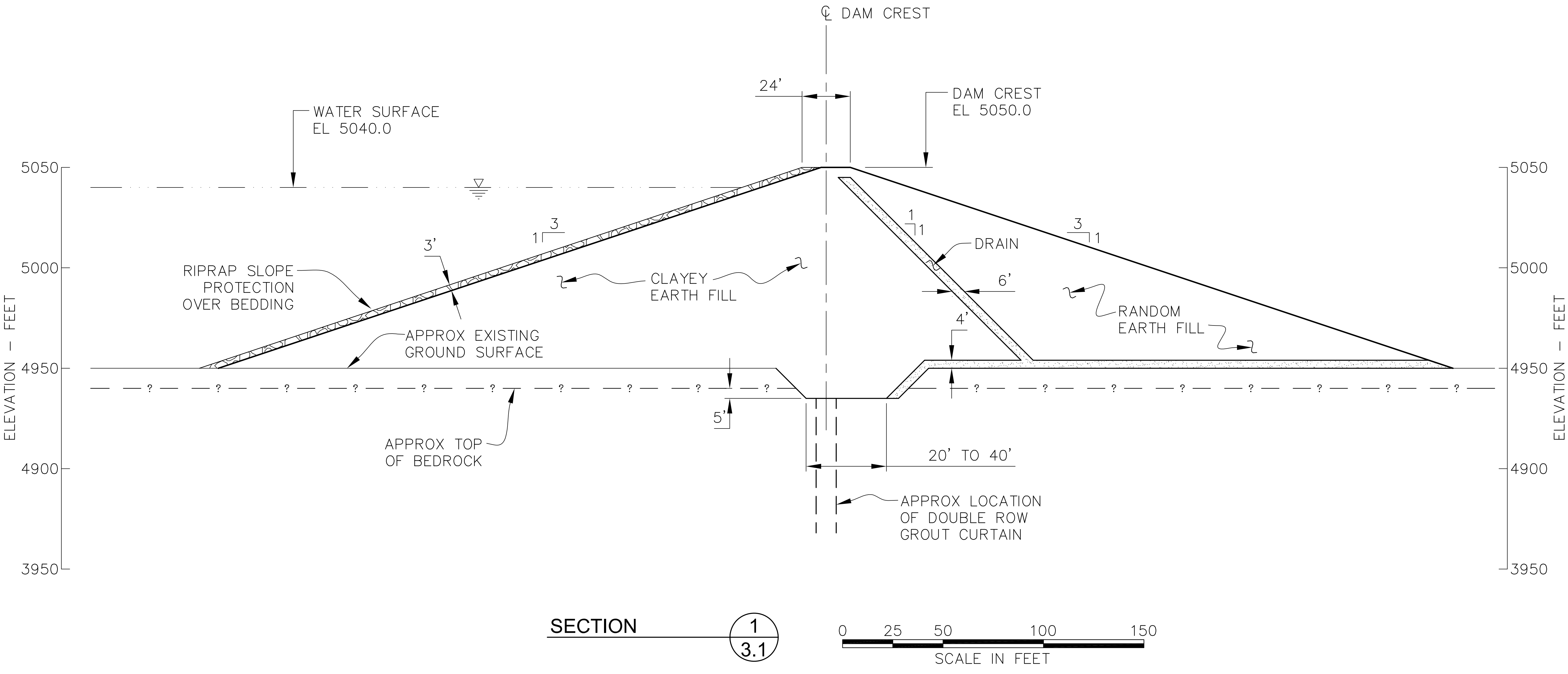
SAND CREEK AND
BULL CREEK SITES

PROJECT NO. 09115

July 2010

Figure 3.1

P:\09115 – CLEAR CREEK\CAD\FIGURES\09115 BULL CREEK AND SAND CREEK.DWG 7/1/2010 3:04 PM



SECTION 1/3.1

NOTES:

1. ALL DIMENSIONS ARE IN FEET.
2. SECTION IS BASED ON USGS 1:24,000 SCALE TOPOGRAPHIC CONTOURS.
3. EXISTING GROUND SURFACE WAS ASSUMED TO BE HORIZONTAL AT THE APPROXIMATE ELEVATION OF THE VALLEY BOTTOM.

RJH CONSULTANTS, INC.

CLEAR CREEK

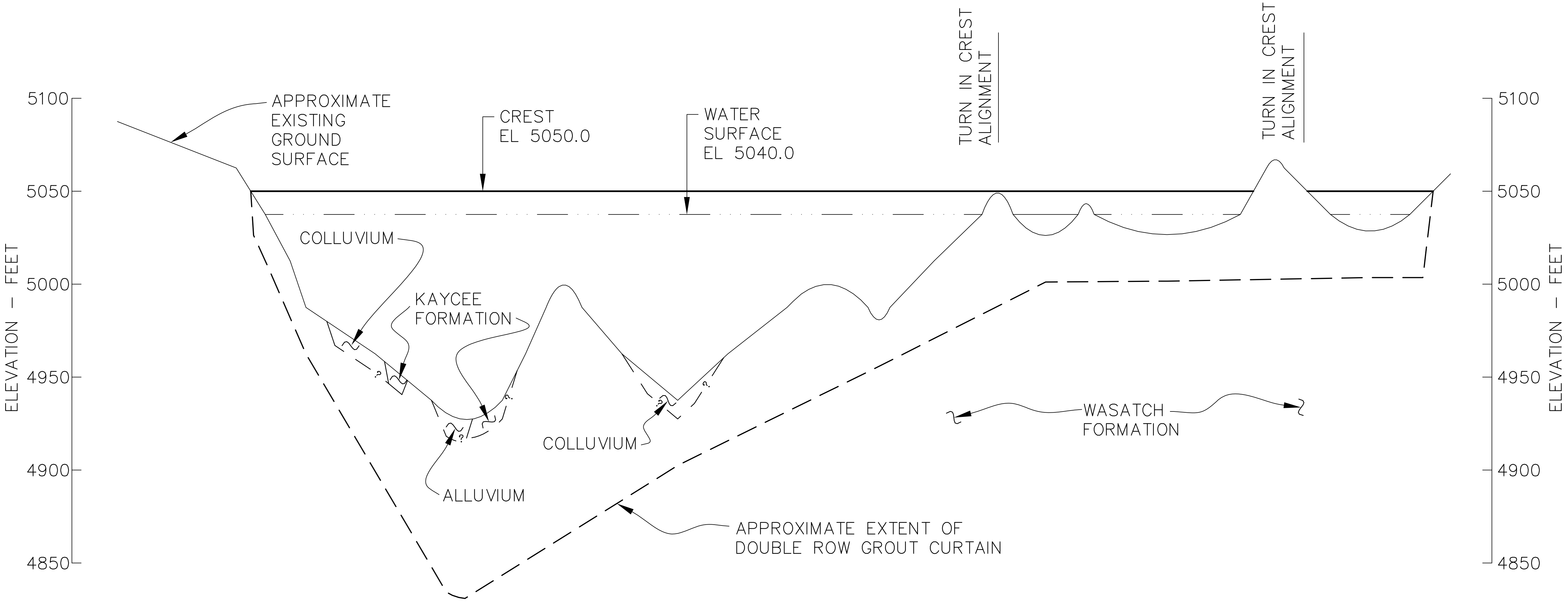
PROJECT NO. 09115

SAND CREEK RESERVOIR
MAXIMUM SECTION

July 2010

Figure 3.2

P:\09115 – CLEAR CREEK\CAD\FIGURES\09115 SAND CREEK PROFILE AND SECTION.DWG 7/1/2010 3:08 PM



SECTION 2/3.1

0 250 500 1000 1500

HORIZONTAL SCALE IN FEET

0 25 50 100 150

VERTICAL SCALE IN FEET

EXPLANATION:

— — ? — APPROXIMATE GEOLOGIC CONTACT

NOTES:

1. ALL DIMENSIONS ARE IN FEET.
2. PROFILE IS BASED ON USGS 1:24,000 SCALE TOPOGRAPHIC CONTOURS.

RJH CONSULTANTS, INC.

CLEAR CREEK

SAND CREEK RESERVOIR EMBANKMENT PROFILE

PROJECT NO. 09115

July 2010

Figure 3.3

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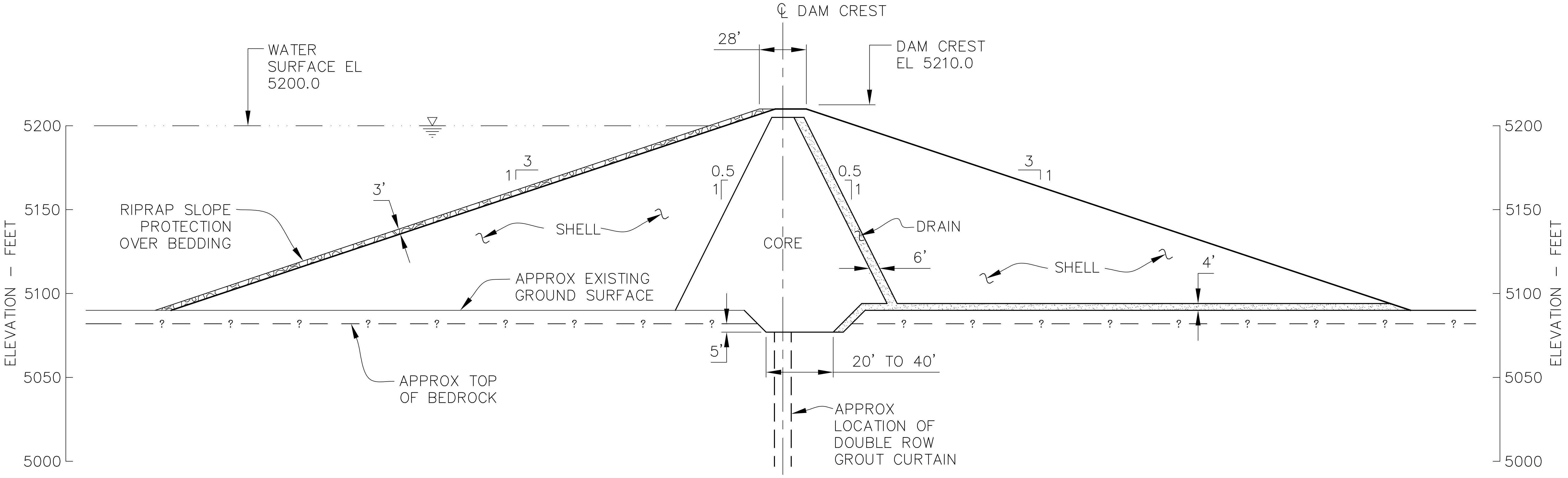


SECTION 3 / 3.1

0 30 60 120 180
SCALE IN FEET

NOTES:

1. ALL DIMENSIONS ARE IN FEET.
2. SECTION IS BASED ON USGS 1:24,000 SCALE TOPOGRAPHIC CONTOURS.
3. EXISTING GROUND SURFACE WAS ASSUMED TO BE HORIZONTAL AT THE APPROXIMATE ELEVATION OF THE VALLEY BOTTOM.

RJH
CONSULTANTS, INC.

CLEAR CREEK

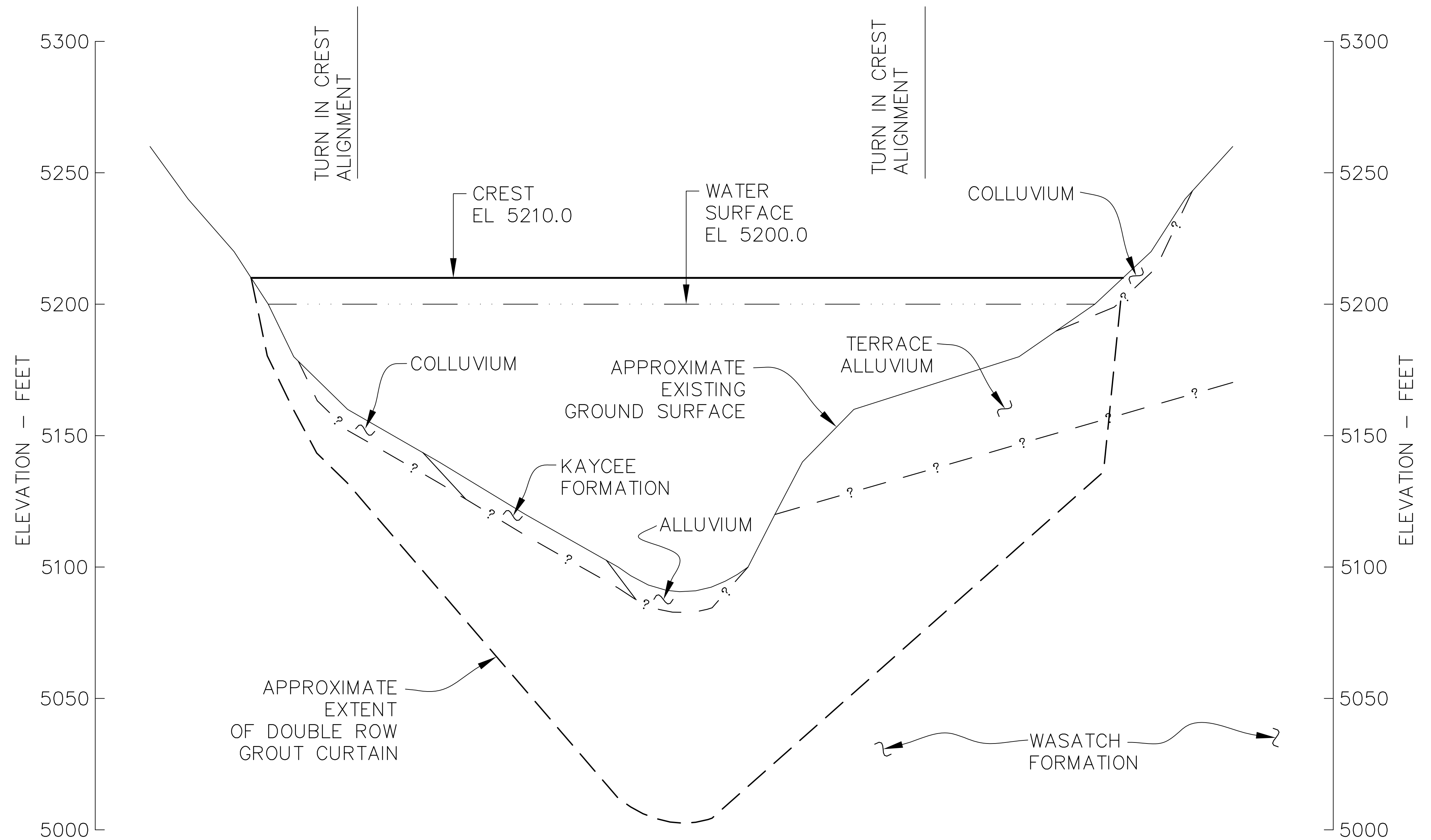
BULL CREEK RESERVOIR
MAXIMUM SECTION

PROJECT NO. 09115

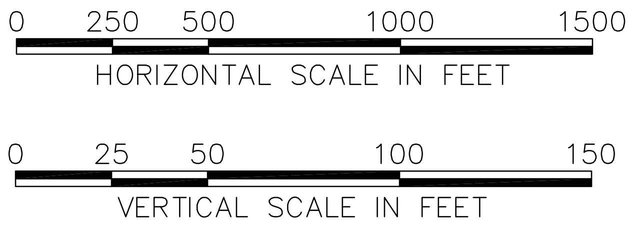
July 2010

Figure 3.4

P:\09115 - CLEAR CREEK\CAD\FIGURES\09115 BULL CREEK PROFILE AND SECTION.DWG 7/1/2010 3:07 PM



SECTION 4/3.1



EXPLANATION:

— —?— APPROXIMATE GEOLOGIC CONTACT

NOTES:

1. ALL DIMENSIONS ARE IN FEET.
2. PROFILE IS BASED ON USGS 1:24,000 SCALE TOPOGRAPHIC CONTOURS.

RJH CONSULTANTS, INC.

CLEAR CREEK

PROJECT NO. 09115

BULL CREEK RESERVOIR
EMBANKMENT PROFILE

July 2010

Figure 3.5

P:\09115 – CLEAR CREEK\CAD\FIGURES\09115 BULL CREEK PROFILE AND SECTION.DWG 7/1/2010 3:06 PM

Appendix 6F
WWDC Dam and Reservoir Program

OPERATING CRITERIA

OF THE

WYOMING WATER DEVELOPMENT PROGRAM

APPROVED BY:
WYOMING WATER DEVELOPMENT COMMISSION
LEGISLATIVE SELECT WATER COMMITTEE
JUNE 5, 2008

Operating Criteria of the Wyoming Water Development Program

TABLE OF CONTENTS

Approved June 5, 2008

Operating Criteria of the Wyoming Water Development Program

CHAPTER I. Introduction

A. Purpose of the Operating Criteria

The Wyoming Water Development Commission (WWDC), comprised of ten (10) public members appointed by the Governor, has authority over the Wyoming Water Development Program. The Wyoming Water Development Office (WWDO) administers the program.

The 1975 Legislature passed W.S. 41-2-112(a), which established the purpose of the program:

> "The Wyoming water development program is established to foster, promote and encourage the optimal development of the state's human, industrial, mineral, agricultural, water and recreational resources. The program shall provide, through the commission, procedures and policies for the planning, selection, financing, construction, acquisition and operation of projects and facilities for the conservation, storage, distribution and use of water, necessary in the public interest to develop and preserve Wyoming's water and related land resources. The program shall encourage development of water facilities for irrigation, for reduction of flood damage, for abatement of pollution, for preservation and development of fish and wildlife resources [and] for protection and improvement of public lands and shall help make available the waters of this state for all beneficial uses, including but not limited to municipal, domestic, agricultural, industrial, instream flows, hydroelectric power and recreational purposes, conservation of land resources and protection of the health, safety and general welfare of the people of the state of Wyoming."

These criteria provide the WWDC, the WWDO and the public with general standards for evaluating and prioritizing applications for program funding, a general framework for the development of program/project recommendations and the generation of water related information.

In addition, these criteria have been developed to assist the WWDC and WWDO to establish priorities and procedures and to serve as a tool to coordinate with other state and federal programs, which provide funding assistance for water projects. The criteria are not intended to be inflexible or uncompromising rules but rather to provide general guidelines for use in the decision making process.

These criteria respond to the requirements of W.S. 41-2-112(a) that the WWDC adopt procedures and policies and W.S. 41-2-121(b) which requires the WWDC to establish criteria for evaluation and administration of water development programs. The statutes also provide specific program guidance and were considered in the development of these criteria.

B. Changes in the Program Criteria

The criteria may be revised on a periodic basis to insure the Water Development Program is serving Wyoming citizens in a responsible and efficient manner. The WWDC and Director of the WWDO may offer changes in the criteria. Proposed changes in the criteria shall be reviewed during the combined Select Water Committee/WWDC meeting in August. During the August meeting, the proposed changes in criteria may be given a preliminary approval or final disapproval. Those proposed changes that are preliminarily approved shall be reviewed by the public during a public hearing process.

The proposed changes which receive preliminary approval and which have been reviewed by the public shall be considered for final approval during the WWDC's May/June meeting. The WWDC shall also weigh the comments provided by the public to determine whether a proposed change shall be accepted as written, amended or disapproved.

C. Program Statutes

The following statutes are the primary basis for these criteria:

W.S. 41-2-112(b) states:

> "In developing financing recommendations under the Wyoming water development program, the commission shall:
>
> (i) Emphasize multipurpose water projects for maximum benefits and cost allocation;
>
> (ii) Identify project costs and benefits;
>
> (iii) Recommend an allocation of project costs, including expenditures of state funds for Level I reconnaissance studies, Level II feasibility studies and Level III development plans, to be reimbursed by project beneficiaries and to be borne by the state;
>
> (iv) Recommend terms and conditions of financing project costs, maintenance and operation, based on the benefits to be derived by project beneficiaries and their respective ability to pay;

(v) Consider all funds, assets and revenue sources of all project beneficiaries and recommend financing plans which will reimburse expenditures of state funds, except as such expenditures may be allocated to a state benefit, including enhancement of fish and wildlife habitat or recreation;

(vi) Consider state construction and ownership of any project which requires the state to finance un-reimbursed costs in excess of ten percent (10%) of the total project cost and submit recommendations on project costs and potential revenues from sale of water or power from the project;

(vii) Consider any other factors necessary to develop comprehensive financing recommendations."

W.S. 41-2-121 provides more specific guidance:

"(a) The water development commission shall establish criteria for evaluation and administration of water development projects. Criteria shall include but not be limited to the following:

(i) All water development proposals submitted to the legislature shall be reviewed by and accompanied by the recommendation of the water development commission;

(ii) The commission's recommendation shall:

(A) Emphasize projects developing un-appropriated water;

(B) Give preference wherever possible to projects developing new storage capacity;

(C) Consider the potential for development of hydroelectric power in any project through Level II;

(D) Include a summary of the commission's findings under W.S. 41-2-112(b);

(E) Include financing methods subject to the following:

(I) Any water development project may be financed by grants not to exceed seventy-five percent (75%) of the total cost of the project;

(II) Storage projects may be financed by grants for the full cost of the storage capacity but not to exceed public benefits as computed by the commission;

(III) Loans may be made for domestic, agricultural, industrial, recreational or fish and wildlife enhancement purposes;

(IV) The term of a loan shall not exceed fifty years after substantial completion of the project;

(V) Payment of interest and principal on loans may be deferred for not more than five (5) years after substantial completion of the project;

(VI) Loan contracts for project construction shall include provisions to ensure the project shall be operated and maintained during the term of the loan;

(VII) The state may elect to own all or a part of a project and enter into water service repayment contracts with project developers;

(VIII) A project involving a trans-basin diversion shall address the impact of the diversion and recommend measures to mitigate any adverse impact identified in the basin of origin;

(IX) Interest on a loan should provide a reasonable return to the state but shall not be less than four percent (4%) except when the commission recommends a lower interest rate because of public benefits;

(X) Loan contracts for project construction should provide for payment of interest on defaulted payments at a rate of ten percent (10%) per annum;

(iii) Repealed by Laws 1986, Chapter 109, Section 3.

(iv) The commission may disqualify from consideration or give lower priority to a project proposed to correct problems identified in a review performed by the department of environmental quality under W.S. 18-5-306(c) where the board of county commissioners

> approved a subdivision application notwithstanding the department's recommendation that the application be disapproved."

D. Program Philosophy

The Wyoming Water Development Program was founded on the philosophy of utilizing a portion of the financial resources the state receives from the development and use of its non-renewable resources, such as coal, oil, and gas, to develop a renewable resource, water. The program provides long-term economic benefits to the State of Wyoming by providing information and water supply projects for the existing and future needs of the State of Wyoming and its citizens. Water availability is a key ingredient for the development of a stable Wyoming economy. The projects also provide short-term economic benefits to the State of Wyoming in the form of jobs and increased material and equipment sales.

Interstate compacts and water related court decrees serve as the primary defense of Wyoming's water entitlements. However, demands downstream of Wyoming are increasing at alarming rates, as are the number of lawsuits, which may interpret the intent of those compacts and decrees. There is resistance from downstream states toward upstream development. Federal laws, rules and regulations are narrowing the window of opportunity to develop water resources. However, water development plans can serve to protect Wyoming's entitlements by documenting the need to develop additional sources of water to meet demands associated with anticipated growth and development. The program's criteria are based on the general philosophy that responsible development and the efficient consumptive beneficial use of water will protect Wyoming's compact and court decreed entitlements.

CHAPTER II. Project Development

A. New Development Program

The New Development Program develops presently unused and/or unappropriated waters of Wyoming. The program is funded by Water Development Account No. I [W.S. 41-2-124(a)(i)], which has received general fund appropriations and budget reserve account appropriations on occasion, as approved by the legislature; the interest earnings that have accrued to Water Development Account No. I; and a percentage (12.45%) of the revenues which accrue to the state's severance tax distribution account. Legislative approval must be granted prior to allocating funds to a particular purpose or project.

The New Development Program provides an opportunity for sponsors to develop water supplies for anticipated future needs to insure that lack of water supply will not inhibit economic growth. The program encourages water development through state/local partnerships. The sponsor can complete a water supply project with state funding assistance. If a project is developed to meet the needs of the sponsor alone, the sponsor owns the project and its revenues. However, if there is an opportunity to sell water for other purposes, the sponsor and state share in the revenues from the sale in proportion to the grant/loan mix. This partnership is discussed in further detail in subsection D.3.g of Chapter III of these criteria.

In as much as the efficient consumptive use of Wyoming's water resources provides the best assurance that Wyoming's water will remain available for the future, the need for water shall be a key consideration in prioritizing projects and dedicating resources for water development purposes. Projects can be placed in the following five categories on the basis of need:

1. Projects developing water for present and future needs of the project sponsors.

   These projects can be pursued through the study and the preliminary design phases if the project sponsor has a legitimate need for the water and has a desire to pursue the project. These projects can be constructed if the sponsor has the ability and willingness to pay a portion of the development costs and all of the operation, maintenance and replacement costs. All projects should be designed to accommodate anticipated future demands of the sponsor during the life of the project. Population projections and other related tools should be used to define realistic future needs of the sponsor.

2. Projects that could be expanded for purposes and needs beyond those of the project sponsor.

   If there is the opportunity on a particular project to expand its scope to address water supply needs and problems beyond those of the project sponsor, the WWDC shall consider the expansion of the project to address those additional needs and problems on a case-by-case basis. Input from local governments will be considered in these deliberations.

3. Projects capable of developing water for secondary benefits

   If there is the opportunity on a particular project to develop water in excess of present and future needs of the sponsor in order to provide secondary benefits, the WWDC shall consider development of the additional supply on a case-by-case basis.

   The key factors shall be the availability of water to promote secondary benefits such as flood control, hydropower, recreation and environmental enhancement. Projects in this category may proceed as a sponsored project with the state providing the funds to promote the secondary benefits.

4. Projects developing water for which there is not a presently defined purpose.

   Federal regulations make developing water for future, undefined uses difficult. However, opportunities on a particular project to develop water in addition to that needed for present, future, expanded, and secondary purposes should not be summarily dismissed. These opportunities should be identified and considered for future enlargements to the project or pursued if possible and if the development of the water may provide economic benefits in the future. Projects in this category may proceed as sponsored projects with the state providing the funds for the development of the additional water and receiving the revenues generated by future sales of the additional water.

5. Projects which may prove feasible in the future.

   One of the primary purposes of river basin plans is to identify water development opportunities as well as define water supply shortages. The plans serve to promote interest from water users who may become interested in a particular project and become project sponsors.

B. Rehabilitation Program

The purpose of the Rehabilitation Program is to provide funding assistance for the improvement of water projects completed and in use for at least fifteen (15) years. The source of revenue for the program is Water Development Account No. II [W.S. 41-2-124(a)(ii)], which receives a percentage (2.10%) of the revenues that accrue to the state's severance tax distribution account and the interest earnings that have accrued to Water Development Account No. II. Legislative approval must be granted prior to allocating funds to a particular purpose or project.

Rehabilitation projects are typically initiated by an application from a project sponsor. If the application is approved, the project is usually assigned a Level II status and can proceed through construction if it is determined the project is technically and economically feasible. The project sponsor must be willing and capable of financially supporting a portion of the project development costs plus all operation and maintenance costs.

The Rehabilitation Program serves to assist project sponsors in keeping existing water supplies effective and viable, thereby preserving their use for the future. Rehabilitation projects can improve an existing municipal or rural domestic water supply system or an agricultural storage facility or conveyance system. The projects serve to insure dam safety, decrease operation, maintenance, and replacement costs and/or provide a more efficient means of using existing water supplies.

C. Dam and Reservoir Program

Proposed new dams with storage capacity of 2,000 acre feet or more and proposed expansions of existing dams of 1,000 acre feet or more qualify for the Dam and Reservoir Program. The source of revenue for the program is Water Development Account No. III [W.S. 41-2-124(a)(iii)], which has received Water Development Account No. I appropriations and budget reserve account appropriations on occasion, as approved by the legislature; the interest earnings that have accrued to the Water Development Account No. III; and a percentage (0.5%) of the revenues which accrue to the state's severance tax distribution account. Legislative approval must be granted prior to allocating funds to a particular purpose or project.

Dams and reservoirs typically provide opportunities for many potential uses. While water supply shall be emphasized in the development of reservoir operating plans, recreation, environmental enhancement, flood control, erosion control and hydropower uses should be explored as secondary purposes.

D. Priorities of Projects

As previously discussed, the statutory guidelines are sufficiently broad to allow the program to address all types of projects involving water. However, in order to establish priorities and to utilize available program funds effectively and efficiently, it is necessary to develop priorities relative to the types of water projects the program should pursue. The following is a list of eligible projects in order of preference:

1. Multipurpose Projects -- For purposes of program implementation, multipurpose projects are hereby defined as projects which serve two or more of the following functions: agriculture, municipal, industrial, rural domestic, recreation, environmental, flood control, erosion control, and hydropower. Priority will be given to those projects that may practically serve more than one entity or purpose and whose service area encompasses a larger, more regional area.

2. Storage Projects -- Dams and reservoirs that store water during times of surplus for use later when needed shall be a program priority. Dams and reservoirs can also serve to re-regulate existing water supplies to meet the demands of the water users in a more efficient and effective manner. Proposed new dams with storage capacity of 2,000 acre feet or more and proposed expansions of existing dams of 1,000 acre feet or more qualify for the Dam and Reservoir Program. Smaller storage projects qualify for funding under the New Development Program. Repairs and improvements to existing storage projects qualify for funding under the Rehabilitation Program.

3. Supply Projects -- These projects include groundwater wells, alluvial wells, diversion dams, and other structures, which put un-appropriated water to beneficial use or supply existing uses.

   The priority for supply projects based on purpose are as follows:

   Priority 1. Irrigation and municipal projects

   Priority 2. Rural domestic projects that are obtaining water from another existing public water supply

   Priority 3. Rural domestic projects with independent water supplies and raw water irrigation projects for municipalities and rural domestic districts

4. Supply Systems -- While the above three types of projects make water available at the source, supply systems bring this source water closer to the point of use through pipeline and canal systems. Projects in this category include major water transmission facilities that deliver water to distribution systems that serve individual users or to water treatment facilities. Typically, the transmission systems transport raw/untreated water. However, if the most efficient/economical project configuration dictates the water should be treated prior to transportation, the transmission systems can serve to deliver treated water.

   The priority for supply systems based on purpose are as follows:

   Priority 1. Irrigation and municipal projects

   Priority 2. Rural domestic projects that are obtaining water from another existing public water supply system

   Priority 3. Rural domestic projects with independent water supply systems and raw water irrigation systems for municipalities and rural domestic districts

   Water treatment facilities are not included in this category and are not eligible for funding with one exception: Disinfection facilities needed to connect groundwater wells to a supply system are eligible for program funding when it expedites the completion of the project.

   Distribution systems are not included in this category and are not eligible for funding. It is often difficult to determine when pipelines are serving as supply systems or distribution systems. The primary purpose of supply systems is to transport or deliver water from one point to another for later distribution to customers. The primary purpose of distribution systems is to deliver water to individual users. The determination as to which pipelines serve as supply systems and thereby qualify for program funding will be completed during the Level II process.

5. Hydropower Projects -- These projects include retrofitting existing facilities or the construction of new facilities capable of developing marketable hydropower. W.S. 41-2-121 directs the consideration of hydropower production on any program project through the feasibility phase. However, these types of projects shall not be subsidized with grants. The potential return of the investment is the key consideration in determining whether to pursue hydropower projects.

6. Purchase of Existing Storage -- This type of investment may be made under the program if the storage is uncommitted or is not being used for a specific purpose. Any such purchase shall be project specific. There should be assurances that the investment will lead to the ultimate use of the water. The potential market for the water shall be the key consideration in determining whether the purchase should be pursued. Potential secondary benefits such as recreational or environmental uses shall also be considered.

7. Recreation -- The development of water projects the primary purpose of which is to enhance recreation may be implemented under this program. In addition, the feasibility of providing recreation benefits shall be considered in the operating plan of all new projects.

8. Drinking Water State Revolving Fund -- By enacting W.S. 16-1-302, the Legislature authorized the use of water development account funds to provide 50% of the state's matching fund requirements for the federal Drinking Water State Revolving Loan Fund (DWSRF) program. The DWSRF program may be used to fund improvements to water treatment systems and to finance measures that address other Safe Drinking Water Act compliance issues. This program is not included in the annual Omnibus Water Bill considered by the Legislature. Water Development Program funds are appropriated automatically by statute to match 10% of the federal capitalization grant.

9. Reimbursement of Temporary or Emergency Funding

   The WWDC may recommend that the legislature reimburse or provide refinancing for projects in which the project sponsors acquired temporary or emergency funding from the State Land and Investment Board (SLIB), if those projects meet these criteria and if the WWDC agreed to recommend refinancing prior to the application for SLIB funding.

In order to further clarify the list defined under program priorities, the following are examples of projects/investments that shall not be considered for funding under the program:

1. Refinancing of Previously Completed Improvements -- Refinancing of existing projects that have been financed with non-state resources is not an allowable program expense. Further, refinancing may conflict with goals and objectives of other programs.

2. Wastewater Projects -- Wastewater treatment plants and/or collector systems shall not be funded under the program.

3. Environmental Enhancement -- Although the feasibility of providing or rehabilitating environmental improvements shall be considered on all program projects, the program does not have the resources to pursue projects that solely serve environmental enhancement purposes.

4. Flood Control -- Projects that deal solely with flood control are essential in many parts of the state. There are active federal funding programs that serve this purpose. Therefore, sponsors are encouraged to seek funding from these alternate sources.

5. Rehabilitation of Hydropower Projects -- Existing hydropower facilities should be generating sufficient revenues to perform operation, maintenance, and replacement without state assistance.

6. Erosion Control -- While improvements to natural streams are sometimes necessary to keep existing water supplies viable, these improvements are typically performed through private or federal funding and should not be funded under the program.

7. Distribution Systems -- For purposes of program implementation, distribution systems are considered to be those facilities whose primary purpose is to deliver water to individual users. There is alternate financing available for distribution systems through other state and federal programs.

8. Water Treatment Facilities -- Historically, the program has not participated in water treatment facilities with the exception of disinfection facilities needed to connect groundwater wells to a supply system when it expedites the completion of the project. While the need for improvements to treatment facilities has been considered in the generation of financing plans for program projects, the funding for water treatment improvements has been considered the responsibility of the sponsor.

9. Subdivisions – For those subdivisions required to undergo review pursuant to W.S. 18-5-306(c), the WWDC shall disqualify a project proposed to correct problems identified in the review performed by the Department of Environmental Quality where the Board of County Commissioners approved a subdivision application notwithstanding the Department's recommendation that the application be disapproved.

E. Levels of Project Development

The following levels of project development are based on complex new development projects. Some aspects of the studies may not be necessary for some new development projects or rehabilitation projects in which the scope of the project is better defined.

1. Level I Study Description

   Level I studies are preliminary analyses and comparison of development alternatives. However, the designation of a Level I study is also used for master plans, watershed improvement studies and other water planning studies. The following outline relates to project specific Level I studies:

   a. The typical Level I study shall identify or provide the following:

      i. Development options;

      ii. Potential project beneficiaries and the benefits each option could provide;

      iii. Factors that could impair or prohibit the development of any identified option including legal constraints;

      iv. An analysis of water rights including identification of conflicting prior rights; and

      v. Option comparisons based on physical and legal water availability, technical, economic, legal, and environmental considerations.

      vi. A review of the sponsor’s methods for financing the operation, maintenance, and replacement of the existing water supply.

   b. Level I studies shall be performed in sufficient detail to identify projects or project options, if any, that should be pursued. In evaluating projects that could be advanced to Level II, the following considerations shall be made:

      i. Whether there is an opportunity to economically develop water or maintain an existing supply for Wyoming's use and benefit;

- ii. Whether the project may be configured to provide service to a regional service area encompassing more than a single entity;

- iii. Whether there are viable solutions to resolve technical, legal and environmental problems.

2. Level II, Phase I – Study Description

   The typical Level II process consists of two phases, which serve first to address project feasibility and then, if the project is determined feasible, to refine the project to the status necessary for a Level III funding request.

   a. A Level II, Phase I investigation shall provide the following:

      - i. A reasonable quantification of the amount of water that can physically and legally be developed or maintained;

      - ii. A determination of water needs that could be or are being served by the project;

      - iii. A determination of technical feasibility including a safety analysis; and for dam and reservoir projects (including stock ponds), a geotechnical and basin geomorphology analysis;

      - iv. A general configuration depicting preliminary physical characteristics of the project;

      - v. A preliminary project operation plan;

      - vi. Cost estimates for construction, consultant services, and operation, maintenance, and replacement;

      - vii. Identification of direct and indirect benefits that result from the implementation of the project;

      - viii. Identification of costs and benefits that would result by incorporating recreation, hydropower generation, and flood control functions into the project operation;

      - ix. A definition of economic, legal, environmental, and administrative problems and identification of alternate solutions to those problems;

x. Identification of lands that may be affected by the project;

xi. An analysis of the project sponsor's ability to pay;

xii. A determination of project components that are eligible for WWDC funding and project components that are not eligible; and

xiii. A financing plan identifying changes in the sponsor’s water financing methods including water rates or charges, tap fees, sinking funds, and other revenues that should be implemented to fund the project. In addition, the financing plan should address alternate sources of funding for the project including project components that are not eligible for WWDC funding. The financing plan should provide a comparison of alternate sources of funding identifying the costs and schedule associated with achieving such funding. Associated inflation costs caused by the time required to achieve the funding will be considered.

b. Once all Level II, Phase I investigations have been completed, the WWDC will evaluate the results and will consider the sponsor's need for the project, interest in the project, and willingness and ability to financially participate in the project to determine if the project should proceed to Level II, Phase II.

3. Level II, Phase II – Study Description

A Level II Phase II investigation shall include the following design and technical services:

a Hydrological investigations;

b. An operating plan that addresses water management during and after construction;

c. A conceptual design and general configuration of the project;

d. The identification of state and federal permits and clearances necessary to construct the project;

e. An environmental analysis, including environmental assessments, etc., of the proposed project's operation and configuration, including:

   i. The identification of anticipated impacts on or improvement to water quality which may occur as a result of the project, i.e., total dissolved solids or total suspended solids, etc.;

   ii. An assessment of the longevity of dam and reservoir projects, including stock ponds, with respect to sediment loading and hydrologic events;

   iii. Identification of the potential to develop wetlands eligible for Wyoming's Wetland Banking Program; and

   iv. The performance of a cultural resource survey of the general project area, as applicable;

f. The development of a detailed schedule of the activities necessary to complete the project;

g. The preparation of an itemized project budget that includes costs for design engineering, permitting, land acquisition, construction, construction engineering, operation, maintenance and replacement, and a financing plan; and

h. The preparation of a socioeconomic analysis of the costs and benefits of the proposed project. This analysis shall include the net present value of the stream of benefits and costs associated with the project. The net present value shall be calculated using a discount rate based on a real rate of return as opposed to a market or nominal rate of return. Sociological and environmental consequences of the project shall be described where values are difficult to place on either benefits or costs.

4. Input from Local Officials

During the Level II process when it is apparent that the project will be a candidate for Level III funding, the following analyses will be completed:

(a) implications of the project on water and energy use of the community or general area;

(b) implications of the project on the future growth of the community or general area; and

(c) the impacts of the project on the operating expenses of any other city, county or special district possessing jurisdiction over a service obligation to the project area.

Written verification from the impacted city, county, or special district must be submitted documenting that the impacts to them are understood and accepted.

5. Level II, Phase III -- Dam and Reservoir Program only

a. This phase of development pertains to projects that enlarge existing storage projects by 1,000 acre-feet or greater or for proposed new dam and reservoirs with a capacity of 2,000 acre-feet or greater. Work included under this phase includes final engineering design, reviews required by the National Environmental Policy Act, consultations required by the Endangered Species Act, and acquisition of state and federal permits.

b. Legislative approval, through the omnibus water bill process, is required before initiation of Level II, Phase III activities.

6. Level III Construction

The following activities must be addressed once the Legislature appropriates funds to construct the project:

a. The project agreement, note and mortgage, which formalize sponsor and WWDC project responsibilities and the financing procedures, shall be the first activity undertaken. Funds cannot be committed for expenditure until these documents are executed.

For those projects where the sponsors wish to pursue construction using their own manpower and equipment, the project agreement shall reflect that funding is only available to pay the cost of invoiced materials. Permit and easement acquisition and retaining labor, equipment and professional services are the obligation of the sponsor.

b. For projects that are funded through a combination of funding sources, the sponsors shall certify that all funding has been secured and is available for project purposes before construction can commence.

c. Professional services required for final design, permitting and construction engineering shall be secured pursuant to the requirements of the State Board of Engineers and Surveyors and the Board of Registration for Professional Geologists.

The sponsor may elect to retain the WWDC's Level II consultant. However, if a consultant selection process is implemented, the sponsors will be encouraged to use WWDC consultant selection procedures for Level III services in the absence of statutory or other legally described procedures.

d. For projects other than storage projects, environmental impact statements or assessments shall be prepared, as required.

For storage projects, environmental review and permitting shall be addressed during the Level II, Phase III Study.

e. For projects other than storage projects, permit applications shall be prepared to secure all necessary construction permits and approvals.
For storage projects, environmental review and permitting shall be addressed during the Level II, Phase III Study.

f. For projects other than storage projects, the construction documents, including technical specifications, contract documents and bidding plans shall be prepared. This work may be performed concurrently with the permitting process if it doesn't adversely impact project feasibility.

For storage projects, final engineering design, the construction documents, including technical specifications, contract documents and bidding plans, shall be prepared during the Level II, Phase III Study. This work may be performed concurrently with the permitting process. The Commission may issue a stop work order for those storage projects where ongoing permit activities indicate that the project may be fatally flawed.

g. Easements or fee titles necessary to construct the project shall be acquired. The scheduling of this task shall be sequenced to minimize impacts to property owners and to expeditiously construct the project.

h. Mitigation of project impacts on cultural resources shall be undertaken.

i. After the above activities are completed, the construction bidding process can be initiated.

j. Construction of the project and construction administration/inspection shall commence upon the acceptance of the bid and upon the issuance of the notice to proceed.

k. The date project benefits accrue to the sponsor, for purposes of triggering loan repayment schedules, shall be determined by the Commission.

l. Once compliance with regulatory permitting conditions has been achieved and reclamation and mitigation activities have been completed, project close-out procedures may be initiated.

F. Sponsored and State Projects

Projects can proceed as sponsored projects or state projects.

1. Sponsored Projects

The project sponsor shall be a public entity that can legally receive state funds, incur debt, generate revenues to repay a state loan, hold title and grant a minimum of a parity position mortgage on the existing water system and improvements appurtenant to the project or provide other adequate security for the anticipated state construction loan. A project sponsor can be a municipality, irrigation district, joint powers board, or other approved assessment district, which will realize the major direct benefits of the project. The project sponsor must be willing and capable of financially supporting a portion of the project development costs and all operation and maintenance costs. Typically, sponsors request project technical and financial assistance from the WWDC through the application process.

The sponsor may request that a Level I or Level II study be conducted to identify solutions and alternatives for addressing water supply issues or they may request funds for a Level III construction project, if it is determined the project is technically and economically feasible and serves to meet a water supply need or alleviate a water supply problem.

2. State Projects

The typical state project serves to benefit more than one entity and is multipurpose in nature. Another common characteristic of state projects is that each has a difficult permitting or political issue, which must be addressed. These issues may include developing a partnership with the federal government, another state, and/or private industry to encourage project development; resolving endangered species, water quality, or wetland issues; or addressing resistance to the project from downstream states.

The WWDC shall consider investments in state projects on a case-by-case basis. However, it should be recognized that present federal laws and regulations make it difficult to achieve federal clearances for projects in which there is not a clearly defined purpose and need.

Chapter III Funding Procedures

A. Project Sponsor/Public Entity

The project sponsor shall be a public entity that can legally receive state funds, incur debt, generate revenues to repay a state loan, hold title and grant a minimum of a parity position mortgage on the existing water system and improvements appurtenant to the project or provide other adequate security for the anticipated state construction loan.

The WWDC may waive the requirement that the project sponsor be a public entity under the following exceptions:

1. The WWDC may accept applications for Level I studies from applicants that are not public entities. This will allow the applicant to know if there is a viable project prior to becoming a public entity. However, the applicant must be a public entity before applying for a Level II study. Under these circumstances, the Level I process will have a two-year duration with the study being completed the first year and the sponsor forming a public entity the second year.

2. The WWDC may accept applications related to the construction of dams and reservoirs from applicants that are not public entities. As the evaluations of the feasibility of new dams are complex, this will allow the applicant to know if the proposed reservoir is feasible prior to becoming a public entity. However, the applicant must be a public entity before applying for Level II, Phase III funding.

B. Applications for Projects New to the Program

1. Requirements for New Applications

The due date for new project applications and application fees is August 15 of each year. The application must include a description of the project, a listing of available information pertinent to the project, and information describing the financial capabilities of the sponsor. The following must accompany the application:

a. An application fee of one thousand dollars ($1,000.00) must be submitted with each application. The application fee shall be deposited into Water Development Account No. I. Acceptance of the fee does not obligate the Water Development Commission or State of Wyoming to fund a study or provide construction funding for any proposed project or purpose. If the application is denied, then seventy-five percent (75%) of the application fee shall be refunded to the applicant. The authority to require an application fee is provided by W.S. 41-2-118(a)(xii).

b. A certified original of a resolution passed by the council or governing body of the sponsoring entity shall be provided with an application unless the applicant qualifies for one of the exceptions provided in Section A. Applicants qualifying for the exceptions shall provide evidence of support for the application by providing letters or petitions from interested water users as a substitute for a resolution.

c. The following financial information:

  i. The annual budget for operation, maintenance, and replacement of the water supply system;

  ii. The existing balance in any emergency funds and sinking funds for the water supply system;

  iii. Water rates, tap fees, and other revenue sources; and

  iv. Amount of funding obtained from other revenues for operation, maintenance, and replacement of the water supply system.

d. To become eligible for funding, the WWDC shall require sponsor certification related to compliance pursuant to public water system rate requirements as set forth in W.S. 15-7-602**,** W.S. 16-1-108**,** and W.S. 41-10-113.

2. Review Requirements for New Applications

Review of new applications shall comply with or address the following:

a. The WWDO project manager assigned to review the application shall advise the applicant of the timetable for project review and evaluation.

b. A representative of the WWDO shall inspect the proposed project site.

The acceptance of the project application for incorporation into the program shall be based on the following criteria:

a. The proposed project must be consistent with the goals and objectives of the Wyoming Water Development Program as outlined in W.S. 41-2-112 and these criteria.

b. The Water Development Program must be the most appropriate source of funds for project study and construction.

c. There must not be any apparent economic, legal, environmental or technical problems that would impair or prohibit project development.

d. The proposed projects must serve twenty (20) or more municipal/domestic water taps with individual water meters for each tap or 2,000 or more water righted acres.

e. Sponsors who pass a local capital facilities tax, commit other local tax revenues to a project or secure funding from non-state sources may receive a priority ranking when compared with projects of a similar nature without such funding sources. While the Water Development Program provides for loans and grants, the willingness and ability of project sponsors to assume responsibility for repayment of project costs shall be a factor in the selection of projects to receive state assistance.

C. Applications for Level II Projects

1. Requirements for Applications for Level II Projects

a. Applications seeking Level II status for a project new to the program must comply with the requirements specified in section B.1.

b. The due date for applications for Level II status for projects already in the program, which are seeking funding for an advanced study level or for construction, is October 1 of each year. Application fees are not required. Sponsors of continuing projects may apply by submitting a letter with a copy of a resolution of the governing body attached unless the applicant qualifies for the exception provided in Section A.2. Applicants qualifying for the exception shall provide evidence of support for the application by providing letters or petitions from interested water users as a substitute for a resolution.

2. Review Requirements for Level II Status

   a. The WWDC may introduce projects into the program at Level II status if the application provides a definition of the project configuration and there is evidence that project will provide a viable water supply or rehabilitate an existing water supply. Often, rehabilitation projects can be introduced into the program at Level II status as the projects are clearly defined.

   b. After the Level I studies under the Program are completed, the WWDC shall initiate its review process to determine if the project should proceed to Level II. During its November meeting, the Commission shall review the findings of the Level I report, consider the sponsor's input, and make its preliminary recommendations.

D. Applications for Level III Projects

1. Requirements for Applications for Level III Projects

   a. Applications seeking Level III status for a project new to the program must comply with the requirements specified in section B.1.

   b. The due date for applications for Level III status for projects already in the program, which are seeking funding for an advanced study level or for construction, is October 1 of each year. A copy of a resolution of support from the governing body must be attached to the application. Application fees are not required.

   c. Written verification from any city, county, or special district that is impacted by the project that they understand and accept those impacts. See subsection E.4 of Chapter 2.

   d. All applications for Level III funding for subdivision or rural domestic projects must be accompanied by a letter or a resolution of support from the effected city council and/or county commission.

2. Review Requirements for Level III Status

   a. The WWDC may introduce projects into the program at Level III status if the project sponsor has completed a feasibility study that meets WWDC requirements.

b. After the Level II studies under the Program are completed, the WWDC shall initiate its review process to determine if the project should proceed to Level III. During its November meeting, the Commission shall review the findings of the Level II report, consider the sponsor's input, and make its preliminary recommendations.

Projects shall not progress to Level III construction status unless the sponsor and state are committed to complete the project. Issues that shall be considered and addressed in the development of Level III recommendations include:

a. Whether the project yields a water supply capable of meeting present needs;

b. Whether the project will yield a reserve water supply to meet future needs;

c. Whether the project is affordable given the existing status of the water development account and prior commitments to the account;

d. Whether the project appears to be a good investment for the State of Wyoming considering primary, secondary or indirect project benefits;

e. Whether the project is economically feasible for the sponsor after all project costs are considered, including debt retirement and costs of project operation, maintenance and replacement;

f. Whether the project sponsors are willing to establish a revolving fund to pay costs associated with the repair or replacement of project components that may wear out or malfunction twenty years from the date those components were incorporated into the system*.*

g. Whether the project sponsors and/or beneficiaries are willing to assume financial responsibility for the project. Whether the project sponsors understand the scope of the project. Whether the project will meet the sponsor’s needs. Whether the project sponsors understand they are obligated to assure that the project must be designed and inspected by registered professionals, i.e., licensed engineers and geologists. If the sponsors wish to pursue construction using their own manpower and equipment, whether they understand the funding limits established by the state. Once construction is initiated, whether the project sponsor understands that they cannot voluntarily abandon the project without repaying state grants and loans, including lost interest-earning opportunities.

After the Level II analysis and report have been completed, the Commission shall determine if the project should be elevated to a Level III construction status.

After other funding sources have been considered, the Water Development Program's per tap or per acre investment shall be compared to the sponsor's ability to pay. Project sponsors shall be given the option of making a formal presentation to the WWDC relative to that sponsor's ability and willingness to pay for the project if the Commission determines that the project should not advance due to high repayment costs. The need for the project, the direct and indirect benefits of the project, and any other information the sponsor deems as reasons the project should be advanced or funded, shall be included in the presentation.

3. Level III Funding Considerations

The Commission shall consider project specific information and sponsor input, when developing its preliminary recommendations for Level III projects. If it is determined that the project should proceed to Level III, the following shall also be addressed in the Commission's recommendations:

a. Project Budget

The project budget shall include costs associated with project permitting, design, land acquisition, construction engineering, and construction.

b. Level I and Level II Study Cost Sharing

The WWDC shall determine if the sponsor should be required to pay a portion of the Level I or Level II study costs incurred to develop the recommended alternative needed to secure funding for Level III construction. Typically, the WWDC is the lead agency in developing Level I and Level II reports. The Commission solely funds the studies to insure the reports are unbiased and performed in such a manner as to determine whether the state should invest in the project. This procedure was also established because the project is better served if the sponsor uses its financial resources to fund its share of the project or to service the debt associated with the construction loan. However, in those exceptional cases where the sponsor assumes the role of lead agency in Level I and Level II studies, it shall share in the costs of those studies. Further, if through the Level II process, a groundwater well is developed that will be used as the water source for a Level III project, the sponsor shall share in the cost of the well.

On dam and reservoir projects, the sponsor shall share in the cost of the Level II, Phase III services unless the WWDC agrees to pay these costs in accordance with subsection e, below.

c. Financial Plan - Loan Grant Mix

  i. The maximum grant shall be seventy-five percent (75%) for proposed Level III projects. In order to obtain the maximum grant, the sponsors must demonstrate to the WWDC that the maximum grant is warranted due to severe financial hardship.

  ii. The typical grant shall be sixty-seven percent (67%) for proposed Level III projects. In order to obtain the typical grant, the sponsors must demonstrate to the WWDC that they have taken steps or are willing to take steps to make their water supply systems financially self supporting.

  iii. The WWDC may provide lesser grant amounts for proposed Level III projects that do not qualify for i or ii, above.

d. Financial Plan - Terms of the Loans

  i. Statutory guidelines establish a minimum rate of four percent (4%) for program loans. The current rate is 4% but may be increased by the Legislature.

  ii. W.S. 41-2-121 specifies the term of the loans cannot exceed fifty (50) years after substantial completion of the project. Further, the term of the loan shall never exceed the economic life of the project.

The sponsor's method of loan repayment (water rates, taxes, bonds, etc.) shall also be considered in establishing the term of the loan.

iii. The statutes allow the WWDC to recommend that the payment of interest and principal be deferred up to five (5) years after substantial completion of the project. In addition, the WWDC can recommend that the accrual of interest also be deferred during the term of the payment deferral. These special conditions shall be granted only on a limited basis. The sponsor's method of repayment and the longevity of the sponsor's existence as a legal entity shall be key considerations in determining if this deferment should be granted. In no event can the combined deferment and term of the loan exceed fifty (50) years.

e. Financial Plan – Special Considerations for Dams and Reservoirs

i. The WWDC may recommend a loan/grant mix based on the sponsor's ability to pay a portion of the project costs and all of the operation, maintenance, and replacement costs.

ii. The WWDC may recommend that permitting and design costs be paid by the program thereby reducing the costs applied to the loan/grant mix.

iii. The WWDC may recommend that the program pay for the storage capacity needed to provide water for environmental mitigation and enhancement thereby reducing the costs applied to the loan/grant mix.

iv. The WWDC may recommend any combination of the above.

f. Financial Plan–Special Considerations for Subdivisions or Rural Domestic Projects:

i. In accordance with the WWDC's support of the regional concept to solve water supply problems, funding preference will be given to those water supply projects for subdivisions or rural domestic projects that are proposing to connect to another existing public water supply system.

ii. Financing plans for water supply systems for subdivisions or rural domestic projects will ensure that the developer of the subdivision does not receive a "windfall" from project funding provided by the WWDC.

g. State/Local Partnership

The program has a philosophy that water development can be achieved through state/local partnerships. The sponsor can complete a water supply project with state funding assistance. If the sponsor uses all of the water, the project basically belongs to the sponsor. However, if there is the opportunity to sell water for other purposes, the sponsor and state share in the revenues. This insures that a project sponsor will not receive a "windfall" from the sale of water that was made available, in part, from a state grant. Therefore, if the project develops a new water supply, the WWDC shall establish the terms of the program's participation in the future sale of water in the project agreement in the following manner:

i. There shall be no lease, sale, assignment or transfer of ownership of more than 100 acre feet of water per year from municipal or irrigation projects funded by the program without prior written approval of the WWDC.

ii. There shall be no lease, sale, assignment or transfer of ownership of water from rural domestic projects funded by the program without prior written approval of the WWDC.

iii. If the WWDC approves such sales, the program will receive a share of the revenues from the sale commensurate with the percent of the grant used to construct the project.

h. Sale of Projects

There shall be no lease, sale, assignment or transfer of ownership of a project funded by the program until the project loan is paid in full and until prior written approval is obtained from the WWDC.

The WWDC will ensure that the project sponsor does not receive a “windfall” from the state’s investment in the project.

i. Abandonment of Construction Projects

If the WWDC determines that any project sponsor has, without good cause, abandoned the completion of the project, that sponsor, in addition to being required to repay the loan, shall be obligated to repay the grant funds actually expended plus interest as established by the state auditor in an amount equal to the interest that would have accrued on the expended grant funds. If these payments are deemed by the WWDC to provide a financial hardship on the sponsors, the WWDC may recommend to the legislature that a loan be approved to repay the program. The recommended interest on the loans will be 4% per year and the term will be based on the ability to pay of the sponsor.

E. Recommendation Process

The Water Development Commission uses the following process to generate funding recommendations for legislative consideration.

1. New Applications

The deadline for new project applications is the fifteenth of August. Upon receipt, new applications and supporting documentation are reviewed, and project sites are visited. The WWDC makes preliminary recommendations regarding applications at its November meeting.

2. Existing Projects

Typically, consultant project reports are drafted by the first of October. These reports are reviewed to determine whether the projects warrant advancement in the program.

3. Preliminary Recommendations

At the November WWDC meeting, the WWDO director presents funding recommendations for new applications and existing projects. Project sponsors are given the opportunity to present their requests. The WWDC takes preliminary action on the sponsor’s request at this meeting.

4. Public Meetings

If a proposed Level I Reconnaissance Study or Level II Feasibility Study is of particular concern or controversy, the WWDC may solicit public input at a public meeting prior to finalizing its project recommendation.

5. Public Hearings

The Commission holds formal public hearings on all projects that are proposed for Level III Final Design and Construction funding.

6. Coordination with the Governor

The WWDC provides the Governor with its preliminary recommendations and a financial report addressing impacts to the water development accounts. The Governor may provide input throughout the recommendation process.

7. Final Recommendations

The WWDC meets in December or early January to finalize its legislative recommendations on new applications and existing projects. The Commission considers public input received at the meetings and hearings and recommendations from the Governor. Sponsors and interested parties who disagree with the Commission’s preliminary recommendation are provided the opportunity to address the Commission with their concerns.

8. Select Water Committee

The Select Water Committee is comprised of 6 senators and 6 representatives. They provide legislative oversight for the program, and review the Commission's recommendations and budgets. Typically, the Select Water Committee serves as sponsor for the Water Development Program legislation.

9. Legislative Process

The legislature must authorize the allocation of funds from the water development accounts to particular projects. This approval is solicited through the Omnibus Water Planning and Construction Bills.

CHAPTER IV. Water Resource Planning

The Wyoming Water Development Commission serves as the water-planning agency for the State of Wyoming. The water development planning function is an important aspect of the Water Development Program. Because the issues facing water development in the West are complex, the scope of the WWDC's planning efforts is not as closely defined as the New Development, Rehabilitation, and Dam and Reservoir Programs. The planning aspects of the Wyoming Water Development Program establish the framework for development strategies and serve to identify and resolve water issues. The source of revenue for the planning function of the program is typically Water Development Account No. I.

A. River Basin Plans

The program develops basin wide plans for each of the state's major drainage basins. These plans identify water supply problems and development opportunities. The plans serve to promote interest from water users who may become interested in a particular project and become project sponsors. Basin plans shall include the development of a water related database to provide data and information to developers and resource managers**.**

B. Watershed Improvement Studies

These studies provide a detailed evaluation of an individual watershed. The studies may identify water development and system rehabilitation projects as well as address erosion control, flood control or other non-water development related environmental issues. Watershed improvement studies are an integral part of the Small Water Project Program, which has its own specific criteria. The studies may identify projects that may be eligible for the New Development, Rehabilitation, or Dam and Reservoir Programs.

C. Master Plans

Master plans provide a service to municipalities, districts and other entities to assist in the preparation of planning documents, which serve as a blueprint for future water supply system improvements. Master plans also serve as a framework for the entities to establish project priorities and to perform the financial planning necessary to meet those priorities.

In addition, master plans assist entities in preparing the reports necessary to achieve federal funding assistance for water development, flood control, erosion control, hydropower, rehabilitation, watershed improvements and other water related projects.

Sound water planning serves to promote the effective and efficient use of available water resources. Master plans provide information to users as to whether the resource can adequately service the existing and anticipated demands for water within a certain area and provide reconnaissance level information regarding costs and scheduling.

D. Federal Funding

Presently, there are federal programs which provide funding assistance for some types of water development projects. However, in order to access these funds, costly feasibility/environmental studies are often needed. If these studies cause a financial burden and if the proposed project alleviates a water development, management, rehabilitation problem, or allows the continued beneficial use of water, the WWDC shall consider participating in the studies. The amount of the WWDC'S financial participation shall be based on the proponent's ability to pay.

E. Research

Water development issues and problems may encompass watersheds, river basins or include the entire state. In order to address these issues, non-project specific research and data collection is necessary. The WWDC has developed a working relationship with state and federal agencies and the University of Wyoming to conduct water related research.

In addition, the legislature has assigned the Water Development Program the following research tasks:

1. Instream Flow

The Wyoming Game and Fish Department (WGFD) selects candidate stream segments for instream flows. The WWDC files water right applications with the State Engineer for permits to appropriate water for instream flows in those segments of stream recommended by the WGFD. Further, W.S. 41-3-1004 assigns the WWDC the responsibility to generate feasibility reports for all instream flow permit applications. The reports are hydrological analyses of water availability in the reach of the stream to which the applications apply. The analyses also quantify existing water rights above and within the stream segment.

As the water-planning agency, the WWDC also reviews instream flow requests to determine whether they may conflict with future water development opportunities.

2. Groundwater Grant Program

W.S. 41-2-119 authorizes the Water Development Commission to grant funds to cities, towns, and special districts for exploration programs to evaluate the potential use of underground water for municipal and rural domestic purposes. Authorized entities are eligible to receive up to $400,000 in grant funds and are required to provide 25% of the total project costs in local matching funds. The primary purpose of the program is to inventory the available groundwater resources in the state. The program also serves to assist communities in the development of efficient water supplies. Unlike other projects within the Water Development Program, funding for projects that meet the criteria of the Groundwater Grant Program can be allocated directly by the WWDC without project specific legislation.

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Version Follows

Approved June 5, 2008

Operating Criteria of the Wyoming Water Development Program

CHAPTER I. Introduction

A. Purpose of the Operating Criteria

The Wyoming Water Development Commission (WWDC), comprised of ten (10) public members appointed by the Governor, has authority over the Wyoming Water Development Program. The Wyoming Water Development Office (WWDO) administers the program.

The 1975 Legislature passed W.S. 41-2-112(a), which established the purpose of the program:

> "The Wyoming water development program is established to foster, promote and encourage the optimal development of the state's human, industrial, mineral, agricultural, water and recreational resources. The program shall provide, through the commission, procedures and policies for the planning, selection, financing, construction, acquisition and operation of projects and facilities for the conservation, storage, distribution and use of water, necessary in the public interest to develop and preserve Wyoming's water and related land resources. The program shall encourage development of water facilities for irrigation, for reduction of flood damage, for abatement of pollution, for preservation and development of fish and wildlife resources [and] for protection and improvement of public lands and shall help make available the waters of this state for all beneficial uses, including but not limited to municipal, domestic, agricultural, industrial, instream flows, hydroelectric power and recreational purposes, conservation of land resources and protection of the health, safety and general welfare of the people of the state of Wyoming."

These criteria provide the WWDC, the WWDO and the public with general standards for evaluating and prioritizing applications for program funding, a general framework for the development of program/project recommendations and the generation of water related information.

In addition, these criteria have been developed to assist the WWDC and WWDO to establish priorities and procedures and to serve as a tool to coordinate with other state and federal programs, which provide funding assistance for water projects. The criteria are not intended to be inflexible or uncompromising rules but rather to provide general guidelines for use in the decision making process.

These criteria respond to the requirements of W.S. 41-2-112(a) that the WWDC adopt procedures and policies and W.S. 41-2-121(b) which requires the WWDC to establish criteria for evaluation and administration of water development programs. The statutes also provide specific program guidance and were considered in the development of these criteria.

B. Changes in the Program Criteria

The criteria may be revised on a periodic basis to insure the Water Development Program is serving Wyoming citizens in a responsible and efficient manner. The WWDC and Director of the WWDO may offer changes in the criteria. Proposed changes in the criteria shall be reviewed during the combined Select Water Committee/WWDC meeting in August. During the August meeting, the proposed changes in criteria may be given a preliminary approval or final disapproval. Those proposed changes that are preliminarily approved shall be reviewed by the public during a public hearing process.

The proposed changes which receive preliminary approval and which have been reviewed by the public shall be considered for final approval during the WWDC's May/June meeting. The WWDC shall also weigh the comments provided by the public to determine whether a proposed change shall be accepted as written, amended or disapproved.

C. Program Statutes

The following statutes are the primary basis for these criteria:

W.S. 41-2-112(b) states:

> "In developing financing recommendations under the Wyoming water development program, the commission shall:
>
> (i) Emphasize multipurpose water projects for maximum benefits and cost allocation;
>
> (ii) Identify project costs and benefits;
>
> (iii) Recommend an allocation of project costs, including expenditures of state funds for Level I reconnaissance studies, Level II feasibility studies and Level III development plans, to be reimbursed by project beneficiaries and to be borne by the state;
>
> (iv) Recommend terms and conditions of financing project costs, maintenance and operation, based on the benefits to be derived by project beneficiaries and their respective ability to pay;

(v) Consider all funds, assets and revenue sources of all project beneficiaries and recommend financing plans which will reimburse expenditures of state funds, except as such expenditures may be allocated to a state benefit, including enhancement of fish and wildlife habitat or recreation;

(vi) Consider state construction and ownership of any project which requires the state to finance un-reimbursed costs in excess of ten percent (10%) of the total project cost and submit recommendations on project costs and potential revenues from sale of water or power from the project;

(vii) Consider any other factors necessary to develop comprehensive financing recommendations."

W.S. 41-2-121 provides more specific guidance:

"(a) The water development commission shall establish criteria for evaluation and administration of water development projects. Criteria shall include but not be limited to the following:

(i) All water development proposals submitted to the legislature shall be reviewed by and accompanied by the recommendation of the water development commission;

(ii) The commission's recommendation shall:

(A) Emphasize projects developing un-appropriated water;

(B) Give preference wherever possible to projects developing new storage capacity;

(C) Consider the potential for development of hydroelectric power in any project through Level II;

(D) Include a summary of the commission's findings under W.S. 41-2-112(b);

(E) Include financing methods subject to the following:

(I) Any water development project may be financed by grants not to exceed seventy-five percent (75%) of the total cost of the project;

(II) Storage projects may be financed by grants for the full cost of the storage capacity but not to exceed public benefits as computed by the commission;

(III) Loans may be made for domestic, agricultural, industrial, recreational or fish and wildlife enhancement purposes;

(IV) The term of a loan shall not exceed fifty years after substantial completion of the project;

(V) Payment of interest and principal on loans may be deferred for not more than five (5) years after substantial completion of the project;

(VI) Loan contracts for project construction shall include provisions to ensure the project shall be operated and maintained during the term of the loan;

(VII) The state may elect to own all or a part of a project and enter into water service repayment contracts with project developers;

(VIII) A project involving a trans-basin diversion shall address the impact of the diversion and recommend measures to mitigate any adverse impact identified in the basin of origin;

(IX) Interest on a loan should provide a reasonable return to the state but shall not be less than four percent (4%) except when the commission recommends a lower interest rate because of public benefits;

(X) Loan contracts for project construction should provide for payment of interest on defaulted payments at a rate of ten percent (10%) per annum;

(iii) Repealed by Laws 1986, Chapter 109, Section 3.

(iv) The commission may disqualify from consideration or give lower priority to a project proposed to correct problems identified in a review performed by the department of environmental quality under W.S. 18-5-306(c) where the board of county commissioners

> approved a subdivision application notwithstanding the department's recommendation that the application be disapproved."

D. Program Philosophy

The Wyoming Water Development Program was founded on the philosophy of utilizing a portion of the financial resources the state receives from the development and use of its non-renewable resources, such as coal, oil, and gas, to develop a renewable resource, water. The program provides long-term economic benefits to the State of Wyoming by providing information and water supply projects for the existing and future needs of the State of Wyoming and its citizens. Water availability is a key ingredient for the development of a stable Wyoming economy. The projects also provide short-term economic benefits to the State of Wyoming in the form of jobs and increased material and equipment sales.

Interstate compacts and water related court decrees serve as the primary defense of Wyoming's water entitlements. However, demands downstream of Wyoming are increasing at alarming rates, as are the number of lawsuits, which may interpret the intent of those compacts and decrees. There is resistance from downstream states toward upstream development. Federal laws, rules and regulations are narrowing the window of opportunity to develop water resources. However, water development plans can serve to protect Wyoming's entitlements by documenting the need to develop additional sources of water to meet demands associated with anticipated growth and development. The program's criteria are based on the general philosophy that responsible development and the efficient consumptive beneficial use of water will protect Wyoming's compact and court decreed entitlements.

CHAPTER II. Project Development

A. New Development Program

The New Development Program develops presently unused and/or un-appropriated waters of Wyoming. The program is funded by Water Development Account No. I [W.S. 41-2-124(a)(i)], which has received general fund appropriations and budget reserve account appropriations on occasion, as approved by the legislature; the interest earnings that have accrued to Water Development Account No. I; and a percentage (12.45%) of the revenues which accrue to the state's severance tax distribution account. Legislative approval must be granted prior to allocating funds to a particular purpose or project.

The New Development Program provides an opportunity for sponsors to develop water supplies for anticipated future needs to insure that lack of water supply will not inhibit economic growth. The program encourages water development through state/local partnerships. The sponsor can complete a water supply project with state funding assistance. If a project is developed to meet the needs of the sponsor alone, the sponsor owns the project and its revenues. However, if there is an opportunity to sell water for other purposes, the sponsor and state share in the revenues from the sale in proportion to the grant/loan mix. This partnership is discussed in further detail in subsection D.3.g of Chapter III of these criteria.

In as much as the efficient consumptive use of Wyoming's water resources provides the best assurance that Wyoming's water will remain available for the future, the need for water shall be a key consideration in prioritizing projects and dedicating resources for water development purposes. Projects can be placed in the following <u>***five***</u> categories on the basis of need:

1. Projects developing water for present and <u>***future needs of the project sponsors.***</u>

   These projects can be pursued through the study and the preliminary design phases if the project sponsor has a legitimate need for the water and has a desire to pursue the project. These projects can be constructed if the sponsor has the ability and willingness to pay a portion of the development costs and all of the operation, maintenance and replacement costs. <u>***All projects should be designed to accommodate anticipated future demands of the sponsor during the life of the project. Population projections and other related tools should be used to define realistic future needs of the sponsor.***</u>

2. Projects <u>***that could be expanded for purposes and needs beyond those of the project sponsor.***</u>

If there is the opportunity on a particular project to expand its scope to address water supply needs and problems beyond those of the project sponsor, the WWDC shall consider the expansion of the project to address those additional needs and problems on a case-by-case basis. Input from local governments will be considered in these deliberations.

3. Projects capable of developing water for secondary benefits

If there is the opportunity on a particular project to develop water in excess of present and future needs of the sponsor in order to provide secondary benefits, the WWDC shall consider development of the additional supply on a case-by-case basis.

The key factors shall be the availability of water to promote secondary benefits such as flood control, hydropower, recreation and environmental enhancement. Projects in this category may proceed as a sponsored project with the state providing the funds to promote the secondary benefits.

4. Projects developing water for which there is not a ***presently defined purpose.***

Federal regulations make developing water for future, undefined uses difficult. However, opportunities on a particular project to develop water in addition to that needed for present, future, expanded, and secondary purposes should not be summarily dismissed. These opportunities should be identified and considered for future enlargements to the project or pursued if possible and if the development of the water may provide economic benefits in the future. Projects in this category may proceed as sponsored projects with the state providing the funds for the development of the additional water and receiving the revenues generated by future sales of the additional water.

5. Projects which may prove feasible in the future.

One of the primary purposes of river basin plans is to identify water development opportunities as well as define water supply shortages. The plans serve to promote interest from water users who may become interested in a particular project and become project sponsors.

B. Rehabilitation Program

The purpose of the Rehabilitation Program is to provide funding assistance for the improvement of water projects completed and in use for at least fifteen (15) years. The source of revenue for the program is Water Development Account No. II [W.S. 41-2-124(a)(ii)], which receives a percentage (2.10%) of the revenues that accrue to the state's severance tax distribution account and the interest earnings that have accrued to Water Development Account No. II. Legislative approval must be granted prior to allocating funds to a particular purpose or project.

Rehabilitation projects are typically initiated by an application from a project sponsor. If the application is approved, the project is usually assigned a Level II status and can proceed through construction if it is determined the project is technically and economically feasible. The project sponsor must be willing and capable of financially supporting a portion of the project development costs plus all operation and maintenance costs.

The Rehabilitation Program serves to assist project sponsors in keeping existing water supplies effective and viable, thereby preserving their use for the future. Rehabilitation projects can improve an existing municipal ***or rural domestic*** water supply system or an agricultural storage facility or conveyance system. The projects serve to insure dam safety, decrease operation, maintenance, and replacement costs and/or provide a more efficient means of using existing water supplies.

C. Dam and Reservoir Program

Proposed new dams with storage capacity of 2,000 acre feet or more and proposed expansions of existing dams of 1,000 acre feet or more qualify for the Dam and Reservoir Program. ***The source of revenue for the program is Water Development Account No. III [W.S. 41-2-124(a)(iii)], which has received Water Development Account No. I appropriations and budget reserve account appropriations on occasion, as approved by the legislature; the interest earnings that have accrued to the Water Development Account No. III; and a percentage (0.5%) of the revenues which accrue to the state's severance tax distribution account. Legislative approval must be granted prior to allocating funds to a particular purpose or project.***

Dams and reservoirs typically provide opportunities for many potential uses. While water supply shall be emphasized in the development of reservoir operating plans, recreation, environmental enhancement, flood control, erosion control and hydropower uses should be explored as secondary purposes.

D. Priorities of Projects

As previously discussed, the statutory guidelines are sufficiently broad to allow the program to address all types of projects involving water. However, in order to establish priorities and to utilize available program funds effectively and efficiently, it is necessary to develop priorities relative to the types of water projects the program should pursue. The following is a list of eligible projects in order of preference:

1. Multipurpose Projects -- For purposes of program implementation, multipurpose projects are hereby defined as projects which serve two or more of the following functions: agriculture, municipal, industrial, rural domestic, recreation, environmental, flood control, erosion control, and hydropower. ***Priority will be given to those projects that may practically serve more than one entity or purpose and whose service area encompasses a larger, more regional area.***

2. Storage Projects -- Dams and reservoirs that store water during times of surplus for use later when needed shall be a program priority. ***Dams and reservoirs can also serve to re-regulate existing water supplies to meet the demands of the water users in a more efficient and effective manner. Proposed new dams with storage capacity of 2,000 acre feet or more and proposed expansions of existing dams of 1,000 acre feet or more qualify for the Dam and Reservoir Program. Smaller storage projects qualify for funding under the New Development Program. Repairs and improvements to existing storage projects qualify for funding under the Rehabilitation Program.***

3. Supply Projects -- These projects include groundwater wells, alluvial wells, diversion dams, and other structures, which put un-appropriated water to beneficial use or supply existing uses.

   The priority for supply projects based on purpose are as follows:

   Priority 1. Irrigation and municipal projects

   Priority 2. Rural domestic projects that are obtaining water from another existing public water supply

Priority 3. Rural domestic projects with independent water supplies and raw water irrigation projects for municipalities and rural domestic districts

4. Supply Systems -- While the above three types of projects make water available at the source, supply systems bring this source water closer to the point of use through pipeline and canal systems. Projects in this category include major water transmission facilities that deliver water to distribution systems that serve individual users or to water treatment facilities. Typically, the transmission systems transport raw/untreated water. However, if the most efficient/economical project configuration dictates the water should be treated prior to transportation, the transmission systems can serve to deliver treated water.

   The priority for supply systems based on purpose are as follows:

   Priority 1. Irrigation and municipal projects

   Priority 2. Rural domestic projects that are obtaining water from another existing public water supply system

   Priority 3. Rural domestic projects with independent water supply systems and raw water irrigation systems for municipalities and rural domestic districts

   Water treatment facilities are not included in this category and are not eligible for funding with one exception: <u>***Disinfection facilities needed to connect groundwater wells to a supply system are eligible for program funding when it expedites the completion of the project.***</u>

   <u>***Distribution systems are not included in this category and are not eligible for funding. It is often difficult to determine when pipelines are serving as supply systems or distribution systems. The primary purpose of supply systems is to transport or deliver water from one point to another for later distribution to customers. The primary purpose of distribution systems is to deliver water to individual users. The determination as to which pipelines serve as supply systems and thereby qualify for program funding will be completed during the Level II process.***</u>

5. Hydropower Projects -- These projects include retrofitting existing facilities or the construction of new facilities capable of developing

marketable hydropower. W.S. 41-2-121 directs the consideration of hydropower production on any program project through the feasibility phase. However, these types of projects shall not be subsidized with grants. The potential return of the investment is the key consideration in determining whether to pursue hydropower projects.

6. Purchase of Existing Storage -- This type of investment may be made under the program if the storage is uncommitted or ***is not being*** ~~has not historically been~~ used for a specific purpose. Any such purchase shall be project specific. There should be assurances that the investment will lead to the ultimate use of the water. The potential market for the water shall be the key consideration in determining whether the purchase should be pursued. Potential secondary benefits such as recreational or environmental uses shall also be considered.

7. Recreation -- The development of water projects the primary purpose of which is to enhance recreation may be implemented under this program. In addition, the feasibility of providing recreation benefits shall be considered in the operating plan of all new projects.

8. Drinking Water State Revolving Fund -- By enacting W.S. 16-1-30***2***, the Legislature authorized the use of water development account funds ***to provide 50% of the state's matching fund requirements for the federal Drinking Water State Revolving Loan Fund (DWSRF) program.*** The DWSRF program may be used to fund improvements to water treatment systems and to finance measures that address other Safe Drinking Water Act compliance issues. This program is not included in the annual Omnibus Water Bill considered by the Legislature. Water Development Program funds are appropriated automatically by statute to match 10% of the federal capitalization grant.

9. Reimbursement of Temporary or Emergency Funding

The WWDC may recommend that the legislature reimburse or provide refinancing for projects in which the project sponsors acquired temporary or emergency funding from the State Land and Investment Board (SLIB), if those projects meet these criteria and if the WWDC agreed to recommend refinancing prior to the application for SLIB funding.

In order to further clarify the list defined under program priorities, the following are examples of projects/investments that shall not be ***considered for funding*** under the program:

1. Refinancing of Previously Completed Improvements -- Refinancing of existing projects that have been financed with non-state resources is not an allowable program expense. Further, refinancing may conflict with goals and objectives of other programs.

2. Wastewater Projects -- Wastewater treatment plants and/or collector systems ***shall not be funded under the program.***

3. Environmental Enhancement -- Although the feasibility of providing ***or rehabilitating*** environmental improvements shall be considered on all program projects, the program does not have the resources to pursue projects that solely serve environmental enhancement purposes.

4. Flood Control -- Projects that deal solely with flood control are essential in many parts of the state. There are active federal funding programs that serve this purpose. Therefore, sponsors are encouraged to seek funding from these alternate sources.

5. ***Rehabilitation of*** Hydropower Projects -- Existing hydropower facilities should be generating sufficient revenues to perform operation, maintenance, and replacement without state assistance.

6. Erosion Control -- While improvements to natural streams are sometimes necessary to keep existing water supplies viable, these improvements are typically performed through private or federal funding ***and should not be funded under the program.***

7. Distribution Systems -- For purposes of program implementation, distribution systems are considered to be those facilities whose primary purpose is to deliver water to individual users. There is alternate financing available for distribution systems through other state and federal programs.

8. Water Treatment Facilities -- Historically, the program has not participated in water treatment facilities ***with the exception of disinfection facilities needed to connect groundwater wells to a supply system when it expedites the completion of the project.*** While the need for improvements to treatment facilities has been considered in the generation of financing plans for

program projects, the funding for water treatment improvements has been considered the responsibility of the sponsor.

9. Subdivisions – For those subdivisions required to undergo review pursuant to W.S. 18-5-306(c), the WWDC shall disqualify a project proposed to correct problems identified in the review performed by the Department of Environmental Quality where the Board of County Commissioners approved a subdivision application notwithstanding the Department's recommendation that the application be disapproved.

E. Levels of Project Development

The following levels of project development are based on complex new development projects. Some aspects of the studies may not be necessary for some new development projects or rehabilitation projects in which the scope of the project is better defined.

1. Level I Study Description

   Level I studies are preliminary analyses and comparison of development alternatives. ***However, the designation of a Level I study is also used for master plans, watershed improvement studies and other water planning studies. The following outline relates to project specific Level I studies:***

   a. The typical Level I study shall identify or provide the following:

      i. Development options;

      ii. Potential project beneficiaries and the benefits each option could provide;

      iii. Factors that could impair or prohibit the development of any identified option including legal constraints;

      iv. An analysis of water rights including identification of conflicting prior rights; and

      v. Option comparisons based on physical and legal water availability, technical, economic, legal, and environmental considerations.

vi. ***A review of the sponsor's methods for financing the operation, maintenance, and replacement of the existing water supply.***

b. Level I studies shall be performed in sufficient detail to identify projects or project options, if any, that should be pursued. In evaluating projects that could be advanced to Level II, the following considerations shall be made:

i. Whether there is an opportunity to economically develop water or maintain an existing supply for Wyoming's use and benefit;

ii. Whether the project may be configured to provide service to a regional service area encompassing more than a single entity;

iii. Whether there are viable solutions to resolve technical, legal and environmental problems.

2. Level II, Phase I – Study Description

The typical Level II process consists of two phases, which serve first to address project feasibility and then, if the project is determined feasible, to refine the project to the status necessary for a Level III funding request.

a. A Level II, Phase I investigation shall provide the following:

i. A reasonable quantification of the amount of water that can physically and legally be developed or maintained;

ii. A determination of water needs that could be or are being served by the project;

iii. A determination of technical feasibility including a safety analysis; and for dam and reservoir projects (including stock ponds), a geotechnical and basin geomorphology analysis;

iv. A general configuration depicting preliminary physical characteristics of the project;

v. A preliminary project operation plan;

vi. Cost estimates for construction, consultant services, and operation, maintenance, ***and replacement;***

vii. Identification of direct and indirect benefits that result from the implementation of the project;

viii. Identification of costs and benefits that would result by incorporating recreation, hydropower generation, and flood control functions into the project operation;

ix. A definition of economic, legal, environmental, and administrative problems and identification of alternate solutions to those problems;

x. Identification of lands that may be affected by the project;

xi. An analysis of the project sponsor's ability to pay;

xii. A determination of project components that are eligible for WWDC funding and project components that are not eligible; and

xiii. A financing plan identifying changes in the sponsor's water financing methods including water rates or charges, tap fees, sinking funds, and other revenues that should be implemented to fund the project. In addition, the financing plan should address alternate sources of funding for the project including project components that are not eligible for WWDC funding. The financing plan should provide a comparison of alternate sources of funding identifying the costs and schedule associated with achieving such funding. Associated inflation costs caused by the time required to achieve the funding will be considered.

b**.** Once all Level II, Phase I investigations have been completed, the WWDC will evaluate the results and will consider the sponsor's need for the project, interest in the project, and willingness and ability to financially participate in the project to determine if the project should proceed to Level II, Phase II.

3. Level II, Phase II – Study Description

A Level II Phase II investigation shall include the following design and technical services:

a Hydrological investigations;

b. An operating plan that addresses water management during and after construction;

c. A conceptual design and general configuration of the project;

d. The identification of state and federal permits and clearances necessary to construct the project;

e. An environmental analysis, including environmental assessments, etc., of the proposed project's operation and configuration, including:

   i. The identification of anticipated impacts on or improvement to water quality which may occur as a result of the project, i.e., total dissolved solids or total suspended solids, etc.;

   ii. An assessment of the longevity of dam and reservoir projects, including stock ponds, with respect to sediment loading and hydrologic events;

   iii. Identification of the potential to develop wetlands eligible for Wyoming's Wetland Banking Program; and

   iv. The performance of a cultural resource survey of the general project area, as applicable;

f. The development of a detailed schedule of the activities necessary to complete the project;

g. The preparation of an itemized project budget that includes costs for design engineering, permitting, land acquisition, construction, construction engineering, operation, maintenance and replacement, ***<u>and a financing plan</u>***; and

h. The preparation of a socioeconomic analysis of the costs and benefits of the proposed project. This analysis shall include the net present value of the stream of benefits and costs associated with the project. The net present value shall be calculated using a discount rate based on a real rate of return as opposed to a market or nominal rate of return. Sociological and environmental consequences of the project shall be described where values are difficult to place on either benefits or costs.

4. Input from Local Officials

During the Level II process when it is apparent that the project will be a candidate for Level III funding, the following analyses will be completed:

(a) ***implications of the project on water and energy use of the community or general area;***

(b) ***implications of the project on the future growth of the community or general area; and***

(c) ***the impacts of the project on the operating expenses of any other city, county or special district possessing jurisdiction over a service obligation to the project area.***

Written verification from the impacted city, county, or special district must be submitted documenting that the impacts to them are understood and accepted.

5. Level II, Phase III -- Dam and Reservoir Program only

a. ***This phase of development pertains to projects that enlarge existing storage projects by 1,000 acre-feet or greater or for proposed new dam and reservoirs with a capacity of 2,000 acre-feet or greater. Work included under this phase includes final engineering design, reviews required by the National Environmental Policy Act, consultations required by the Endangered Species Act, and acquisition of state and federal permits.***

b. Legislative approval, through the omnibus water bill process, is required before initiation of Level II, Phase III activities.

6. Level III Construction

The following activities must be addressed once the Legislature appropriates funds to construct the project:

a. The project agreement, note and mortgage, which formalize sponsor and WWDC project responsibilities and the financing procedures, shall be the first activity undertaken. Funds cannot be committed for expenditure until these documents are executed.

For those projects where the sponsors wish to pursue construction using their own manpower and equipment, the project agreement shall reflect that funding is only available to pay the cost of invoiced materials. Permit and easement acquisition and retaining labor, equipment and professional services are the obligation of the sponsor.

b. For projects that are funded through a combination of funding sources, the sponsors shall certify that all funding has been secured and is available for project purposes before construction can commence.

c. Professional services required for final design, permitting and construction engineering shall be secured pursuant to the requirements of the State Board of Engineers and Surveyors and the Board of Registration for Professional Geologists.

The sponsor may elect to retain the WWDC's Level II consultant. However, if a consultant selection process is implemented, the sponsors will be encouraged to use WWDC consultant selection procedures for Level III services in the absence of statutory or other legally described procedures.

d. For projects other than storage projects, environmental impact statements or assessments shall be prepared, as required.

For storage projects, environmental review and permitting shall be addressed during the Level II, Phase III Study.

e. For projects other than storage projects, permit applications shall be prepared to secure all necessary construction permits and approvals.
For storage projects, environmental review and permitting shall be addressed during the Level II, Phase III Study.

f. For projects other than storage projects, the construction documents, including technical specifications, contract documents and bidding plans shall be prepared. This work may be performed concurrently with the permitting process if it doesn't adversely impact project feasibility.

For storage projects, final engineering design, the construction documents, including technical specifications, contract documents and bidding plans, shall be prepared during the Level II, Phase III Study. This work may be performed concurrently with the permitting process. The Commission may issue a stop work order for those storage projects where ongoing permit activities indicate that the project may be fatally flawed.

g. Easements or fee titles necessary to construct the project shall be acquired. The scheduling of this task shall be sequenced to minimize impacts to property owners and to expeditiously construct the project.

h. Mitigation of project impacts on cultural resources shall be undertaken.

i. After the above activities are completed, the construction bidding process can be initiated.

j. Construction of the project and construction administration/inspection shall commence upon the acceptance of the bid and upon the issuance of the notice to proceed.

k. The date project benefits accrue to the sponsor, for purposes of triggering loan repayment schedules, shall be determined by the Commission.

l. Once compliance with regulatory permitting conditions has been achieved and reclamation and mitigation activities have been completed, project close-out procedures may be initiated.

F. Sponsored and State Projects

Projects can proceed as sponsored projects or state projects.

1. Sponsored Projects

The project sponsor shall be a public entity that can legally receive state funds, incur debt, generate revenues to repay a state loan, hold title and grant a minimum of a parity position mortgage on the existing water system and improvements appurtenant to the project or provide other adequate security for the anticipated state construction loan. A project sponsor can be a municipality, irrigation district, ***joint powers board,*** or other approved assessment district, which will realize the major direct benefits of the project. The project sponsor must be willing and capable of financially supporting a portion of the project development costs and all operation and maintenance costs. Typically, sponsors request project technical and financial assistance from the WWDC through the application process.

The sponsor may request that a Level I or Level II study be conducted to identify solutions and alternatives for addressing water supply issues or they may request funds for a Level III construction project, if it is determined the project is technically and economically feasible and serves to meet a water supply need or alleviate a water supply problem.

2. State Projects

The typical state project serves to benefit more than one entity and is multipurpose in nature. Another common characteristic of state projects is that each has a difficult permitting or political issue, which must be addressed. These issues may include developing a partnership with the federal government, another state, and/or private industry to encourage project development; resolving endangered species, water quality, or wetland issues; or addressing resistance to the project from downstream states.

The WWDC shall consider investments in state projects on a case-by-case basis. However, it should be recognized that present federal laws and regulations make it difficult to achieve federal clearances for projects in which there is not a clearly defined purpose and need.

Chapter III Funding Procedures

A. Project Sponsor/Public Entity

The project sponsor shall be a public entity that can legally receive state funds, incur debt, generate revenues to repay a state loan, hold title and grant a minimum of a parity position mortgage on the existing water system and improvements appurtenant to the project or provide other adequate security for the anticipated state construction loan.

The WWDC may waive the requirement that the project sponsor be a public entity under the following exceptions:

1. ***The WWDC may accept applications for Level I studies from applicants that are not public entities. This will allow the applicant to know if there is a viable project prior to becoming a public entity. However, the applicant must be a public entity before applying for a Level II study. Under these circumstances, the Level I process will have a two-year duration with the study being completed the first year and the sponsor forming a public entity the second year.***

2. ***The WWDC may accept applications related to the construction of dams and reservoirs from applicants that are not public entities. As the evaluations of the feasibility of new dams are complex, this will allow the applicant to know if the proposed reservoir is feasible prior to becoming a public entity. However, the applicant must be a public entity before applying for Level II, Phase III funding.***

B. Applications for Projects New to the Program

1. Requirements for New Applications

The due date for new project applications and application fees is August 15 of each year. The application must include a description of the project, a listing of available information pertinent to the project, and information describing the financial capabilities of the sponsor. The following must accompany the application:

a. An application fee of one thousand dollars ($1,000.00) must be submitted with each application. The application fee shall be deposited into Water Development Account No. I. Acceptance of the fee does not obligate the Water Development Commission or State of Wyoming to fund a study or provide construction funding for any proposed project or purpose. If the application is denied, then seventy-five percent (75%) of the application fee shall be refunded to the applicant. The authority to require an application fee is provided by W.S. 41-2-118(a)(xii).

b. A certified original of a resolution passed by the council or governing body of the sponsoring entity shall be provided with an application ***unless the applicant qualifies for one of the exceptions provided in Section A. Applicants qualifying for the exceptions shall provide evidence of support for the application by providing letters or petitions from interested water users as a substitute for a resolution.***

c. ***The following financial information:***

  i. ***The annual budget for operation, maintenance, and replacement of the water supply system;***

  ii. ***The existing balance in any emergency funds and sinking funds for the water supply system;***

  iii. ***Water rates, tap fees, and other revenue sources; and***

  iv. ***Amount of funding obtained from other revenues for operation, maintenance, and replacement of the water supply system.***

d. To become eligible for funding, the WWDC shall require sponsor certification related to compliance pursuant to public water system rate requirements as set forth in W.S. 15-7-602**,** W.S. 16-1-108**,** and W.S. 41-10-113.

2. Review Requirements for New Applications

Review of new applications shall comply with or address the following:

a. The WWDO project manager assigned to review the application shall advise the applicant of the timetable for project review and evaluation.

b. A representative of the WWDO shall inspect the proposed project site.

The acceptance of the project application for incorporation into the program shall be based on the following criteria:

a. The proposed project must be consistent with the goals and objectives of the Wyoming Water Development Program as outlined in W.S. 41-2-112 and these criteria.

b. The Water Development Program must be the most appropriate source of funds for project study and construction.

c. There must not be any apparent economic, legal, environmental or technical problems that would impair or prohibit project development.

d. The proposed projects must serve twenty (20) or more municipal/domestic water taps with individual water meters for each tap or 2,000 or more ***<u>water righted acres</u>***.

e. Sponsors who pass a local capital facilities tax, commit other local tax revenues to a project or secure funding from non-state sources may receive a priority ranking when compared with projects of a similar nature without such funding sources. While the Water Development Program provides for loans and grants, the willingness and ability of project sponsors to assume responsibility for repayment of project costs shall be a factor in the selection of projects to receive state assistance.

C. Applications for Level II Projects

1. Requirements for Applications for Level II Projects

a. Applications seeking Level II status for a project new to the program must comply with the requirements specified in section B.1.

b. The due date for applications for Level II status for projects already in the program, which are seeking funding for an advanced study level or for construction, is October 1 of each year. ***Application fees are not required.*** Sponsors of continuing projects may apply by submitting a letter with a copy of a resolution of the governing body attached ***unless the applicant qualifies for the exception provided in Section A.2. Applicants qualifying for the exception shall provide evidence of support for the application by providing letters or petitions from interested water users as a substitute for a resolution.***

2. Review Requirements for Level II Status

a. The WWDC may introduce projects into the program at Level II status if the application provides a definition of the project configuration and there is evidence that project will provide a viable water supply or rehabilitate an existing water supply. Often, rehabilitation projects can be introduced into the program at Level II status as the projects are clearly defined.

b. After the Level I studies under the Program are completed, the WWDC shall initiate its review process to determine if the project should proceed to Level II. During its November meeting, the Commission shall review the findings of the Level I report, consider the sponsor's input, and make its preliminary recommendations.

D. Applications for Level III Projects

1. Requirements for Applications for Level III Projects

a. Applications seeking Level III status for a project new to the program must comply with the requirements specified in section B.1.

b. The due date for applications for Level III status for projects already in the program, which are seeking funding for an advanced study level or for construction, is October 1 of each year. ***A copy of a resolution of support from the governing body must be attached to the application. Application fees are not required.*** ~~Sponsors of continuing projects may apply by submitting a letter with a copy of a resolution of the governing body attached.~~

c. Written verification from any city, county, or special district that is impacted by the project that they

understand and accept those impacts. See subsection E.4 of Chapter 2.

d. ***All applications for Level III funding for subdivision or rural domestic projects must be accompanied by a letter or a resolution of support from the effected city council and/or county commission.***

2. Review Requirements for Level III Status

<u>a. The WWDC may introduce projects into the program at Level III status if the project sponsor has completed a feasibility study that meets WWDC requirements.</u>

b. After the Level II studies under the Program are completed, the WWDC shall initiate its review process to determine if the project should proceed to Level III. During its November meeting, the Commission shall review the findings of the Level II report, consider the sponsor's input, and make its preliminary recommendations.

Projects shall not progress to Level III construction status unless the sponsor and state are committed to complete the project. Issues that shall be considered and addressed in the development of Level III recommendations include:

a. Whether the project yields a water supply capable of meeting present needs;

b. Whether the project will yield a reserve water supply to meet future needs;

c. Whether the project is affordable given the existing status of the water development account and prior commitments to the account;

d. Whether the project appears to be a good investment for the State of Wyoming considering primary, secondary or indirect project benefits;

e. Whether the project is economically feasible for the sponsor after all project costs are considered, including debt retirement and costs of project operation, maintenance ***<u>and replacement;</u>***

f. ***<u>Whether the project sponsors are willing to establish a revolving fund to pay costs associated with the repair or replacement of project components that may wear out or malfunction</u> twenty years from the date those components were incorporated into the system.***

g. Whether the project sponsors and/or beneficiaries are willing to assume financial responsibility for the project. Whether the project sponsors understand the scope of the project. Whether the project will meet the sponsor's needs. Whether the project sponsors understand they are obligated to assure that the project must be designed and inspected by registered professionals, i.e., licensed engineers and geologists. If the sponsors wish to pursue construction using their own manpower and equipment, whether they understand the funding limits established by the state. Once construction is initiated, whether the project sponsor understands that they cannot voluntarily abandon the project without repaying state grants and loans, including lost interest-earning opportunities.

After the Level II analysis and report have been completed, the Commission shall determine if the project should be elevated to a Level III construction status.

After other funding sources have been considered, the Water Development Program's per tap or per acre investment shall be compared to the sponsor's ability to pay. Project sponsors shall be given the option of making a formal presentation to the WWDC relative to that sponsor's ability and willingness to pay for the project if the Commission determines that the project should not advance due to high repayment costs. The need for the project, the direct and indirect benefits of the project, and any other information the sponsor deems as reasons the project should be advanced or funded, shall be included in the presentation.

3. Level III Funding Considerations

The Commission shall consider project specific information and sponsor input, when developing its preliminary recommendations for Level III projects. If it is determined that the project should proceed to Level III, the following shall also be addressed in the Commission's recommendations:

a. Project Budget

The project budget shall include costs associated with project permitting, design, land acquisition, construction engineering, and construction.

b. Level I and Level II Study Cost Sharing

The WWDC shall determine if the sponsor should be required to pay a portion of the Level I or Level II study costs incurred to develop the recommended alternative needed to secure funding for Level III construction. Typically, the WWDC is the lead agency in developing Level I and Level II reports. The Commission solely funds the studies to insure the reports are unbiased and performed in such a manner as to determine whether the state should invest in the project. This procedure was also established because the project is better served if the sponsor uses its financial resources to fund its share of the project or to service the debt associated with the construction loan. However, in those exceptional cases where the sponsor assumes the role of lead agency in Level I and Level II studies, it shall share in the costs of those studies. Further, if through the Level II process, a groundwater well is developed that will be used as the water source for a Level III project, the sponsor shall share in the cost of the well.

On dam and reservoir projects, the sponsor shall share in the cost of the Level II, Phase III services unless the WWDC agrees to pay these costs in accordance with subsection e, below.

c. Financial Plan - Loan Grant Mix

i. ***The maximum grant shall be seventy-five percent (75%) for proposed Level III projects. In order to obtain the maximum grant, the sponsors must demonstrate to the WWDC that the maximum grant is warranted due to severe financial hardship.***

ii. ***The typical grant shall be sixty-seven percent (67%) for proposed Level III projects. In order to obtain the typical grant, the sponsors must demonstrate to the WWDC that they have taken steps or are willing to take steps to make their water supply systems financially self supporting.***

iii. ***The WWDC may provide lesser grant amounts for proposed Level III projects that do not qualify for i or ii, above.***

d. Financial Plan - Terms of the Loans

i**.** Statutory guidelines establish a minimum rate of four percent (4%) for program loans. The current rate is 4% but may be increased by the Legislature.

ii. W.S. 41-2-121 specifies the term of the loans cannot exceed fifty (50) years after substantial completion of the project. Further, the term of the loan shall never exceed the economic life of the project. The sponsor's method of loan repayment (water rates, taxes, bonds, etc.) shall also be considered in establishing the term of the loan.

iii. The statutes allow the WWDC to recommend that the payment of interest and principal be deferred up to five (5) years after substantial completion of the project. ***In addition, the WWDC can recommend that the accrual of interest also be deferred during the term of the payment deferral.*** These special conditions shall be granted only on a limited basis. The sponsor's method of repayment and the longevity of the sponsor’s existence as a legal entity shall be key considerations in determining if this deferment should be granted. In no event can the combined deferment and term of the loan exceed fifty (50) years.

e. Financial Plan – Special Considerations for Dams and Reservoirs

i. The WWDC may recommend a loan/grant mix based on the sponsor’s ability to pay a portion of the project costs and all of the operation, maintenance, and replacement costs.

ii. The WWDC may recommend that permitting and design costs be paid by the program thereby reducing the costs applied to the loan/grant mix.

iii. The WWDC may recommend that the program pay for the storage capacity needed to provide water

for environmental mitigation and enhancement thereby reducing the costs applied to the loan/grant mix.

iv. The WWDC may recommend any combination of the above.

f. Financial Plan–Special Considerations for Subdivisions or Rural Domestic Projects:

i. In accordance with the WWDC's support of the regional concept to solve water supply problems, funding preference will be given to those water supply projects for subdivisions or rural domestic projects that are proposing to connect to another existing public water supply system.

ii. Financing plans for water supply systems for subdivisions or rural domestic projects will ensure that the developer of the subdivision does not receive a "windfall" from project funding provided by the WWDC.

g. State/Local Partnership

The program has a philosophy that water development can be achieved through state/local partnerships. The sponsor can complete a water supply project with state funding assistance. If the sponsor uses all of the water, the project basically belongs to the sponsor. However, if there is the opportunity to sell water for other purposes, the sponsor and state share in the revenues. This insures that a project sponsor will not receive a "windfall" from the sale of water that was made available, in part, from a state grant. Therefore, if the project develops a new water supply, the WWDC shall establish the terms of the program's participation in the future sale of water in the project agreement in the following manner:

i. There shall be no lease, sale, assignment or transfer of ownership of more than 100 acre feet of water per year from municipal or irrigation projects funded by the program without prior written approval of the WWDC.

ii. There shall be no lease, sale, assignment or transfer of ownership of water from rural domestic projects funded by the program without prior written approval of the WWDC.

iii. If the WWDC approves such sales, the program will receive a share of the revenues from the sale commensurate with the percent of the grant used to construct the project.

h. Sale of Projects

There shall be no lease, sale, assignment or transfer of ownership of a project funded by the program until the project loan is paid in full and until prior written approval is obtained from the WWDC. The WWDC will ensure that the project sponsor does not receive a "windfall" from the state's investment in the project.

i. Abandonment of Construction Projects

If the WWDC determines that any project sponsor has, without good cause, abandoned the completion of the project, that sponsor, in addition to being required to repay the loan, shall be obligated to repay the grant funds actually expended plus interest as established by the state auditor in an amount equal to the interest that would have accrued on the expended grant funds. If these payments are deemed by the WWDC to provide a financial hardship on the sponsors, the WWDC may recommend to the legislature that a loan be approved to repay the program. The recommended interest on the loans will be 4% per year and the term will be based on the ability to pay of the sponsor.

E. Recommendation Process

The Water Development Commission uses the following process to generate funding recommendations for legislative consideration.

1. New Applications

The deadline for new project applications is the fifteenth of August. Upon receipt, new applications and supporting documentation are reviewed, and project sites are visited. The WWDC makes preliminary recommendations regarding applications at its November meeting.

2. Existing Projects

Typically, consultant project reports are drafted by the first of October. These reports are reviewed to determine whether the projects warrant advancement in the program.

3. Preliminary Recommendations

At the November WWDC meeting, the WWDO director presents funding recommendations for new applications and existing projects. Project sponsors are given the opportunity to present their requests. The WWDC takes preliminary action on the sponsor's request at this meeting.

4. Public Meetings

If a proposed Level I Reconnaissance Study or Level II Feasibility Study is of particular concern or controversy, the WWDC may solicit public input at a public meeting prior to finalizing its project recommendation.

5. Public Hearings

The Commission holds formal public hearings on all projects that are proposed for Level III Final Design and Construction funding.

6. Coordination with the Governor

The WWDC provides the Governor with its preliminary recommendations and a financial report addressing impacts to the water development accounts. The Governor may provide input throughout the recommendation process.

7. Final Recommendations

The WWDC meets in December or early January to finalize its legislative recommendations on new applications and existing projects. The Commission considers public input received at the meetings and hearings and recommendations from the Governor. Sponsors and interested parties who disagree with the Commission's preliminary recommendation are provided the opportunity to address the Commission with their concerns.

8. Select Water Committee

The Select Water Committee is comprised of 6 senators and 6 representatives. They provide legislative oversight for the program, and review the Commission's recommendations and budgets. Typically, the Select Water Committee serves as sponsor for the Water Development Program legislation.

9. Legislative Process

The legislature must authorize the allocation of funds from the water development accounts to particular projects. This approval is solicited through the Omnibus Water Planning and Construction Bills.

CHAPTER IV. Water Resource Planning

The Wyoming Water Development Commission serves as the water-planning agency for the State of Wyoming. The water development planning function is an important aspect of the Water Development Program. Because the issues facing water development in the West are complex, the scope of the WWDC's planning efforts is not as closely defined as the New Development, Rehabilitation, and Dam and Reservoir Programs. The planning aspects of the Wyoming Water Development Program establish the framework for development strategies and serve to identify and resolve water issues. The source of revenue for the planning function of the program is typically Water Development Account No. I.

A. River Basin Plans

The program develops basin wide plans for each of the state's major drainage basins. These plans identify water supply problems and development opportunities. The plans serve to promote interest from water users who may become interested in a particular project and become project sponsors. Basin plans shall include the development of a water related database to provide data and information to developers and resource managers**.**

B. Watershed Improvement Studies

These studies provide a detailed evaluation of an individual watershed. The studies may identify water development and system rehabilitation projects as well as address erosion control, flood control or other non-water development related environmental issues. Watershed improvement studies are an integral part of the Small Water Project Program, which has its own specific criteria. The studies may identify projects that may be eligible for the New Development, Rehabilitation, or Dam and Reservoir Programs.

C. Master Plans

Master plans provide a service to municipalities, districts and other entities to assist in the preparation of planning documents, which serve as a blueprint for future water supply system improvements. Master plans also serve as a framework for the entities to establish project priorities and to perform the financial planning necessary to meet those priorities.

In addition, master plans assist entities in preparing the reports necessary to achieve federal funding assistance for water development, flood control, erosion control, hydropower, rehabilitation, watershed improvements and other water related projects.
Sound water planning serves to promote the effective and efficient use of available water resources. Master plans provide information to users as to whether the resource can adequately service the existing and anticipated demands for water within a certain area and provide reconnaissance level information regarding costs and scheduling.

D. Federal Funding

Presently, there are federal programs which provide funding assistance for some types of water development projects. However, in order to access these funds, costly feasibility/environmental studies are often needed. If these studies cause a financial burden and if the proposed project alleviates a water development, management, rehabilitation problem, or allows the continued beneficial use of water, the WWDC shall consider participating in the studies. The amount of the WWDC'S financial participation shall be based on the proponent's ability to pay.

E. Research

Water development issues and problems may encompass watersheds, river basins or include the entire state. In order to address these issues, non-project specific research and data collection is necessary. The WWDC has developed a working relationship with state and federal agencies and the University of Wyoming to conduct water related research.

In addition, the legislature has assigned the Water Development Program the following research tasks:

1. Instream Flow

The Wyoming Game and Fish Department (WGFD) selects candidate stream segments for instream flows. The WWDC files water right applications with the State Engineer for permits to appropriate water for instream flows in those segments of stream recommended by the WGFD. Further, W.S. 41-3-1004 assigns the WWDC the responsibility to generate feasibility reports for all instream flow permit applications. The reports are hydrological analyses of water availability in the reach of the stream to which the applications apply. The analyses also quantify existing water rights above and within the stream segment.

As the water-planning agency, the WWDC also reviews instream flow requests to determine whether they may conflict with future water development opportunities.

2. Groundwater Grant Program

W.S. 41-2-119 authorizes the Water Development Commission to grant funds to cities, towns, and special districts for exploration programs to evaluate the potential use of underground water for municipal and rural domestic purposes. Authorized entities are eligible to receive up to $400,000 in grant funds and are required to provide 25% of the total project costs in local matching funds. The primary purpose of the program is to inventory the available groundwater resources in the state. The program also serves to assist communities in the development of efficient water supplies. Unlike other projects within the Water Development Program, funding for projects that meet the criteria of the Groundwater Grant Program can be allocated directly by the WWDC without project specific legislation.

Appendix 7A
Sage Grouse Policy

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82009-1828

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
6500 (930) P

December 29, 2009

EMS TRANSMISSION: January 4, 2010
Instruction Memorandum No. WY-2010- 012
Expires: 9/30/11

To: District Managers and Deputy State Directors

From: State Director

Subject: Greater Sage-Grouse Habitat Management Policy on Wyoming Bureau of Land Management (BLM) Administered Public Lands including the Federal Mineral Estate

Program Area: All programs

Purpose: This Instruction Memorandum (IM) provides guidance to Wyoming Bureau of Land Management (WY BLM) Field Offices on sage-grouse habitat management for proposed activities and resource management planning. The guidance also provides consistency in management practices for WY BLM Field Offices for the conservation of sage-grouse and their habitats. The Wyoming State Office will conduct an annual review of the implementation measures contained in this IM to determine the effectiveness of the guidance and make changes as necessary. This IM replaces IM No. WY-2004-057 (USDI BLM 2004b).

Policy/Action: It is the policy of WY BLM to manage sage-grouse seasonal habitats and maintain habitat connectivity to support population objectives set by the Wyoming Game and Fish Department (WGFD). This guidance is consistent with guidelines provided in the Governor's Sage-Grouse Implementation Team's Core Population Area strategy and the Governor's Executive Order (EO) (Order 2008-2). This policy is consistent with the BLM National Sage-grouse Habitat Conservation Strategy (USDI BLM 2004a) and national policy issued for the 2009 wildfire season that provided guidance for conservation of sage-grouse "Key Habitats" (USDI BLM 2009a). WY BLM sage-grouse Key Habitat Areas correspond to the State of Wyoming's Core Population Areas (Core Areas).

The guidance is structured to utilize an adaptive management approach to habitat conservation, restoration, and enhancement. The policy applies to all programs and activities occurring on public lands and Federal mineral estate in Wyoming, except for livestock grazing management within the range management program, because recommendations and policy regarding grazing patterns will be issued separately. In addition, the policy herein will not apply to nondiscretionary activities managed under 43 CFR 3809 for locatable minerals and for discretionary activities approved under 43 CFR 3400 including Coal Management, and 43 CFR 3500 including Non-energy Leasables (i.e., trona operations). This policy will be considered in the case of authorizations for discretionary leasable solid minerals (other than coal and trona) and mineral materials actions.

This guidance is to be implemented in conjunction with existing program-specific policies and Best Management Practices (BMPs) such as, but not limited to, those contained in the Oil and Gas Program and the Lands and Realty program.

It is the goal of WY BLM to work toward the conservation of sage-grouse habitats along with the WGFD, input from the Local Sage-Grouse Working Groups (LWG), and other partners and stakeholders through a process that includes the implementation of the following Policy Statements.

Policy Statement 1: Habitat Mapping and Assessment

The WY BLM State Office and other Wyoming partners will continue to support the development of statewide sage-grouse seasonal habitat models for the State of Wyoming. Regional models will be developed for nesting, early brood-rearing, and winter habitats. Draft models are expected to become available for use and testing during FY 10 and final models are predicted for completion in late 2011. Until that time, Field Offices are encouraged to work with the WGFD, LWGs, researchers, industry, and other partners to identify and delineate important sage-grouse seasonal habitats, corridors, and habitat connectivity areas. These corridors and areas of habitat connectivity are best defined by sage-grouse use and suitable areas of sagebrush on the landscape. It is the intent of the Governor’s Implementation Team to modify Core Area boundaries using the above listed information. If, in the meantime, BLM Field Offices have sage-grouse habitat use information useful for Core Area boundary modification, which has been coordinated with local WGFD personnel, the information should be presented to the Wyoming State Office Wildlife Biology Team for coordination and consideration by the Governor’s Implementation Team.

The BLM Washington Office will be finalizing the Sage-grouse Habitat Assessment Framework by Spring 2010. When it is final, Field Offices will refer to it for methodologies to use when assessing or evaluating sage-grouse habitats at multiple scales.

Policy Statement 2: Timing, Distance, and Density Restrictions

Pending completion of ongoing land use planning decisions, Wyoming Field Offices must consider and evaluate the following sage-grouse habitat conservation measures related to timing, distance, and density for all proposed projects both within and outside of Core Areas. In addition, Field Offices should, on a project-by-project basis, evaluate other habitat conservation measures as appropriate.

Sage-grouse leks inside Core Areas: Surface disturbing activity or surface occupancy is prohibited or restricted on or within a six tenths (0.6) mile radius of the perimeter[1] of occupied or undetermined[2] sage-grouse leks.

Disruptive activity is restricted on or within six tenths (0.6) mile radius of the perimeter of occupied or undetermined sage-grouse leks from 6 pm to 8 am from March 15 – May 15.

Sage-grouse leks outside Core Areas: Surface disturbing activities or surface occupancy is prohibited or restricted on or within one quarter (0.25) mile radius of the perimeter of occupied or undetermined sage-grouse leks.

Disruptive activity is restricted on or within one quarter (0.25) mile radius of the perimeter of occupied or undetermined sage-grouse leks from 6 pm to 8 am from March 15 – May 15.

Sage-grouse nesting/early brood-rearing habitat inside Core Areas: Surface disturbing and/or disruptive activities are prohibited or restricted from March 15–June 30. Apply this restriction to *suitable sage-grouse nesting and early brood-rearing habitat* within Core Areas (See Policy Statement 4).

Sage-grouse nesting/early brood-rearing habitat outside Core Areas: Surface disturbing and/or disruptive activities are prohibited or restricted from March 15–June 30. Apply this restriction in *suitable sage-grouse nesting and early brood-rearing habitat* within mapped habitat important for connectivity or within 2 miles of any occupied or undetermined lek.

Sage-grouse winter habitat/concentration areas: Surface disturbing and/or disruptive activities in mapped or modeled sage-grouse winter habitats/concentration areas that support Core Area populations, are prohibited or restricted from November 15–March 14.

Surface disturbing and disruptive activities are defined in the WY BLM Guidance for Use of Standardized Surface Use Definitions (WY IB 2007-029). For non-emergency actions, to determine if activity proposed in sage-grouse nesting habitats is “disruptive”, the activity would require people and/or the activity to be in nesting habitats for a duration of 1 hour or more during a 24 hour period during the nesting season in a site-specific area. Disruptive activity restrictions are not applicable to activities meeting the definition of casual use as found in various sections of the Code of Federal Regulations.

For authorization of any development actions where there are valid existing rights, Field Offices must analyze, in the site-specific or project-level National Environmental Policy Act (NEPA) documentation, an alternative that limits development to one disturbance location per 640 acres within the State’s Core Areas to coincide with the Governor’s EO.

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[1] Mapping of lek perimeters is underway in cooperation with the WGFD. Field offices are encouraged to continue to coordinate with WGFD to complete lek perimeter mapping. Until such time as the perimeter is mapped, use 0.6 miles from the center of the lek.

[2] See the Wyoming Sage-grouse Definitions in Attachment 1.

Density of disturbances: The goal of consolidating anthropogenic features from development and transmission on the landscape should apply regardless of whether proposed actions are inside or outside of Core Areas (See Policy Statement 4) and regardless of land ownership patterns.

Inside Core Areas, the density goal includes:

- maintenance of sagebrush communities by maintaining or reducing the existing level of density of energy production and/or transmission structures on the landscape, or
- to not exceed one energy production location and/or transmission structure per 640 acres. The one location and cumulative value of existing disturbances in the area will not exceed 5 percent of sagebrush habitat within those same 640 acres.

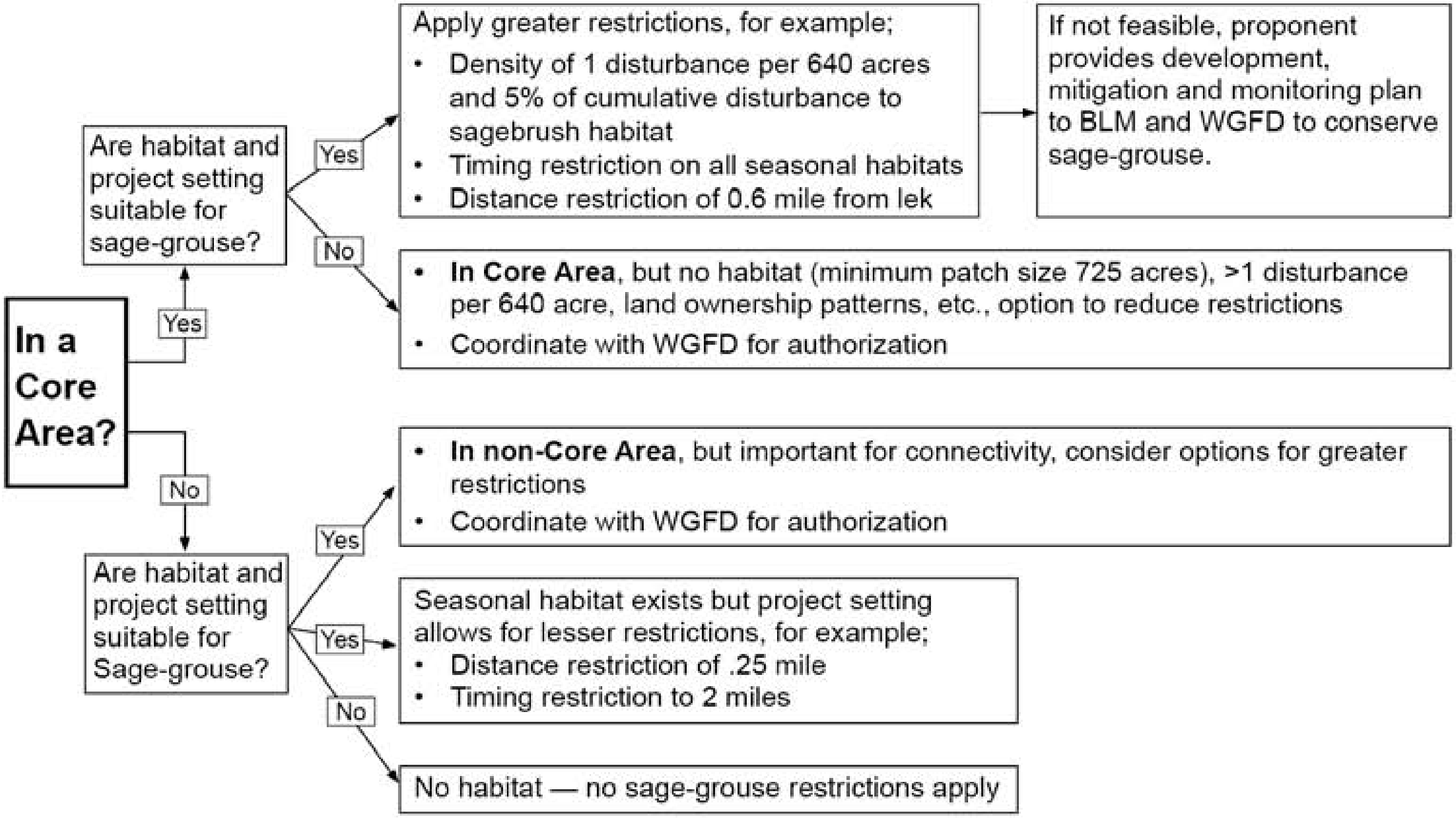
Although they may require timing limitations, vegetation treatments that do not make the habitat unsuitable for sage-grouse, fence lines, two-tracks, water pipelines, stock tanks, etc., should not be added to the density calculation.

The WY BLM Greater Sage-grouse Project Authorization Screens (Figures 1 and 2) are provided below for use when considering project proposals (external proponent or internal BLM). The screens will be used to determine the appropriate timing, distance, and density restrictions that must be evaluated regardless of whether the sage-grouse habitat has been, or has yet to be, fully mapped and modeled. The purpose of the Project Authorization Screen is to provide a process to determine, within the context of an analysis, the appropriate management of sage-grouse seasonal habitats based on the relative amount of disturbance and anthropogenic features on the landscape at the proposed project site. In areas without completed habitat mapping /modeling, Field Offices should use the most recent version of the Governor’s Sage-grouse Core Population Area map and GIS layers (located in the WYSO GIS shared drive under “Sage-grouse”) until additional mapping is completed.

Figure 1

WY BLM Greater sage-grouse Project Authorization Screen

Prior to Mapping and Modeling Sage-grouse Habitat



Are habitat and project setting suitable for sage-grouse?

Apply greater restrictions, for example;

- Density of 1 disturbance per 640 acres and 5% of cumulative disturbance to sagebrush habitat
- Timing restriction on all seasonal habitats
- Distance restriction of 0.6 mile from lek

If not feasible, proponent provides development, mitigation and monitoring plan to BLM and WGFD to conserve sage-grouse.

- **In Core Area**, but no habitat (minimum patch size 725 acres), >1 disturbance per 640 acre, land ownership patterns, etc., option to reduce restrictions
- Coordinate with WGFD for authorization

Are habitat and project setting suitable for Sage-grouse?

- **In non-Core Area**, but important for connectivity, consider options for greater restrictions
- Coordinate with WGFD for authorization

Seasonal habitat exists but project setting allows for lesser restrictions, for example;

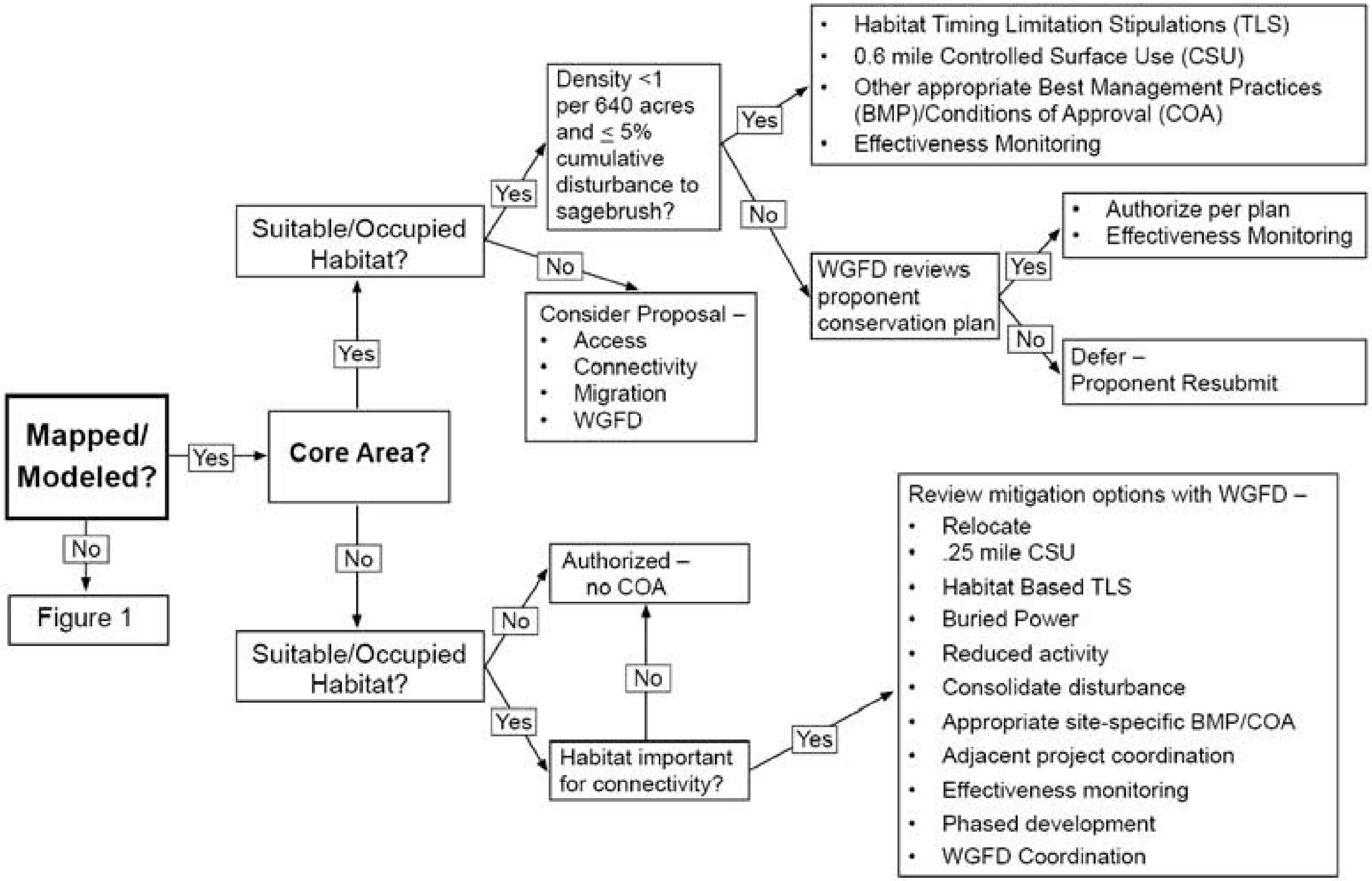
- Distance restriction of .25 mile
- Timing restriction to 2 miles

No habitat — no sage-grouse restrictions apply

Figure 2

WY BLM Greater sage-grouse Project Authorization Screen

In Mapped and Modeled Sage-grouse Habitat



Timing, distance, and density restrictions will be considered across all Field Offices in NEPA analyses. Field Offices may vary in their application of these restrictions when that variance is based on locally collected scientific data and information and is included in the NEPA analysis (including analyses and rationale that support existing Records of Decision).

Exceptions to lease stipulations, Conditions of Approval (COAs), and terms and conditions (T&Cs), etc. will continue to be considered on a case-by-case basis consistent with approved resource management plans (RMP)**.** Adequate pre-planning can reduce or eliminate the need for exceptions in many cases. When considering exceptions to timing restrictions applied to oil and gas activities, Field Offices will continue to coordinate with the WGFD in accordance with Appendix 5G of the Umbrella MOU (WGFD and USDI BLM 1990, as revised) between the two agencies where exceptions are being considered.

Policy Statement 3: Conservation Objectives and Mitigation

Ensure that site-specific, measurable, conservation objectives are included in project planning within sage-grouse habitats. Include the collection of baseline data and outline post-project monitoring components into the project planning. Utilize LWG plans and other sources of information to guide development of conservation objectives for local management of sage-grouse habitats. Field Offices are encouraged to work within multiple programs, such as the hazardous fuels, fire management, range, and wildlife programs, to accomplish sage-grouse habitat conservation activities.

Field Offices will work with project proponents, partners, and stakeholders to implement direct mitigation (e.g. relocating disturbance, timing restrictions, etc.), and utilize BMPs and off-site compensatory mitigation where appropriate. Information sources to reduce impacts include, but are not limited to, the *Wyoming BLM Mitigation Guidelines for Surface-Disturbing and Disruptive Activities* (USDI BLM 1990) and the BLM *Offsite Mitigation* policy (USDI BLM 2008). Reclamation of surface disturbances in sage-grouse habitats will include consideration of methods for restoring or augmenting functional sage-grouse seasonal habitats in addition to reclamation of the physical disturbance on the site itself in accordance with the Wyoming Reclamation Policy (USDI BLM 2009b). Refer to the WGFD Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats (May 2009 as amended) for planning and management considerations to avoid, minimize, or reduce impacts from oil and gas development activities. WY BLM will recognize the population goals set by the WGFD when considering mitigation. In Core Areas, the goal is to maintain or enhance sage-grouse populations. Outside Core Areas, the goal is to sustain lek persistence over the long term, in sufficient proportions of the sage-grouse population to maintain connectivity and movements.

This policy does not preclude the development and immediate implementation of new mitigation or conservation measures to reduce activity/project impacts to sage-grouse or their habitats. Any new measures applied for sage-grouse will be coordinated with the WGFD. All recommendations, mitigation, and conservation measures will be analyzed in site-specific NEPA documents. As appropriate, these measures may be incorporated into COAs of the permit, plans of development, and/or other use authorizations.

Policy Statement 4: Project Locations and Analyses

Many sage-grouse seasonal habitats, where proposed surface disturbing activities may occur, are encumbered by valid existing rights, such as mineral leases. In some cases, such leases may include less stringent lease stipulations than the timing, distance, and density restrictions identified for consideration by this policy. Field Offices will work with proponents in these situations to ensure that measurable sage-grouse conservation objectives such as, but not limited to, consolidation of infrastructure to reduce habitat fragmentation and loss, and effective conservation of seasonal habitats and habitat connectivity to support population objectives set by the WGFD, are included in project proposals. Field Offices will work with project proponents (including those within BLM) to site their projects in locations that meet the purpose and need for their project, but have been determined to contain the least sensitive habitats whether inside or outside of Core Areas.

For the purpose of effects analysis for a proposed action, a sage-grouse habitat evaluation shall extend, at minimum, out to 4 miles from relatively small individual proposed actions and shall extend, at minimum, out 11 miles from the project boundary for large-scale proposed actions. Current research suggests that impacts to greater sage-grouse leks from energy development are discernable out to a minimum of 4 miles, and that some leks within this radius have been extirpated as a direct result of development (Walker et al. 2007, Walker 2008, Naugle et al. *In press*). Evaluation of the area within the 11-mile radius from the project boundary in large projects is required to encompass the majority of seasonal habitats that may be affected (Connelly et al. 2000).

For the purpose of illustrating the implementation of this policy, examples of relatively small actions may include but are not limited to, exploratory wells, individual rights-of-way (including surface level linear projects), vegetation treatments less than 500 acres, and wind energy site testing and monitoring projects. Examples of large-scale actions may include, but are not limited to, oil and gas full field developments, wind energy development projects, large power lines, and vegetation treatments larger than 500 acres in size. Field Managers will be responsible for the determination of whether an individual project is large or small within their Field Office Area.

BLM regularly conducts wildlife habitat evaluations in response to proposed activities. Evaluations involve a review of baseline data from office-based sources including, but not limited to, aerial photography, satellite imagery, sage-grouse demographic data, potential threats to sage-grouse, and may include field visits to identify and map seasonal habitats, especially leks, nesting, early brood-rearing, and winter habitat/concentration areas. During habitat evaluations, other vegetation communities not generally used by sage-grouse can be identified as potential sites in which to relocate projects with surface disturbing or disruptive activities. Sage-grouse habitat indicators that may be useful to consider when identifying conservation measures may include existing disturbances, habitat availability, patch size, fragmentation of existing habitats, patch connectivity, patch dynamics (i.e., seral stages of vegetation), habitat edge characteristics, and corridors potentially used for migration.

In cases where the migratory status of sage-grouse populations is not known, BLM personnel will make management decisions based on the assumption that the population is migratory. If populations have been documented as not migratory, the habitat evaluation will extend, at minimum, out 4 miles from the project boundary regardless of the project size. For populations that have been documented as migratory, use the distances and locations appropriate to that population.

Policy Statement 5: Resource Management Plans (RMPs)
For ongoing and future RMP revisions, follow Section 1.3.1 of BLM's National Sage-Grouse Habitat Conservation Strategy (USDI BLM 2004a) for sagebrush habitat conservation in BLM RMPs. The following table provides an example of a range of alternatives for analysis:

No Action	Resource Protection Example	Resource Use Example	Balanced Example
RMP specific	Limit the density of disturbances on the landscape to 1 per 640 acres. The cumulative acres of disturbance must not exceed 5% of the sagebrush within the same 640 acres. Controlled Surface Use (CSU) for 0.6 mi from leks Timing Limitation Stipulation (TLS) on all nesting, early brood rearing and winter habitats. Consider identifying areas for no leasing or exclusion.	Possibly the same as No Action - CSU for ¼ mi from leks TLS to habitat within 2 miles from lek TLS on mapped winter concentration areas	Apply Resource Protection Alternative management in areas that contain at least 2/3 of the population in WY (Core Areas). Apply Resource Use Alternative measures to areas outside the Core Areas.

The following items will be incorporated into WY BLM Field Office RMPs as modifications occur:

- Identify areas not available for oil and gas leasing or wind energy development in an alternative as appropriate. Also consider deferring leasing when existing leases expire.
- Recommended management practices and sage-grouse conservation measures from the 1.4.1 of BLM's National Sage-Grouse Habitat Conservation Strategy (USDI BLM 2004a), Wyoming Greater Sage-Grouse Conservation Plan, local sage-grouse working group plans, peer reviewed research, and other available information, to the extent possible, for public lands and the Federal mineral estate.
- Objectives for maintenance and improvement of sage-grouse habitats to support population objectives set by the Wyoming Game and Fish Department. These objectives and associated management practices will be designed to limit loss, degradation, simplification, and fragmentation of habitats (US EPA 1993). See section 1.3.1 of BLM's National Sage-Grouse Habitat Conservation Strategy (USDI BLM 2004a) for further direction in developing RMP goals and objectives and a range of alternatives for sage-grouse and sagebrush habitats. (See example above)

- Develop plans to monitor sage-grouse habitats in order to assess effectiveness of conservation measures that will be applied in achieving the conservation of sage-grouse habitats.
- All BLM authorized activities located in sage-grouse habitats will require appropriate sage-grouse conservation measures.
- Sage-grouse specific exception criteria for application of greater or lesser restrictions to short or long-term activities. Exception evaluation factors may include, but are not limited to, condition of the habitat, presence of sage-grouse or their sign, presence of other activities in the area, importance for migration or connectivity, duration and timing of proposed activity, local topography, severity and forecast of weather, beneficial aspects of the project for sage-grouse, including possible reclamation activities, and cover and forage availability.
- Landscape scale conservation strategies that may include special management of seasonal habitats and linkage zones. Use program-specific BMPs such as, but not limited to, temporary set-asides, phased development and/or off-site mitigation if offered by the proponent, reclamation methods, buried power lines, and efforts to reduce or consolidate surface-disturbing and disruptive activities in these strategies.

Policy Statement 6: Lek Data

The official Wyoming sage-grouse lek database is maintained by the WGFD in accordance with Appendix 4B of the Umbrella MOU between the WGFD and BLM (WGFD and USDI BLM 1990).

BLM and WGFD will meet at least annually to coordinate and review the accuracy of data and incorporate the most up-to-date information. For data to be included in the database, it must be collected using techniques and accuracy standards agreed upon by WGFD and BLM. Annual lek surveys and lek counts will be coordinated between WGFD and the BLM to reduce duplicated efforts and minimize disturbance in accordance with the Umbrella MOU.

Policy Statement 7: West Nile Virus

Artificial water impoundments will be managed to the extent of BLM’s authority to prevent the spread of West Nile virus where the virus poses a threat to sage-grouse. This may include but is not limited to: a) the use of larvicides and adulticides to treat reservoirs; b) overbuilding ponds to create non-vegetated and muddy shorelines; c) building steep shorelines to reduce shallow water and aquatic vegetation; d) maintaining the water level below rooted vegetation; e) avoiding flooding terrestrial vegetation in flat terrain or low lying areas; f) constructing dams or impoundments that restrict seepage or overflow; g) lining the channel where discharge water flows into the pond with crushed rock, or use a horizontal pipe to discharge inflow directly into existing open water; h) lining the overflow spillway with crushed rock and construct the spillway with steep sides to preclude the accumulation of shallow water and vegetation; and i) restricting access of ponds to livestock and wildlife (Doherty 2007).

Field Offices should consider alternate means to manage produced waters that could produce vectors for West Nile virus such as injection under an approved UIC permit, transfer to single/centralized facility, etc.

This does not apply to naturally occurring waters. Impoundments for wildlife and/or livestock use should be designed to reduce the potential to produce vectors for West Nile Virus where the virus may pose a threat to sage-grouse.

Policy Statement 8: Use of Dogs
At this time, BLM is not aware of any technique other than radio telemetry that is effective for detecting individual nesting sage-grouse. Field Offices are not to utilize dogs as a sole mechanism for conducting clearances to provide exceptions for activities to occur in sage-grouse nesting habitat during the nesting season. Carefully consider the disturbance or potential for mortality of birds before using this methodology. The use of well-trained dogs and experienced handlers for conducting clearances of winter concentration areas is permissible only when conducted with simultaneous verification of bird presence by visual observation of sage-grouse or their sign. This policy is in compliance with the WY BLM policy (USDI BLM 2009c) which does not allow employees to transport dogs in government vehicles.

Policy Statement 9: Monitoring Effectiveness
It is extremely important that the directives contained in this IM are monitored to determine the effectiveness of their implementation. Field Offices are to establish monitoring protocols that will be incorporated into project approvals as necessary. Small or in-house projects will also have a monitoring plan incorporated in the approval document.

Policy Statement 10: Variances
This statewide policy is intended to provide consistent sage-grouse habitat management directives on BLM administered public lands including the Federal mineral estate in Wyoming. Because Wyoming is such a diverse State, there may be occasional, special circumstances which could justify deviation from the policies stated herein. Field Offices may vary from this policy **where locally collected scientific data supported by comprehensive, objective NEPA analysis of a proposed action presents compelling justification for variance.** Where justified, changes will be made as COAs and terms and conditions to **all** land use authorizations affected at the site. In all cases, prior to actions wherein deviations from policy or variance from standard policies may take place, Field Offices will coordinate with WGFD counterparts and advise the Deputy State Director for Resource Policy and Management (WY 930) and the Deputy State Director for Minerals and Lands (WY 920) through the District Office of their intent to take such actions. The purpose of such notification and interaction is to ensure statewide awareness through monitoring of the number and type of such actions, and not to request advance WY BLM State Office approval for such actions.

Timeframe: Effective immediately.

Budget Impact: There may be a significant effect on the budget.

Background: Since 1999, many petitions have been submitted to the U.S. Fish and Wildlife Service (FWS) to list greater sage-grouse as threatened or endangered under the Endangered Species Act (ESA). Following the previous status reviews, the FWS determined in 2005 that the species was "not warranted" for listing. Decision documents supporting that determination noted the need to continue or expand all efforts to conserve sage-grouse. The FWS is currently reviewing the status based on litigation challenging the past FWS determinations (Winmill 2007). Future petitions to list sage-grouse under the Endangered Species Act (ESA) are anticipated. Part of the ESA listing process includes evaluating the adequacy of regulatory mechanisms to protect or conserve species, and this IM is intended to ensure that WY BLM has adequate regulatory mechanisms in place.

Because of the potential for ESA listing, the State of Wyoming took a proactive approach to sage-grouse conservation. Following the Wyoming Governor's 2007 Sage-grouse Summit, the Governor's Implementation Team developed a map of Core Population Areas in Wyoming. The Governor's Executive Order (EO) 2008-2, titled Greater Sage-grouse Core Area Protection, issued on August 1, 2008, directed State agencies to focus on maintenance and enhancement of sage-grouse habitats and populations within Core Population Areas. State agencies have been directed to work collaboratively with Federal agencies to ensure, to the greatest extent possible, a uniform and consistent application of the EO to maintain and enhance sage-grouse habitats and populations. The EO does not specifically apply to public lands; however, it is important to note that, at the time the Core Population Areas were developed, approximately 82 percent of the State's peak male sage-grouse attendance at leks was located within those Core Areas. To form the Core Area to encompass at least two thirds of the population in Wyoming, polygons were drawn on a paper map with a sage-grouse density background. The lek density map is based on peak male observation data from 2005 to 2007 from the WGFD database. A buffer was applied to each lek with a 4 mile radius. Then, highest density areas were delineated that represent the following categories of male sage-grouse lek counts: 65 percent, 70 percent, 75 percent, 80 percent and 85 percent of the male population. Modifications to the boundaries are expected to occur with new information and can be accomplished during RMP revisions, large projects EISs, and upon completion of mapping efforts for example.

WY BLM identified Key Habitat Areas in May 2008 in response to a national level effort to identify key sage-grouse habitats on BLM lands. The Key Habitat Areas differed slightly from the Governor's Core Population areas by the addition of sagebrush areas along State borders in order to edge match Key Habitat Areas with adjacent States. The BLM Washington Office issued direction to the BLM Fire and Wildlife Programs on June 19, 2008 (USDI BLM 2009) to protect all Key Habitats during fire management operations, especially in Sage-grouse Management Zones 3, 4 and 5. Although sage-grouse populations in Wyoming are in Management Zones 1 and 2, WY BLM implemented the guidance in the IM.

Broad application of the new restrictions as COAs to existing leases would likely be considered an interference with lease rights unless the lease contains language allowing for such a modification. Sage-grouse Lease Notice No. 3 has been attached to all leases issued by Wyoming BLM since April 2008. BLM may, to some degree, exceed the siting/timing limitations set forth in 43 C.F.R. § 3101.1-2 if supported by current research, site-specific NEPA analysis demonstrating the necessity of the additional mitigation and consistency with lease rights. The application of additional post-lease mitigation must also be consistent with the terms of the governing RMP. Development plans should be reviewed on a case-by-case basis to determine if impositions of these new conditions are consistent with the governing RMP and would not interfere with lease rights and allow for reasonable use and development of the leaseholds. A recent Interior Board of Land Appeals (IBLA) decision (176 IBLA 144 – 161) upheld the BLM's exercise of discretion in applying a timing restriction out to 3 miles from a lek as a COA on an APD permit because it was consistent with the governing RMP, was biologically based, was adequately supported by site-specific NEPA analysis, and because the lessee did not show how it interfered with lease rights.

The Mineral Leasing Act (MLA) provides that all lands subject to the Act "which are known or believed to contain oil or gas deposits may be leased by the Secretary [of the Interior]." 30 U.S.C. 226(a) (2009). The Supreme Court held that the Act gives the Secretary broad discretion not to offer an oil and gas tract for leasing. *Udall v. Tallman*, 380 U.S. 1,4 (1965). The U.S. Court of Appeals for the Ninth Circuit held that refusing to issue leases is a legitimate exercise of the Secretary's discretion under the MLA. *See Burglin v. Morton*, 527 F.2d 486, 488 (9th Cir. 1975) (citing *Tallman*, 380 U.S. at 4). The IBLA has expressly held that lands identified for oil and gas leasing in an RMP are open for permissible uses, and the BLM has no duty to offer them for lease, even when the BLM has received a pre-sale non-competitive offer to lease, *Richard D. Sawyer*, 160 IBLA 158, 163 (2003), or a nomination for competitive lease. *Marathon Oil Co.*, 139 IBLA 347 (1997). The BLM may also decline to lease even after it has received bids and bonus monies at a competitive lease sale. *Continental Land Resources*, 162 IBLA 1, 14-15 (2004). The IBLA has also upheld the BLM's authority to impose more stringent protection measures on approval of development plans or permits than provided for in lease stipulations when supported by current science and analyzed through the NEPA process. *See William P. Maycock*, 177 IBLA 1 (2009); *Yates Petroleum Corp.*, 176 IBLA 144 (2008); IBLA Order 2008-236 (Sorenson).

Standard terms related to surface activities found in the Wyoming BLM *Guidance for Use of Standardized Surface Use Definitions* (USDI BLM 2007) were used throughout this IM. The Wyoming Sage-grouse Definitions (WGFD 2006) found in Attachment 1 were used to standardize terminology associated with sage-grouse habitat management in Wyoming.

WY BLM has adopted the management vision contained in the 2000 Western Association of Fish and Wildlife Agencies (WAFWA) Memorandum of Understanding (MOU) with BLM, and incorporated the principles and strategies contained in the BLM National Sage-Grouse Habitat Conservation Strategy (USDI BLM 2004a); the WY Greater Sage-Grouse Conservation Plan (WGFD 2003); and the Local Working Group plans. Updates to these documents will be incorporated into this policy as appropriate.

Manual or Handbook Sections Affected: No manual or handbook sections are affected.

Coordination: This IM was coordinated among the Washington BLM Division of Fish, Wildlife and Plant Conservation and the Division of Minerals, Realty and Resource Protection, the WY BLM Field Offices, other BLM State Offices, the Wyoming Office of Governor Freudenthal, and the Wyoming Game and Fish Department.

Contacts: Chris Keefe, Wildlife Biologist, 307-775-6101 and Bill Hill, Deputy State Director for Resources, Policy and Management, 307-775-6113.

Signed by:
Bill Hill
Acting State Director

Authenticated by:
Pamela D. Hernandez
Wyoming Central Files

4 Attachments:

1 – Wyoming Sage-Grouse Definitions (4 pp)
2 – Seasonal Sage-grouse Habitat Components Descriptions (2 pp)
3 – Background for Sage-grouse Habitat Management (2 pp)
4 - References (3 pp)

<u>Distribution</u>

Director (230), Room 204, LS	1 (w/o atchs,)
Field Managers	2 (w/atchs,)
CF	2(w/atchs,)

Wyoming Sage-Grouse Definitions:

(Revised 12/16/09)

The following definitions have been adopted for the purposes of collecting and reporting sage-grouse data. See the sage-grouse chapter of the Wyoming Game and Fish Department's Handbook of Biological Techniques for additional technical details and methods.

Lek - A traditional courtship display area attended by male sage-grouse in or adjacent to sagebrush dominated habitat. A lek is designated based on observations of two or more male sage-grouse engaged in courtship displays. Before adding the suspected lek to the database, it must be confirmed by an additional observation made during the appropriate time of day, during the strutting season. Sign of strutting activity (tracks, droppings, feathers) can also be used to confirm a suspected lek. Sub-dominant males may display on itinerant (temporary) strutting areas during population peaks. Such areas usually fail to become established leks. Therefore, a site where small numbers of males (<5) are observed strutting should be confirmed active for two years before adding the site to the lek database.

Satellite Lek – A relatively small lek (usually less than 15 males) that develops within about 500 meters of a large lek during years of relatively high grouse numbers. Locations of satellite leks should be encompassed within lek perimeter boundaries. Birds counted on satellite leks should be added to those counted on the primary lek for reporting purposes.

Lek Perimeter – The outer perimeter of a lek and any associated satellites. Perimeters should be mapped by experienced observers using established protocols for all leks with larger leks receiving higher priority. Perimeters may vary over time as population levels or habitat and weather conditions change. However, changes to mapped perimeters should occur infrequently and only if grouse use consistently (2+ years) demonstrates the existing perimeter to be inaccurate. A point **within** the lek perimeter must be recorded or calculated as the identifying location for the lek. The point may be the geographic center of the perimeter polygon as calculated though a GIS exercise or a GPS point reflecting the center of breeding activity as typically witnessed on the lek.

Lek Complex - A lek or group of leks within 2.5 km (1.5 mi) of each other between which male sage-grouse may interchange from one day to the next.

Lek Count - A census technique that documents the actual number of male sage-grouse observed attending a lek complex. The following criteria are designed to assure counts are done consistently and accurately, enabling valid comparisons to be made among data sets. Additional technical criteria are available from the WGFD.

- Conduct lek counts at 7-10 day intervals over a 3-4 week period after the peak of mating activity. Although mating typically peaks in early April in Wyoming, the number of males counted on a lek is usually greatest in late April or early May when attendance by yearling males increases.
- Conduct lek counts only from the ground. Aerial counts are not accurate and are not comparable to ground counts.

- Conduct counts between ½ hour before sunrise to 1 hour after.
- Count attendance at each lek a minimum of three times annually during the breeding season.
- Conduct counts only when wind speeds are less than 15 kph (~10 mph) and no precipitation is falling.
- All leks within a complex should be counted on the same morning.

Lek Count Route – A lek route is a census of a group of leks that are relatively close and represent part or all of a single breeding population/sub-population. Leks should be counted on routes to facilitate repetition by other observers, increase the likelihood of recording satellite leks, and account for shifts in breeding birds if they occur. Lek routes should be established so that all leks along the route can be counted within 1.5 hours following the criteria listed under "Lek Count".

Lek Survey - Ideally, all sage-grouse leks would be counted annually. However, some breeding habitat is inaccessible during spring because of mud and snow, or the location of a lek is so remote it cannot be routinely counted. In other situations, topography or vegetation may prevent an accurate count from any vantage point. In addition, time and budget constraints often limit the number of leks that can be visited. Where lek counts are not feasible for any of these reasons, surveys are the only reliable means to monitor population trends. Lek surveys are designed principally to determine whether leks are active or inactive, requiring as few as one visit to a lek. Obtaining accurate counts of the numbers of males attending is not essential. Lek surveys involve substantially less effort and time than lek counts. They can also be done from a fixed-wing aircraft or helicopter. Lek surveys can be conducted from the initiation of strutting in early March until early-mid May, depending on the site and spring weather.

Annual status – Lek status is assessed annually based on the following definitions:

- **active** – Any lek that has been attended by male sage-grouse during the strutting season. Acceptable documentation of grouse presence includes observation of birds using the site or signs of strutting activity.

- **inactive** – Any lek where sufficient data suggests that there was no strutting activity throughout a strutting season. Absence of strutting grouse during a single visit is insufficient documentation to establish that a lek is inactive. This designation requires documentation of either: 1) an absence of birds on the lek during at least 2 ground surveys separated by at least 7 days. These surveys must be conducted under ideal conditions (4/1-5/7, no precipitation, light or no wind, ½ hour before to 1 hour after sunrise) or, 2) a ground check of the exact known lek site late in the strutting season (after 4/15) that fails to find any sign (droppings/feathers) of strutting activity. Data collected by aerial surveys may not be used to designate inactive status.

- **unknown** – Leks for which status as active or inactive has not been documented during the course of a strutting season. Use of this status should be rare. Leks should be checked with enough visits to determine whether it is active or not. It is better to have two good checks every other year and confirm it "inactive" than to check it once every year, not see birds, but remain in “unknown” status.

Management status - Based on its annual status, a lek is assigned to one of the following categories for management purposes:

- **occupied lek** – A lek that has been active during at least one strutting season within the prior ten years. Occupied leks are protected through prescribed management actions during surface disturbing activities.

- **unoccupied lek** – (Formerly “historical lek”.) There are two types of unoccupied leks, “destroyed” and “abandoned.” Unoccupied leks are not protected during surface disturbing activities.

    - **destroyed lek** – A formerly active lek site and surrounding sagebrush habitat that has been destroyed and is no longer suitable for sage-grouse breeding. A lek site that has been strip-mined, paved, converted to cropland or undergone other long-term habitat type conversion is considered destroyed. Destroyed leks are not monitored unless the site has been reclaimed to suitable sage-grouse habitat.

    - **abandoned lek** – A lek in otherwise suitable habitat that has not been active during a period of 10 consecutive years. To be designated abandoned, a lek must be “inactive” (see above criteria) in at least four non-consecutive strutting seasons spanning the ten years. The site of an “abandoned” lek should be surveyed at least once every ten years to determine whether it has been reoccupied by sage-grouse.

- **undetermined lek** – Any lek that has not been documented active in the last ten years, but survey information is insufficient to designate the lek as unoccupied. Undetermined leks will be protected through prescribed management actions during surface disturbing activities until sufficient documentation is obtained to confirm the lek is unoccupied. Use of this status should be rare (see “unknown” above).

Winter Concentration Area - During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. Sage-grouse tend to select wintering sites where sagebrush is 10-14 inches above the snow. Sagebrush canopy cover utilized by sage-grouse above the snow may range from 10 to 30 percent. Foraging areas tend to be on flat to generally southwest facing slopes or on ridges where sagebrush height may be less than 10 inches but the snow is routinely blown clear by wind. When these conditions are met, sage-grouse typically gain weight over winter. In most cases winter is not considered limiting to sage-grouse. Under severe winter conditions grouse will often be restricted to tall stands of sagebrush often located on deeper soils in or near drainage basins. Under these conditions winter habitat may be limiting. On a landscape scale, winter habitats should allow sage-grouse access to sagebrush under all snow conditions.

Large numbers of sage-grouse have been documented to persistently use some specific areas which are characterized by the habitat features outlined above. These areas should be delineated as "winter concentration areas". Winter concentration areas do not include all winter habitats used by sage-grouse, nor are they limited to narrowly defined "severe winter relief" habitats. Delineation of these concentration areas is based on determination of the presence of winter habitat characteristics confirmed by repeated observations and sign of large numbers of sage-grouse. The definition of "large" is dependent on whether the overall population is large or small. In core population areas frequent observations of groups of 50+ sage-grouse meet the definition while in marginal populations group size may be 25+. Consultation and coordination with the WGFD is required when delineating winter concentration areas.

The following definitions are derived from the WAFWA sage-grouse guidelines (Connelly et al. 2000):

Non-migratory Populations – Sage-grouse populations that **do not** make long distance movements (i.e., > 10 km one way) between or among seasonal ranges.

Migratory Populations – Sage-grouse populations that **do** make long distance movements (i.e.,> 10 km one way) between or among seasonal ranges. These long distance movements may take place in stages between 2 or 3 distinct seasonal ranges.

The following definitions are derived from the EPA habitat evaluation guidance (US EPA 1993):

Habitat Destruction (Loss/Conversion) – The ultimate form of a habitat impact. The destruction of a natural ecosystem through its conversion to another land use. In each conversion, the original natural characteristics of the land are eliminated, while the associated habitat values are modified to varying degrees.

Habitat Fragmentation (Breakdown Partitioning) – A form of habitat impact which often only destroys part of a habitat, leaving other portions of the habitat intact. Depending on the scale of concern, many instances of local habitat destruction are better thought of as habitat fragmentation, or partitioning. Such fragmentation can be the principal cause of loss of "area-sensitive" species (e.g., grizzly bears, sage-grouse, etc.), and is the most serious threat to biological diversity.

Habitat Simplification (Removal of Components) – A habitat impact that includes the removal of ecosystem components, such as standing dead trees, cover logs, or stream debris, the death of sensitive submerged plants from siltation, and the loss of microhabitats (such as nests and dens) that are rendered unusable by human intrusion. The removal of vertical habitat structure can reduce the diversity of species.

Habitat Degradation (Reduced Quality/Contamination) – This form of habitat impact specifically refers to a decrease in the health or ecological integrity of the "intact" habitat. Chemical contamination, invasion of exotic plants and animals, increased water temperatures, UV-B exposure, or draw-down of aquifers are all examples of habitat degradation.

BASIC SAGE-GROUSE HABITAT COMPONENT DESCRIPTIONS

To effectively manage for sage-grouse and their habitat it is necessary to have a basic understanding of general sage-grouse biology and habitat needs.

The following seasonal use periods and habitat components are important to sage-grouse and contribute to their productivity and conservation. Breeding habitats have been identified as limiting factors in sage-grouse populations across their range. Winter habitats have been identified as a limiting factor in portions of their range when sage-grouse are unable to have access to sagebrush under a variety of snow conditions. The following habitat descriptions are a composite characterization of sage-grouse seasonal use areas found across Wyoming as presented in the Wyoming Sage-grouse Conservation Plan (WGFD 2003). These descriptions are most useful in providing an overall, contextual view of typical sage-grouse seasonal habitats in Wyoming, a State of very diverse ecosystems. Important sage-grouse seasonal habitats and use areas can vary from one part of the State to another. The regional sage-grouse plans prepared by the local sage-grouse working groups (LWG) provide a more specific description of the seasonal habitats and use areas for each region of the State.

The following are descriptions of breeding and winter habitat components which are based on definitions entitled "Wyoming Sage-grouse Definitions" developed and adopted by the WGFD, and others (Attachment 1).

BREEDING HABITATS: Breeding habitats are composed of leks, nesting and early brood-rearing habitats.

Leks - A lek is typically an open area surrounded by potential nesting habitat. The common feature of leks is that they have less shrub and herbaceous cover than surrounding habitats. The sagebrush cover that surrounds a lek provides important hiding cover from predators for both the male sage-grouse and particularly hens while attending a lek. Sagebrush cover immediately adjacent to a lek may or may not meet the following definition of productive, high quality nesting habitat.

Nesting/Early Brood-Rearing Habitat - Nesting habitat for sage-grouse in Wyoming is generally described as sagebrush stands having canopy cover 15 to 30 percent and shrub heights of 11 to 32 inches (40-80 cm). Grasses and forbs with height (6 inches (15 cm) or greater) and shrub canopy cover (greater than 15 percent) provides important cover and food for sage-grouse using these habitats. Early brood-rearing habitat generally has 10 to 25 percent sagebrush canopy cover and has slightly higher canopy cover of grasses and forbs than nesting habitat. Early brood-rearing habitat is generally used by sage-grouse hens with chicks when the chicks range in age from newly hatched up to 21 days of age.

Research conducted on sage-grouse nesting activities range-wide has established that incubating hens normally leave the nest twice a day for 20 to 45 minutes during the early morning and late afternoon to feed (Holloran 2005). Activities or actions that cause hens to leave the nest more frequently or for longer periods increase the likelihood of nest failure. Studies since 1977 indicate that many populations of sage-grouse contained birds

> nesting much further than 2 miles from the lek of breeding. Studies conducted in Wyoming from 1994 to 2003 indicate 45 percent of sage-grouse hens nest within 1.86 miles (3 km) of the lek, 64 percent nest within 3.1 miles (5 km), and 74 percent of nests are located within 4 miles (6.5 km) of the lek (Holloran and Anderson 2005, Holloran et al. 2007). Nest locations are independent of lek location, and are based on availability of suitable nesting habitat. Not all sagebrush habitats within these 2 to 4 mile radius distances may be suitable as nesting habitat or other seasonal habitats for sage-grouse.

WINTER HABITATS: During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. Sage-grouse tend to select wintering sites where sagebrush is 10-14 inches (25 -36 cm) above the snow. Sagebrush canopy cover utilized by sage-grouse above the snow may range from 10 to 30 percent. Foraging areas tend to be on flat to generally southwest facing slopes or in areas where sagebrush height may be less than 10 inches (25 cm) but the snow is routinely blown clear by wind. When these conditions are met, sage-grouse typically gain weight over winter. In most cases, winter conditions are not considered limiting to sage-grouse. Under severe winter weather conditions sage-grouse will often be restricted to tall stands of sagebrush usually located on deeper soils in or near drainages. Under these severe winter conditions, winter habitat may be limiting. On a landscape scale, sage-grouse winter habitats should allow sage-grouse access to sagebrush under all snow conditions.

Large numbers of sage-grouse have been documented to consistently use some specific areas which are characterized by the habitat features outlined above. These areas are "winter concentration areas." Not all winter habitats used by sage-grouse, or "severe winter relief" habitats (a survival range), serve as winter concentration areas. Delineation of these concentration areas is based on determination of the presence of winter habitat characteristics confirmed by repeated observations and/or sign of large numbers of sage-grouse. The definition of "large" is dependent on whether the overall population is large or small. In core population areas frequent observations of groups of 50+ sage-grouse meet the definition, while in marginal populations group size may be 25+.

Background for Sage-grouse Habitat Management

Information in this background synopsis exemplifies the need for large, landscape-level, sage-grouse habitat evaluation and management.

The *Guidelines to Manage Sage-grouse Populations and Habitats (2000 WAFWA Guidelines)* (Connelly et al. 2000) and *Monitoring of Greater Sage-grouse Habitats and Populations* (Connelly et al. 2003) recommend that agencies determine if sage-grouse populations are migratory or non-migratory in order to apply the appropriate management prescriptions. When nesting habitats are distributed less uniformly around a lek, sage-grouse hens travel greater distances from the lek to locate nests within suitable nesting habitat. In migratory populations, sage-grouse hens may nest up to 15 miles (25km) or further from the lek of breeding. Non-migratory populations may have all seasonal habitats interspersed within their annual ranges with no major barriers (e.g., topography, large reservoirs, subdivisions, or other large scale developments) or long distance movements (>6.2 miles; 10 km) between seasonal habitats. Most sage-grouse populations in Wyoming are migratory and have large annual ranges with distinct seasonal use areas. Migratory populations may use areas within a landscape as large as 1042 square miles (2700 km^2) on an annual basis. Within these areas, sage-grouse use specific habitats each year and exhibit high fidelity to seasonal ranges. Use of these seasonal habitats can be highly dependent on traditional migratory corridors between these areas (Connelly et al. 2000, 2003, and 2004). Activities that impact these traditional use corridors and seasonal habitat areas (occupied or unoccupied) may adversely affect sage-grouse populations and their habitats at great distances from the activities. See Attachment 1 for definitions of migratory and non-migratory sage-grouse populations.

Research studies conducted in the upper Green River Basin since 1999 (Lyon and Anderson 2003, Holloran 2005, and Kaiser 2006) and studies in the Powder River Basin since 2002 (Walker et al. 2007a, and Doherty et al. 2008) describe the impact of oil and gas field development on sage-grouse. These recent studies conclude sage-grouse are sensitive to human disturbance and habitat degradation at even relatively low levels, and detrimental impact thresholds to sage-grouse can be reached quickly at the landscape scale. The Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats (WGFD 2009) provides sage-grouse specific thresholds derived from the scientific literature.

Lek sites that appear to be abandoned may be important habitat components for rebounding sage-grouse populations. Analysis of long-term monitoring data suggests sage-grouse populations are cyclic or oscillate based on environmental factors such as drought (WGFD 2003). Within these cycles, sage-grouse populations decline and some leks become temporarily inactive for a period of years. Once environmental conditions improve, these leks may become active again. These cycles appear to be approximately 10 years.

The recent spread of West Nile virus (WNv) in North America represents an important new stressor on greater sage-grouse populations. In 2003, an outbreak of WNv decreased late-summer survival of sage-grouse by 25% (Naugle et al. 2004) and resulted in near-extirpation of a local breeding population (Walker et al. 2004). By summer 2004, survival across the species' range was 10% lower (86%) at sites with WNv mortalities than at sites without (Naugle et al. 2005). Extreme susceptibility of sage-grouse was confirmed in 2004 when all non-vaccinated birds experimentally infected with WNv died (Clark et al. 2006). Infection rates in sage-grouse show that impacts of WNV in the near future will depend more on changes in climate and vector distribution than on spread of resistance (Walker et al. 2007b).

Domestic livestock grazing has occurred within the range of sage-grouse for over 150 years and is the most common and widespread use of rangelands in the western U.S. Livestock grazing practices may affect herbaceous composition, cover, and height and has a potential to impact sagebrush habitats. WY BLM has standards and guidelines to ensure proper livestock grazing management on public lands which can help maintain healthy rangeland conditions and provide functional habitat for sage-grouse. However, poor livestock grazing practices can have long-term negative impacts on sage-grouse habitat by degrading sagebrush, meadow, and riparian communities (Bohne et al. 2007).

In recent decades, prescribed fire has been used as a preferred land management treatment in many locations. Baker (2006), Dahlgren et al. (2006), and Woodward (2006) have evaluated the use of fire in sage-grouse habitats. An interagency report entitled "Wyoming Guidelines for Management of Sagebrush Communities with an Emphasis on Fire Management" (Wyoming Interagency Vegetation Committee 2002) presents some broad, landscape guidelines for use of fire in sagebrush ecosystems and is further supplemented with sage-grouse specific information in Bohne et al. (2007).

Wildfires are a natural occurrence in sagebrush ecosystems, though they may not be occurring at “natural” frequencies, severities and intensities. As fire goes through a site both the understory and overstory vegetation are removed on the surface, and it may take many years for some species of sagebrush to return to some sites. Sage-grouse are highly dependent on the presence of sagebrush in their habitat, and loss of sagebrush to fire can have a highly detrimental effect on sage-grouse within their range. Invasive species such as cheatgrass, etc., can increase fire frequency and may prevent the establishment of sagebrush and native grass and forb understory. Cheatgrass is a landscape issue threatening sage-grouse habitats. Management guidance goes beyond the scope of this policy although integrated pest management could be included in the Conservation Objectives and RMP policy statements.

Drought severity and frequency have a significant impact to sagebrush ecosystems. Impacts may include loss of vegetation to support brood-rearing habitat function (insects, succulent forb production, hiding cover, etc.). Drought can amplify detrimental effects and slow habitat recovery from disturbances such as fire. Local sage-grouse working groups, Natural Resource Conservation Service (NRCS) offices, BLM field offices and others have specific reclamation recommendations which include seed mix compositions appropriate for consideration in reclaiming sage-grouse habitats.

This information was provided as background for sage-grouse habitat management.

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DAVE FREUDENTHAL
GOVERNOR

THE STATE OF WYOMING

STATE CAPITOL
CHEYENNE, WY 82002

Office of the Governor

STATE OF WYOMING
EXECUTIVE DEPARTMENT
EXECUTIVE ORDER

2010- 4
(Replaces 2008-2)

GREATER SAGE-GROUSE CORE AREA PROTECTION

WHEREAS the Greater Sage-Grouse (*Centrocercus urophasianus*) inhabits much of the sagebrush-steppe habitat in Wyoming; and

WHEREAS the sagebrush-steppe habitat type is abundant across the state of Wyoming; and

WHEREAS the state of Wyoming currently enjoys robust populations of Greater Sage-Grouse; and

WHEREAS the state of Wyoming has management authority over Greater Sage-Grouse populations in Wyoming; and

WHEREAS the Greater Sage-Grouse has been the subject of several petitions to list the species as a threatened or endangered species pursuant to the Endangered Species Act; and

WHEREAS the United States Department of the Interior has determined that listing the Greater Sage-Grouse as a threatened or endangered species is warranted over all of its range, including the populations in Wyoming; and

WHEREAS the United States Department of the Interior has determined that listing the Greater Sage-Grouse as a threatened or endangered species is currently precluded by higher priority listing actions; and

WHEREAS the Greater Sage-Grouse is currently considered a “candidate” species under the auspices of the Endangered Species Act; and

WHEREAS the United States Department of the Interior is required to review the status of all candidate species every year; and

WHEREAS the listing of the Greater Sage-Grouse would have a significant adverse effect on the economy of the state of Wyoming, including the ability to generate revenues from state lands; and

WHEREAS the listing of the Greater Sage-Grouse would have a significant adverse effect on the custom and culture of the state of Wyoming; and

WHEREAS the Wyoming State Legislature and other agencies have dedicated significant state resources to conserve Greater Sage-Grouse populations in Wyoming; and

WHEREAS the state of Wyoming has developed a "Core Population Area" strategy to weave the many on-going efforts to conserve the Greater Sage-Grouse in Wyoming into a statewide strategy; and

WHEREAS on April 17, 2008, the Office of the Governor requested that the U.S. Fish and Wildlife Service review the "Core Population Area" strategy to determine if it was a "sound policy that should be moved forward" and on May 7, 2008, the U.S. Fish and Wildlife Service responded that the "core population area strategy, as outlined in the Implementation Team's correspondence to the Governor, is a sound framework for a policy by which to conserve greater sage-grouse in Wyoming"; and

WHEREAS new science, information and data continue to emerge regarding "Core Population Areas" and the habitats and behaviors of the Greater Sage-Grouse, which led the Governor's Sage Grouse Implementation Team to re-evaluate the original "core population areas" and protective stipulations for Greater Sage-Grouse.

NOW, THEREFORE, pursuant to the authority vested in me by the Constitution and Laws of the State, and to the extent such actions are consistent with the statutory obligations and authority of each individual agency, I, Dave Freudenthal, Governor of the State of Wyoming, do hereby issue this Executive Order providing as follows:

1. Management by state agencies should, to the greatest extent possible, focus on the maintenance and enhancement of Greater Sage-Grouse habitats, populations and connectivity areas identified in Attachment A. Absent substantial and compelling information, these Core Population Areas should not be altered for at least five (5) years.
2. Existing land uses within Core Population Areas should be recognized and respected by state agencies. It is assumed that existing activities in Core Population Areas will not be managed under Core Population Area stipulations. Examples of existing activities include oil and gas, mining, agriculture, processing facilities, housing and other uses that were in place prior to the development of the Core Population Areas. Provided these activities are within a defined project boundary (such as a recognized oil and gas unit, mine plan, subdivision plat, etc.) they should be allowed to continue within the existing boundary, even if the use exceeds recommended stipulations (see Attachment B).
3. New development or land uses within Core Population Areas should be authorized or conducted only when it can be demonstrated that the activity will not cause declines in Greater Sage-Grouse populations.
4. Development consistent with the stipulations set forth in Attachment B shall be deemed sufficient to demonstrate that the activity will not cause declines in Greater Sage-Grouse populations.
5. Funding, assurances (including efforts to develop Candidate Conservation Agreements and Candidate Conservation Agreements with Assurances), habitat enhancement, reclamation efforts, mapping and other associated proactive efforts to assure viability of Greater Sage-Grouse in Wyoming should be focused and prioritized to take place in Core Population Areas.
6. To the greatest extent possible, a non-regulatory approach shall be used to influence management alternatives within Core Population Areas. Management alternatives

should reflect unique localized conditions, including soils, vegetation, development type, predation, climate and other local realities.

7. For activities outside of Core Population Areas, no more than a one-quarter (1/4) mile no surface occupancy standard and a two (2) mile seasonal buffer should be applied to occupied leks. Incentives to enable development of all types outside Core Population Areas should be established (these should include stipulation waivers, enhanced permitting processes, density bonuses, and other incentives). Development scenarios should be designed and managed to maintain populations, habitats and essential migration routes where possible. It is recognized that some incentives may result in reduced numbers of sage grouse outside of Core Population Areas.
8. Incentives to accelerate or enhance required reclamation in habitats adjacent to Core Population Areas should be developed, including but not limited to stipulation waivers, funding for enhanced reclamation, and other strategies. It is recognized that some incentives may result in reduced numbers of sage grouse outside of the Core Population Areas.
9. Existing rights should be recognized and respected.
10. On-the-ground enhancements, monitoring, and ongoing planning relative to sage grouse and sage grouse habitat should be facilitated by sage grouse local working groups whenever possible.
11. Fire suppression efforts in Core Population Areas should be emphasized, recognizing that other local, regional, and national suppression priorities may take precedent. However, public and firefighter safety remains the number one priority for all fire management activities.
12. State and federal agencies, including the U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Forest Service, and other federal agencies shall work collaboratively to ensure a uniform and consistent application of this Executive Order to maintain and enhance Greater Sage-Grouse habitats and populations.
13. State agencies shall work collaboratively with local governments and private landowners to maintain and enhance Greater Sage-Grouse habitats and populations in a manner consistent with this Executive Order.
14. It is critical that existing land uses and landowner activities continue to occur in core areas, particularly agricultural activities on private lands. For the most part, these activities on private lands are not subject to state agency review or approval. Only those activities which state agencies are required by state or federal statute to review or approve are subject to consistency review. This Executive Order in no way adds or expands the review or approval authority of any state agency. It is acknowledged that such land uses and activities could have localized impacts on Greater Sage-Grouse. To offset these impacts, Core Population Areas have been mapped to include additional habitat beyond that strictly necessary to prevent listing of the species. The additional habitat included within the Core Population Area boundaries is adequate to accommodate continuation of existing land uses and landowner activities. As a result, state agencies are not required to review most existing land uses and landowner activities in Core Population Areas for consistency with this Executive Order. Attachment C contains a list of existing land uses and landowner activities that do not require review for consistency.
15. It will be necessary to construct significant new transmission infrastructure to transport electricity generated in Wyoming to out-of-state load centers. New transmission lines constructed within Core Population Areas will be consistent with this Executive Order if they are constructed between July 1 and March 14 (or between July 1 and November 30 in winter concentration areas) and within one half (1/2) mile either side of existing 115 kV or larger transmission lines. New

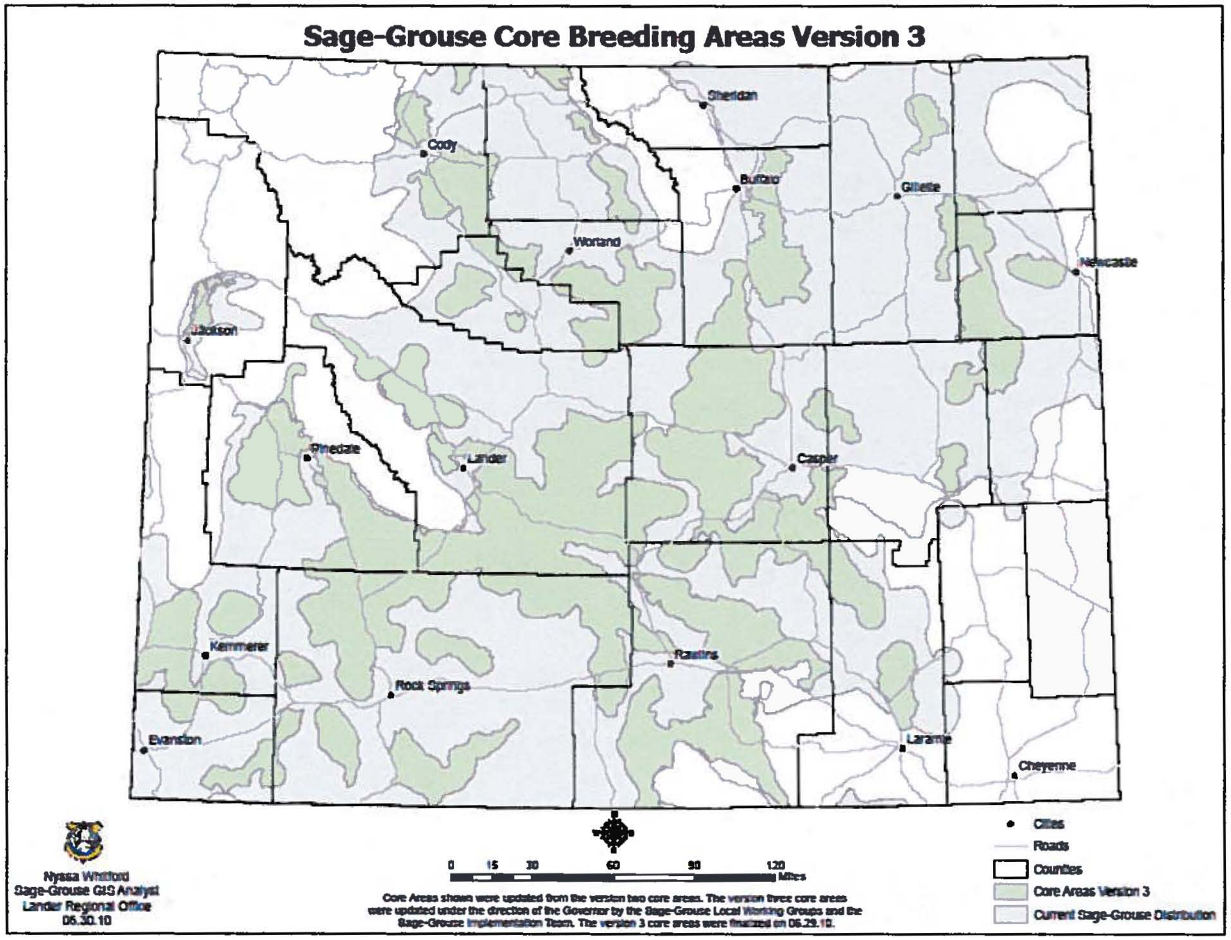
transmission outside this one (1) mile wide corridor within Core Population Areas should be authorized or conducted only when it can be demonstrated that the activity will not cause declines in Greater Sage-Grouse populations.

16. For purposes of consistency with this Executive Order there is established a transmission line corridor through Core Population Areas in south central and southwestern Wyoming as illustrated on Attachment D. This two (2) mile wide corridor represents the state of Wyoming's preferred alternative for routing transmission lines across the southern portion of the state while reducing impacts to Core Population Areas and other natural resources. New transmission lines constructed within this corridor shall be considered consistent with this Executive Order if construction occurs within the corridor between July 1 and March 14 (or between July 1 and November 30 in winter concentration areas). New transmission lines sited outside this corridor within Core Population Areas should be authorized or conducted only when it can be demonstrated by the state agency that the activity will not cause declines in Greater Sage-Grouse populations.
17. State agencies shall report to the Office of the Governor within ninety (90) days detailing their actions to implement this Executive Order.

Given under my hand and the Executive Seal of the State of Wyoming this 18th day of August, 2010.

Dave Freudenthal
Governor

ATTACHMENT A



Sage-Grouse Core Breeding Areas Version 3

Nyssa Whitford
Sage-Grouse GIS Analyst
Lander Regional Office
06.30.10

Core Areas shown were updated from the version two core areas. The version three core areas were updated under the direction of the Governor by the Sage-Grouse Local Working Groups and the Sage-Grouse Implementation Team. The version 3 core areas were finalized on 06.29.10.

ATTACHMENT B

Permitting Process and Stipulations for Development in Sage-Grouse Core Areas

PERMITTING PROCESS

Point of Contact: The first point of contact for addressing sage-grouse issues in any permit application should be the Wyoming Game and Fish Department (WGFD). Project proponents (proponents) need to have a thorough description of their project and identify the potential effects on sage-grouse prior to submitting an application to the permitting agency (details such as a draft project implementation area analysis, habitat maps and any other information will help to expedite the project). Project proponents should contact WGFD at least 45-60 days prior to submitting their application. More complex projects will require more time. It is understood that WGFD has a role of consultation, recommendation, and facilitation, and has no authority to either approve or deny the project. The purpose of the initial consultation with the WGFD is to become familiar with the project proposal and ensure the project proponent understands recommended stipulations and stipulation implementation process.

Maximum Disturbance Process: All activities will be evaluated within the context of maximum allowable disturbance (disturbance percentages, location and number of disturbances) of suitable sage-grouse habitat (See Appendix A for definition of suitable sage-grouse habitat and disturbance of suitable sage-grouse habitat) within the area affected by the project. The maximum disturbance allowed will be analyzed via a Project Impact Analysis Area (PIAA) process conducted by the Federal Land Management Agency on federal Land and the project proponent on non-federal (private, state) land. Unsuitable habitat occurring within the project area will not be included in the disturbance cap calculations.

1. Project impact analysis area (PIAA) delineation:
   Determine all leks that may be affected by the project by placing a four-mile boundary around the project boundary (as defined by the proposed area of disturbance related to the project). All occupied leks located within the four-mile boundary will be considered affected by the project.

A four-mile boundary will then be placed around the perimeter of each affected lek. The area within the boundary of affected leks and the project boundary creates the PIAA for each individual project. Disturbance will be analyzed for the PIAA as a whole and for each individual affected lek within the PIAA. Any portion of the PIAA occurring outside of core area will be removed from the analysis.

2. Disturbance analysis: Total disturbance acres within the PIAA will be determined through an evaluation (Appendix A) of:
    a. Existing disturbance (sage-grouse habitat that is disturbed due to existing anthropogenic activity and wildfire).
    b. Approved permits (that have approval for on the ground activity) not yet implemented.

3. Habitat Assessment: A habitat assessment will be conducted to create a baseline survey identifying:
    a. Suitable and unsuitable habitat within the PIAA
    b. Sage-grouse use of suitable habitat (seasonal, densities, etc)
    c. Priority restoration areas (which could reduce 5% cap)
        i. Areas where plug and abandon activities will eliminate disturbance
        ii. Areas where old reclamation has not produced suitable habitat
    d. Areas of invasive species
    e. Other assurances in place (CCAA, easements, habitat contracts, etc.)

4. Determination of existing and allowable suitable habitat disturbance: Acres of disturbance within suitable habitat divided by the total suitable habitat within the PIAA times 100 equals the percent of disturbed suitable habitat within the PIAA. Subtracting the percentage of existing disturbed suitable habitat from 5% equals new allowable suitable habitat disturbance until plant regeneration or reclamation reduces acres of disturbed habitat within the PIAA.

Permitting: The complete analysis package developed by consultation and review outlined herein will be forwarded to the appropriate permitting agency. Wyoming Game and Fish Department recommendations will be included, as will other recommendations from project proponents and other appropriate agencies.

Excepted Activities: A list of "deminimus" activities, including standard uses of the landscape, is being developed and will be completed by 01 July 2010 as further guidance for these recommendations.

GENERAL STIPULATIONS

These stipulations are designed to maintain existing suitable sage-grouse habitat by permitting development activities in core areas in a way that will not cause declines in sage-grouse populations. General stipulations are recommended to apply to all activities in core areas, with the exception of de minimus actions defined herein or specifically identified activities. The specific industry stipulations are considered in addition to the general stipulations.

1. **Surface Disturbance**: Surface disturbance will be limited to 5% of suitable sage-grouse habitat per an average of 640 acres. The PIAA process will be used to determine the level of disturbance. Distribution of disturbance may be considered and approved on a case-by-case basis. Unsuitable habitat should be identified in a seasonal and landscape context, on a case-by-case basis, outside the 0.6 mile buffer around leks. This will incentivize proponents to locate projects in unsuitable habitat to avoid creating additional disturbance acres. Acres of development in unsuitable habitat are not considered disturbance acres. The primary focus should be on protection of suitable habitats and protecting from habitat fragmentation. See Appendix A for a description of suitable, unsuitable habitat and disturbance.

2. **Surface Occupancy**: Within 0.6 miles of the perimeter of occupied sage-grouse leks there will be no surface occupancy (NSO). NSO, as used in these recommendations, means no surface facilities including roads shall be placed within the NSO area. Other activities may be authorized with the application of appropriate seasonal stipulations, provided the resources protected by the NSO are not adversely affected. For example, underground utilities may be permissible if installation is completed outside applicable seasonal stipulation periods and significant resource damage does not occur. Similarly, geophysical exploration may be permissible in accordance with seasonal stipulations.

3. **Seasonal Use**: Activity (production and maintenance activity exempted) will be allowed from July 1 to March 14 outside of the 0.6 mile perimeter of a lek in core areas where breeding, nesting and early brood-rearing habitat is

present. In areas used solely as winter concentration areas, exploration and development activity will be allowed March 14 to December 1. Activities in unsuitable habitat may also be approved year-round (including March 15-June 30) on a case-by-case basis (except in specific areas where credible data shows calendar deviation). Activities may be allowed during seasonal closure periods as determined on a case-by-case basis.

4. **Transportation**: Locate main roads used to transport production and/or waste products > 1.9 miles from the perimeter of occupied sage-grouse leks. Locate other roads used to provide facility site access and maintenance > 0.6 miles from the perimeter of occupied sage-grouse leks. Construct roads to minimum design standards needed for production activities.

5. **Overhead Lines**: Bury lines when possible, if not; locate overhead lines at least 0.6 miles from the perimeter of occupied sage-grouse leks. New lines should be raptor proofed if not buried.

6. **Noise**: Limit new noise levels to 10 dBA above ambient noise (existing activity included) measured at the perimeter of a lek from 6 PM to 8 AM during initiation of breeding (March 1 to May 15). Actual thresholds may be adjusted upon completion of current research being conducted in core habitat.

7. **Vegetation Removal:** Vegetation removal should be limited to the minimum disturbance required by the project. All topsoil stripping and vegetation removal in suitable habitat will occur between July 1 and March 14 in areas that are within 4.0 miles of an occupied lek. Initial disturbance in unsuitable habitat between March 15 and June 30 may be approved on a case-by-case basis.

8. **Sagebrush Treatment:** Sagebrush eradication is considered disturbance and will contribute to the 5% disturbance factor. Sagebrush treatments that maintain sagebrush canopy cover at or above 15% total canopy cover within the treated acres will not be considered disturbance. Treatments that reduce sagebrush canopy cover below 15% will be allowed if all such treated areas make up less than 20% of the suitable sagebrush habitat within the PIAA, and any point within the treated area is within 60 meters of sagebrush habitat with 10% or greater canopy cover. Treatments to enhance sagebrush/grassland will be evaluated based upon the existing habitat quality and the functional level post-treatment.

9. **Monitoring/adaptive response**: For all activities allowed in Core Areas, sage-grouse monitoring will be conducted to evaluate the response of the affected populations (PIAA identified leks) to the permitted activity. Monitoring plans will be coordinated and modified by the permitting agency with input from WGFD. Monitoring will include the evaluation of affected leks and at least three reference leks (one control area) outside the PIAA. If declines in affected leks (using a three-year running average during any five-year period relative to trends on reference leks) are determined to be caused by the project, the operator will propose adaptive management responses to increase the number of birds. If the operator cannot demonstrate a restoration of bird numbers to baseline levels (established by pre-disturbance surveys, reference surveys and taking into account regional and statewide trends) within three years, operations will cease until such numbers are achieved.

10. **Reclamation:** Reclamation should re-establish native grasses, forbs and shrubs during interim and final reclamation to achieve cover, species composition, and life form diversity commensurate with the surrounding plant community or desired ecological condition to benefit sage-grouse and replace or enhance sage-grouse habitat to the degree that environmental conditions allow. Seed mixes should include two native forbs and two native grasses with at least one bunchgrass species. Where sagebrush establishment is prescribed, establishment is defined as meeting the standard prescribed in the individual reclamation plan. Landowners should be consulted on desired plant mix on private lands. The operator is required to control noxious and invasive weed species, including cheatgrass. Rollover credit, if needed, will be outlined in the individual project reclamation plan.

    Credit may be given for completion of habitat enhancements on bond released or other minimally functional habitat when detailed in a plan. These habitat enhancements may be used as credit for reclamation that is slow to establish in order to maintain the disturbance cap or to improve nearby sage-grouse habitat.

11. **Existing Activities**: Areas already disturbed or approved for development within Core Areas prior to Executive Order 2008-02 are not subject to new sage-grouse stipulations with the exception existing operations may not initiate activities resulting in new surface occupancy within 0.6 mile of the perimeter of a sage-grouse lek. Any existing disturbance will be counted

toward the calculated disturbance cap for a new proposed activity. The level of disturbance for existing activity and rollover credit may exceed 5%.

12. **Exceptions:** Any exceptions to these general or specific stipulations will be considered on a case by case basis and must show that the exception will not cause declines in sage-grouse populations.

SPECIFIC STIPULATIONS (To be applied in addition to general stipulations)

1. **Oil and Gas:** Well pad densities not to exceed an average of one pad per square mile (640 acres) and suitable habitat disturbed not to exceed 5% of suitable habitat within the PIAA. As an example, the number of well pads within a two mile radius of the perimeter of an occupied sage-grouse lek should not exceed 11, distributed preferably in a clumped pattern in one general direction from the lek.

2. **Mining**

    a. For development drilling or ore body delineation drilled on tight centers, (approximately 100'X100') the disturbance area will be delineated by the external limits of the development area. Assuming a widely-spaced disturbance pattern, the actual footprint will be considered the disturbance area.

    b. Monitoring results will be reported annually in the mine permit annual report and to WGFD. Pre-disturbance surveys will be conducted as required by the appropriate regulatory agency.

    c. The number of active mining development areas (e.g., operating equipment and significant human activity) are not to exceed an average of one site per square mile (640 acres) within the PIAA.

    d. Surface disturbance and surface occupancy stipulations will be waived within the Core Area when implementing underground mining practices that are necessary to protect the health, welfare, and safety of miners, mine employees, contractors and the general public. The mining practices include but are not limited to bore holes or shafts necessary to: 1) provide adequate oxygen to an underground mine; 2) supply inert gases or other substances to prevent, treat, or suppress combustion or mine fires; 3) inject mine roof stabilizing substances;

and 4) remove methane from mining areas. Any surface disturbance or surface occupancy necessary to access the sites to implement these mining practices will also be exempt from any stipulation.

e. Coal mining operations will be allowed to continue under the regulatory and permit-specific terms and conditions authorized under the federal Surface Mining Control and Reclamation Act.

3. **Connectivity**:

    a. The suspension of federal and state leases in connectivity corridors is encouraged where there is mutual agreement by the leasing agency and the operator. These suspensions should be allowed until additional information clarifies their need. Where suspensions cannot be accommodated, disturbance should be limited to more than 5% (up to 32 acres) per 640 acres of suitable sage-grouse habitat within connectivity corridors.

    b. For protection of connectivity corridors, a controlled surface use (CSU) buffer of 0.6 miles around leks or their documented perimeters is required. In addition, a March 15 – June 30 timing limitation stipulation is required within nesting habitat within 4 miles of leks.

4. **Process Deviation or Undefined Activities**: Development proposals incorporating less restrictive stipulations or development that is not covered by these stipulations may be considered depending on site-specific circumstances and the proponent must have data demonstrating that the alternative development proposal will not cause declines in sage-grouse populations in the core area. Proposals to deviate from standard stipulations will be considered by a team including WGFD and the appropriate land management and permitting agencies, with input from the U.S. Fish and Wildlife Service. Project proponents need to demonstrate that the project development would meet at least one of the following conditions:

    a. No suitable habitat is present in one contiguous block of land that includes at least a 0.6-mile buffer between the project area and suitable habitat;

    b. No sage-grouse use occurs in one contiguous block of land that includes at least a 0.6 mile buffer between the project area and adjacent occupied habitat, as documented by total absence of sage-grouse droppings and an absence of sage-grouse activity for the previous ten years;

c. Provision of a development/mitigation plan that has been implemented and demonstrated by previous research not to cause declines in sage-grouse populations. The demonstration must be based on monitoring data collected and analyzed with accepted scientific based techniques.

5. **Wind Development:** Wind development is not recommended in sage-grouse core areas.

Appendix 1
Suitable Sage-Grouse Habitat Definition

Sage-grouse require somewhat different seasonal habitats distributed over large areas to complete their life cycle. All of these habitats consist of, are associated with, or are immediately adjacent to, sagebrush. If sage-grouse seasonal habitat use maps do not exist for the project site the following description of suitable habitat should be used to determine areas of unsuitable sage grouse habitat for development siting purposes. An abbreviated description of a complex system cannot incorporate all aspects of, or exceptions to, what habitats a local sage-grouse population may or may not utilize. The references provided below will assist where more detailed site evaluations are required.

Suitable sage-grouse habitat (nesting, breeding, brood-rearing, or winter) is within the mapped occupied range of sage-grouse, and:

1) has 5% or greater sagebrush canopy cover as measured by the technique developed by interagency efforts. "Sagebrush" includes all species and sub-species of the genus Artemisia except the mat-forming sub-shrub species: frigida (fringed) and pedatifida (birdfoot); or
2) is riparian, wet meadow (native or introduced) or areas of alfalfa or other suitable forbs (brood rearing habitat) within 60 meters of sagebrush habitat with 10% or greater canopy cover and the early brood rearing habitat does not exceed 20% of the suitable sagebrush habitat present within the PIAA, Larger riparian/wet meadow, and grass/forb producing areas may be considered suitable habitat as determined on a case by case basis; or
3) is a burned or treated sagebrush site being managed to return to its ecological site potential via succession that will allow it to meet a minimum 5% sagebrush canopy cover within 10 to 15 years.

To evaluate the 5% disturbance cap per average 640 acres or PIAA, suitable habitat is considered disturbed when it is removed and unavailable for immediate sage-grouse use.

a. Long-term removal occurs when habitat is physically removed through activities that replace suitable habitat with long term occupancy of unsuitable habitat such as a road, well pad or active mine.
b. Short–term removal occurs when vegetation is removed in small areas, but restored to suitable habitat within a few years of disturbance, such as a successfully reclaimed pipeline, or successfully reclaimed drill hole or pit.
c. Suitable habitat rendered unusable due to numerous anthropogenic disturbances less than 1.2 miles apart that preclude use by sage-grouse.

ATTACHMENT C

Existing Land Uses and Landowner Activities in Greater Sage-Grouse Core Population Areas That Do Not Require State Agency Review for Consistency With Executive Order No. 2010-4

1. Existing animal husbandry practices (including branding, docking, herding, trailing, etc).

2. Existing farming practices (excluding conversion of sagebrush/grassland to agricultural lands).

3. Existing grazing operations that utilize recognized rangeland management practices (allotment management plans, NRCS grazing plans, prescribed grazing plans, etc).

4. Construction of agricultural reservoirs capable of storing less than 20 acre-feet and drilling of agricultural and residential water wells (including installation of tanks, water windmills and solar water pumps) more than 0.6 miles from leks. Within 0.6 miles from leks no review is required if construction does not occur March 15 to June 30 and construction does not occur on the lek. All water tanks shall have escape ramps.

5. Agricultural and residential electrical distribution lines more than 0.6 miles from leks. Within 0.6 miles from leks no review is required if construction does not occur March 15 to June 30 and construction does not occur on the lek. Raptor perching deterrents shall be installed on all poles within 0.6 miles from leks.

6. Agricultural water pipelines if construction activities are more than 0.6 miles from leks. Within 0.6 miles from leks no review is required if construction does not occur March 15 to June 30 and construction is reclaimed.

7. New fencing more than 0.60 miles from leks and maintenance on existing fence. For new fencing within 0.60 miles of leks, fences with documented high potential for strikes should be marked.

8. Irrigation (excluding the conversion of sagebrush/grassland to new irrigated lands).

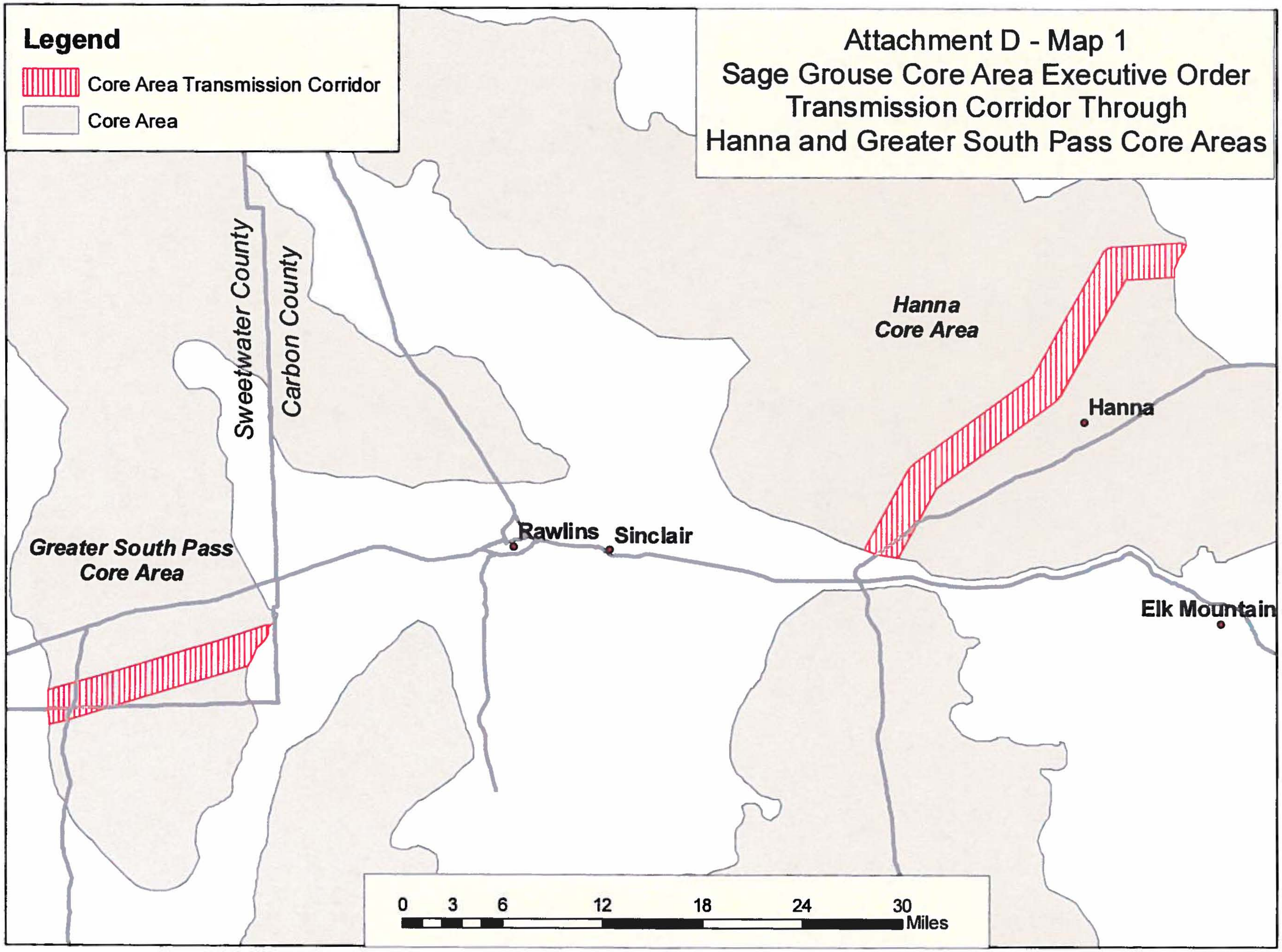
9. Spring development if the spring is protected with fencing and enough water remains at the site to provide mesic (wet) vegetation.

10. Herbicide use within existing road, pipeline and power line rights-of-way. Herbicides application using spot treatment. Grasshopper/Mormon cricket control following Reduced Agent-Area Treatments (RAATS) protocol.

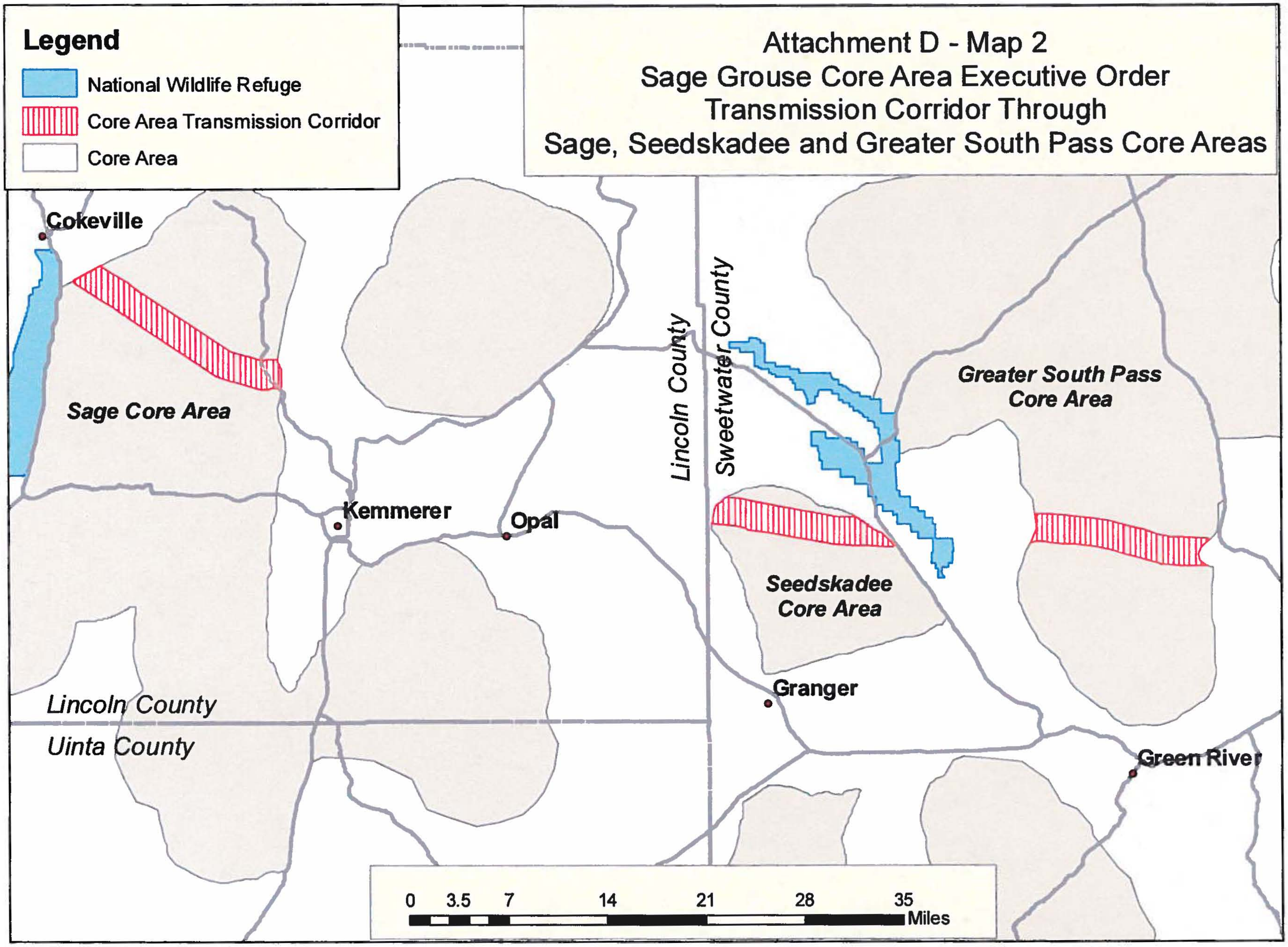
11. Existing county road maintenance.

12. Cultural resource pedestrian surveys.

13. Emergency response.



Attachment D - Map 1
Sage Grouse Core Area Executive Order Transmission Corridor Through Hanna and Greater South Pass Core Areas



Attachment D - Map 2
Sage Grouse Core Area Executive Order
Transmission Corridor Through
Sage, Seedskadee and Greater South Pass Core Areas

Appendix 8A
Legal Entities

Source: Wyoming State Engineer's Office

IRRIGATION DISTRICTS:

This entity is covered in Chapter 7 of Title 41 of the Wyoming Statutes (W.S. 41-7-101 through 1006). An irrigation district is created by a petition to the district court. The lands to be included in the district must be defined and the state engineer is included in the approval process. With existing ditch system, the state engineer approval is usually a mylar map showing the district boundaries and detailing all of the water rights within the district boundaries.

- An irrigation district is a subdivision *of* the state and as such is capable o£ contracting with the Water Development Commission for funds.

- The district is split into commissioner districts. A commissioner is elected from each district and function to direct the operation *of* the district.

- All actions of the District must be approved by the district court.

- For all non-federal districts, after approval *of* assessment schedule by the district court, the assessments are collected by the county and forwarded to the district for their operation.

- The District can define their operations through the establishment *of* by-laws.

- District can act on behalf *of* the landowners in water right matters.

- Wyoming Statute 41-7-210 lists a number *of* powers for an irrigation district as follows:
    - To sue and be sued;
    - To adopt and use a corporate seal; .To have perpetual succession;
    - To file on and acquire the right to use of water for domestic and irrigation purposes; to acquire sites for reservoirs, and rights *of* way for ditches, canals and laterals;
    - To exercise the power *of* eminent domain under chapter 316 (C.S. 1920), and all acts or parts *of* acts amendatory thereto;
    - To contract with the state of Wyoming for the reclamation and segregation of public lands pursuant to the laws of the United States and the state of Wyoming and to contract for the sale of water rights by it acquired pursuant to said laws, and to purchase and acquire state lands;
    - To acquire by purchase or otherwise irrigation works, water rights, land and other property and to sell, lease or otherwise dispose of the same, to buy, develop, sell and distribute electrical energy as an incident to the ownership, control and operation of irrigation works of the district or the cooperative works of

Source: Wyoming State Engineer's Office

the district and the United States as the district may deem expedient or suitable for the development of the district.

- Irrigation districts formed under Wyoming Statute 41-7-201 through 210 are exempt from sale tax (Wyoming Statute 39-6- 405) .

- The District must advertise for bids on work which will exceed $7,500.

Source: Wyoming State Engineer's Office

WATERSHED IMPROVEMENT DISTRICTS:

This district is formed under Chapter 8, Title 41 of the Wyoming Statutes.

- District can receive grants and loans from the Water Development Commission.
- District for the prevention and control of erosion, floodwater and sediment damages.
- District may be formed as a subdistrict of conservation districts.
- The land area of a district must lie within the same or adjoining watershed or sub-watershed areas.
- Formed by filing a petition with the board of supervisors of the conservation district.
- District formed by referendum vote after board of supervisors holds a public hearing.
- Board of supervisors holds election for board of directors who will be the governing body for the watershed improvement district.
- Main powers listed in Wyoming Statute 41-8-113:
  - Levy and collect assessments for special benefits accruing to lands
  - Acquire by purchase, exchange, lease, gift, grant, bequest, devise, or otherwise, any property, real or personal, or rights or interests therein; maintain, administer, and improve any such property; and sell, lease, or otherwise dispose of any such property in furtherance of the purposes and provisions of this act;
  - Exercise the power of eminent domain and in the manner provided by law for the condemnation of private property for public use;
  - Construct, improve, operate and contract for the maintenance of such structures as may be necessary for the performance of any authorized function of the watershed improvement district;
  - Borrow such money as is necessary to carry out any of the purposes and provisions of this act, and issue, negotiate, sell its bonds or other evidence of indebtedness as provided in section 14[41-8-114];
  - Cooperate with, and receive from or grant assistance to, towns, cities, counties, and state and federal agencies in carrying out the purposes and provisions of the act.

Source: Wyoming State Engineer's Office

WATER CONSERVANCY DISTRICTS:

These districts are formed under Article 7, Chapter 3 of Title 41 of the Wyoming Statutes. The District is to provide for the conservation of water resources of the state of Wyoming and for the greatest beneficial use of water within this state.

- The organization of water conservancy districts and the construction of works as herein defined by such districts are a public use and will:
  - Be essentially for the public benefit and advantage of the people of the state of Wyoming;
  - Indirectly benefit all industries of the state;
  - Indirectly benefit the state of Wyoming in the increase of its taxable property valuation;
  - Directly benefit municipalities by providing adequate supplies of water for domestic use;
  - Directly benefit lands to be irrigated or drained from works to be constructed;
  - Directly benefit lands now under irrigation by stabilizing the flow of water in streams and by increasing flow and return flow of water to such streams;
  - Promote the comfort, safety and welfare of the people of the, state of Wyoming, and it is therefore declared to be the policy of the state of Wyoming:
    - To control, make use of and apply to beneficial use all unappropriated water in this state to a direct and supplemental use of such water for domestic, transportation, industrial, manufacturing, irrigation, power, recreation and other beneficial uses;
    - To obtain from water in Wyoming the highest duty for domestic uses and irrigation of lands in Wyoming within the terms of interstate compacts;
    - To cooperate with the United States under the federal reclamation laws now existing, or hereafter enacted, and agencies of the state of Wyoming for the construction and financing of works in the state of Wyoming as herein defined and for the operation and maintenance thereof;
    - To promote the greater prosperity and general welfare of the people of the state of Wyoming by encouraging the organization of water conservancy districts.

- A water conservancy district is formed by petition to the district court.

- The district court must hold a hearing on the formation of the district and the state engineer shall become an interested party in all court proceedings.

Source: Wyoming State Engineer's Office

- Subdistricts may be formed upon petition of the district court.

- District controlled by a board of directors.

- General powers:
    - To have perpetual succession;
    - To obtain or dispose of water, water works, water rights and sources of water supply; to acquire construct or operate, control and use any and all works, facilities and means necessary or convenient to the exercise of its powers.
    - To have and to exercise the power of eminent domain.
    - To construct and maintain works and establish and maintain facilities and obtain the necessary rights-of-ways for same.
    - To contract with the United States or any agency thereof , or with an agency of the state of Wyoming
    - To list in separate ownership the lands within the district which are susceptible of irrigation from district sources and to make an allotment of water to all such lands; to levy assessments.
    - To fix rates at which water not allotted to lands shall be sold, leased or otherwise disposed of.
    - To enter into contracts, employ and retain personal services and employ laborers; to create, establish and maintain such offices and positions as shall be necessary and convenient for the transaction of business of the district; and to elect, appoint and employ such officers, attorneys, agents and employees therefore as shall be found by the board to be necessary.
    - To adopt plans and specifications for the works for which the district was organized.
    - To appropriate and otherwise acquire water and water rights within or without the state for use within the district.
    - To invest any surplus money in the district treasury .To adopt rules and regulations for investing funds. .To incur bonded indebtedness and to borrow money. .To adopt by-laws.

- The district is capable of contracting with the Water Development Commission for funds.

Districts	**Authority**	**Purpose**	**Formation**	**Structure**	**Authorities**	**Funding**
Watershed Improvement Districts	WS 41-8-101 through 41-8-126	Provide for the prevention and control of erosion, floodwater and sedimentation damages, ag uses, and the storage, conservation development, utilization and disposal of water, preserve and protect land and water resources	-Petition to the Conservation District Board of Supervisors. -Hearing and referendum held. - A majority of votes representing the majority of acreage must be obtained to form the district.	-5 member board elected by electors and landowners within the district -Board members Must be landowners within the district -Annually elected on staggered terms	-Levy and collect assessments -Acquire, maintain, and dispose of property -Have power of eminent domain -Construct structures -Borrow money -Cooperate with towns, cities, counties, state and federal agencies	-Levy taxes - Obtain grants and receive gifts -Issue Bonds

Source: Wyoming Assoc. of Conservation Districts

ATTACHMENT G

Districts	Authority	Purpose	Formation	Structure	Authorities	Funding
Irrigation Districts	WS 41-7-101 through 41-7-1006	Provide irrigation; improve the existing water supply; or purchase, extend, operate, or maintain constructed irrigation works; or to cooperate with the United States under the federal reclamation laws.	-Petition to the County District Court -Majority of private landowners embracing the majority of the land must sign petition to be valid. -Hearings are held by the court -Court makes the final decision to form district	-3 or 5 commissioners appointed by the court and at all times under the direction of the court. -After original appointments, commissioners are elected by landowners within the district. -Staggered terms -Landowners may cast 1 vote per irrigable acre.	-Established and have the powers of a corporation -Own, operate, maintain, construct, improve, or purchase any irrigation works. -Powers of eminent domain -Acquire water rights. -Court can levy assessments to be enforced by commissioners. -Perpetual succession -Undertake hydroelectric power projects	-Levy assessments -Obtain grants and receive gifts -Issue interest bearing warrants

Source: Wyoming Assoc. of Conservation Districts

Districts	**Authority**	**Purpose**	**Formation**	**Structure**	**Authorities**	**Funding**
Water Conservancy Districts	WS 41-3-701 through 41-3-779	Provide for the conservation of water resources; provide adequate municipal water supplies; benefit irrigation by stabilizing the flow of water in streams by increasing stream flows; to control, make use of and apply to beneficial use of all unappropriated water; promote the comfort, safety and welfare of Wyoming citizens	-Petition filed with the clerk of District court -Petition signed by at least 25% of the owners on not less than 25% of irrigated land. -Bond filed with petition to cover formation costs. -Hearing held by the District court or judge -State Engineer becomes an interested party -District court determines if district is feasible -District becomes a corporation	-District court appoints a board of directors consisting of not less than 5 or more than 9 -Board members must be landowners within the proposed district. -Staggered terms -After the initial appointment, directors are then elected by landowners within the district -Subdistricts can be formed	-Perpetual succession -Hold water rights; own and control water works and sources of supply; own real and personal property - Power of eminent domain -Construct and maintain water works -Enter into maintenance contracts with the state -Allocate water within the district -Sell or lease water -Acquire water rights -Borrow money -Invest money	-Levy and collect taxes -Issue bonds -Obtain grants and receive gifts

Source: Wyoming Assoc. of Conservation Districts