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FINAL REPORT
for
UPPER NORTH PLATTE RIVER
WATERSHED STUDY, LEVEL I

Prepared for:

Wyoming Water Development Commission
6920 Yellowtail Road
Cheyenne, WY 82002

Prepared by:

Anderson Consulting Engineers, Inc.
375 E. Horsetooth Road, Bldg. 5
Fort Collins, CO 80525
(ACE Project No. WYWDC36)

December 11, 2015

Anderson Consulting Engineers, Inc.
Civil • Water Resources • Environmental

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I. INTRODUCTION AND OVERVIEW

I. INTRODUCTION AND OVERVIEW

1.1 Introduction

In 2013 the Saratoga Encampment Rawlins Conservation District (SERCD) requested funding from the Wyoming Water Development Commission (WWDC) for the completion of a watershed management plan for the Upper North Platte River watershed. The intent of the funding request was to have a comprehensive watershed inventory completed which identified issues related to land use and water resources and to then develop a plan addressing those issues. The WWDC approved funding for the project and Anderson Consulting Engineers, Inc. (ACE) was ultimately contracted in June, 2014 to complete the project.

The project study area is generally defined as the subbasin of the Upper North Platte River delineated by the boundaries of the North Platte River Watershed (HUC 10180002) and the Pathfinder Seminoe Watershed (HUC 10180002) eight order Hydrologic Units as defined by the United States Geologic Survey. However, because the Medicine Bow River Watershed Study was being completed simultaneously and also funded by the WWWDC, the northern portion of the study area was adjusted to coincide roughly with the participating and sponsoring conservation districts. Figure 1.1-1 shows the general location of the watershed within the State of Wyoming.

1.2 Project Overview

The term “watershed” may have been best defined by John Wesley Powell, scientist geographer, when he said that a watershed is:

> *"that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community."*

The State of Wyoming recognizes the benefits of basin planning efforts on the basis of watershed areas which do not necessarily adhere to political boundaries such as counties or states. In an article entitled “Conservation and Watershed Studies. What's the Connection?” which appeared in the WWDC’s *Water Planning News* Fall 2009 newsletter (Wyoming Water Development Commission, 2009), a watershed study is described as follows:

> *“Today, conservation by watershed is an old concept with new horizons. Watersheds have long been recognized in the western United States for their significant natural resources and the interrelationships found contained in land areas connected by stream systems. These relationships were recognized by John Wesley Powell from his early expeditions of the west and resulted in proposed conservation, low density open grazing, irrigation systems and state boundaries based on watershed areas.*

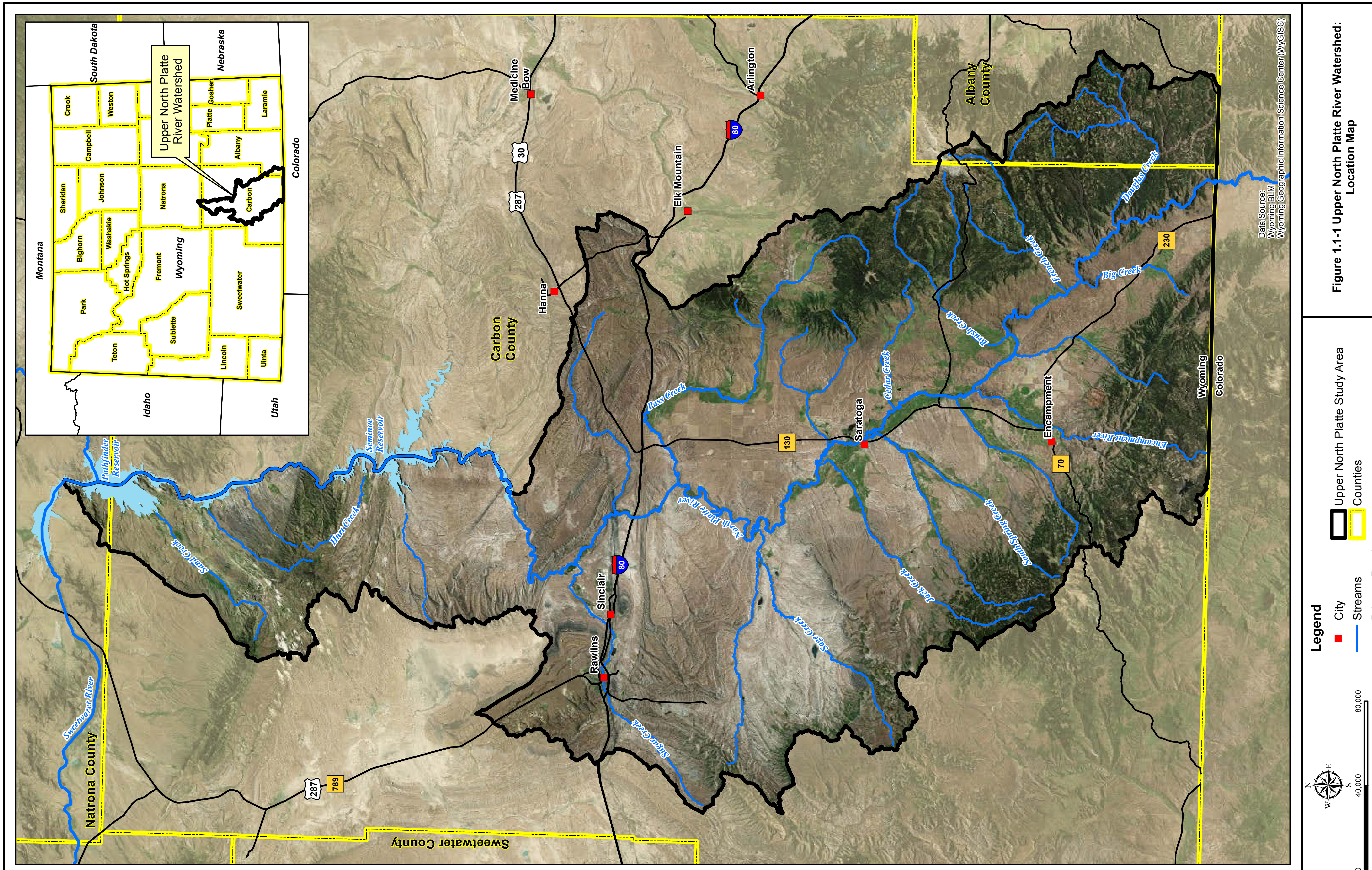


Figure 1.1-1 Upper North Platte River Watershed: Location Map

The conservation concept developed over time to coalesce in the early 1930's with the formation of special districts whose boundaries were often based on watersheds. At that time the relationship between stream systems and landscape function was recognized. This relationship was broadened to embrace watershed condition and quality and its response to human influences. This further provided some understanding of the historic land use effect on watershed condition and how management and restoration needs to be based on local landscape characteristics.

Today, these relationships are embraced by the Wyoming Water Development Commission and Office through a watershed study program. On behalf of a local community sponsor, a watershed study can provide a comprehensive evaluation, analysis and description of the resources associated with a watershed and the watershed's water development opportunities. It is best stated that information related to the physical sciences is incorporated into a biological system.

There are three prominent issues that are important considerations in a watershed information review and study. The first is surface water storage. Surface water storage is often of significant interest to a watershed community in order to address seasonal and/or annual shortages of water supply, augment late season stream flow to benefit riparian habitat, fisheries and wildlife, address flood impacts, enhance recreation opportunities, improve water quality and steam channel stability.

Second is the evaluation of irrigation infrastructure and development of information necessary to guide its rehabilitation and conservation. Of interest to local water users are ways to improve water delivery and on-farm irrigation efficiencies often timed to address annual or seasonal shortages of water supply or irrigation water delivery issues.

Third is the enhancement of upland water resources and distribution for livestock and wildlife that allows grazing management adjustments for range resource improvement. Benefits to the watershed, through plant community invigoration, reduction of erosion and stream channel stabilization, can be achieved from water development projects being strategically implemented over the watershed. Other issues and opportunities such as making beneficial use of produced water and removal of high water demand invasive species can also be important.

A watershed study, providing management and rehabilitation plans for water storage, irrigation systems and upland water development, can help empower a community to proactively enhance their watershed. Conservation by watershed can be an effective holistic approach to embracing the natural resource challenges and opportunities facing a community. A watershed study can provide the information to meet those challenges."

The Upper North Platte River Watershed Study is one of several watershed planning studies completed on behalf of the WWDC and the Wyoming Water Development Office (WWDO). Watershed investigations either completed or in the process of being completed include the following:

Prairie Dog Creek Watershed Study	Clear Creek Watershed Study
Popo Agie River Watershed Study	Kirby Creek Watershed Study
Cottonwood Creek / Grass Creek Watershed Study	Shell Valley Watershed Study
Sweetwater River Watershed Study	Thunder Basin Watershed Study
Buffalo Creek Watershed Study	Little Snake River Watershed Study
Middle North Platte River Watershed Study	Upper Green River Watershed Study
Badwater/Poison Creek Watershed Study	Snake River Watershed Study
Medicine Bow River Watershed Study	Upper Laramie River Watershed Study
Middle North Platte – Glendo Watershed Study	Bear River Watershed Study

As a direct result of these efforts, numerous additional studies have been initiated and multiple projects have been constructed.

1.3 Project Issues and Understanding

The study culminates in the delivery of a Watershed Management and Rehabilitation Plan (the Plan). It is the goal and objective of the sponsors and the WWDC to generate a plan that is not only technically sound, but also one that is practical and economically feasible. The formulated plan also includes development of a database to facilitate the planning process and the evaluation/implementation of watershed improvements. In order to accomplish this task, the project sponsors, the WWDC, and the consultant address several key issues, including the following:

- *Utilization of grazing allotments*
- *Water availability*
- *Channel stability/riparian restoration/enhancement*
- *Irrigation system assessment (to promote rehabilitation of existing facilities and provide opportunities for water conservation that would support an increase in water availability)*
- *Public participation and acceptance (intent is to focus on solutions, not compliance issues)*

One of the purposes of this Level I watershed study is to provide the basis upon which the WWDC can make future decisions pertaining to State funding of water development projects. Upon completion of the Level I watershed study, landowners and stakeholders within the geographic boundaries of the project study area become eligible to apply for funding through the WWDC's Small Water Project Program, or SWPP. According to the operating criteria of the SWPP:

> "*The purpose of the Small Water Project Program (SWPP) is to participate with land management agencies and sponsoring entities in providing incentives for improving watershed condition and function. Projects eligible for SWPP grant funding assistance include the construction or rehabilitation of small reservoirs, wells, pipelines and conveyance facilities, springs, solar platforms, irrigation works, windmills and wetland developments. Projects should improve watershed condition and function and provide benefit for wildlife, livestock and the environment.*

Projects may provide improved water quality, riparian habitat, habitat for fish and wildlife and address environmental concerns by providing water supplies to support plant and animal species or serve to improve natural resource conditions".

Small projects are defined as projects where estimated construction of rehabilitation costs, permit procurement, construction engineering and project land procurement are $135,000 or less. Applicants can receive up to $35,000 towards these costs.

Individuals would apply for funding through the SERCD which would serve as the applicant's sponsor. Application deadlines are December 31st of the year for consideration . According to the WWDC's recently revised operating guidelines, project priorities are as follows:

1. Source water development
2. Storage
3. Pipelines, conveyance facilities, solar platforms and windmills
4. Irrigation
5. Environmental

In addition, projects that have completed permitting requirements, certified designs, agency notifications, land procurement and finalized other financial agreements (in other words, "shovel ready" projects) may be considered as a funding priority at the discretion of the WWDC.

During the completion of this level I investigation, efforts were made to meet with as many landowners and stakeholders as possible and to provide assistance defining their individual small water project. These projects are then outlined as components of the Watershed Management Plan.

1.4 Project Purpose and Objectives

The primary goal of this Level I Study is to combine all existing data with data collected and generated from this study to form a comprehensive Watershed Management and Rehabilitation Plan. The purpose and objectives of the project are itemized below:

- *Facilitate consensus building among the Conservation District, landowners and the Wyoming Water Development Commission.*
- *Facilitate public participation.*
- *Conduct an evaluation and description of the Upper North Platte River watershed, including quantity and quality of surface water resources, and riparian/upland conditions.*
- *Inventory and describe Irrigation systems, water storage, and flood control needs present within the watershed.*
- *Conduct a geomorphic assessment of the primary channels within the watershed and identify potential mitigation measures to improve impaired channel reaches.*

- *Conduct an irrigation system inventory and develop a rehabilitation plan for those ditches expressing an interest to participate.*
- *Conduct an evaluation of water storage needs and opportunities to augment water available for livestock and wildlife.*
- *Develop a watershed management plan which identifies problem areas within the watershed and proposes practical economic solutions.*
- *Identify permits, easements, and clearances necessary for plan implementation.*
- *Develop cost estimates for improvements.*
- *Complete an economic Analysis and evaluate alternative sources of funding.*

II. PROJECT MEETINGS

II. PROJECT MEETINGS

2.1 Introduction

An integral part of the Upper North Platte River Watershed Study was the public outreach and involvement effort. Meetings were orchestrated by Anderson Consulting Engineers (ACE) and typically included informal presentations conducted by ACE staff and the Wyoming Water Development Office (WWDO). The objectives of the meetings were to:

- Discuss the purpose, existing data, and available information for the watershed study
- Obtain input and opinions from residents and landowners about the study area
- Identify concerns and answer questions about the area’s water and land resources
- Request participation in the study effort and coordinate inventory activities
- Present initial results and preliminary findings from the watershed study

Ten project meetings were held and included the following:

Date	Meeting	Location
10-Sep-14	Scoping Meeting	Platte River Community Center, Saratoga
27-Jan-15	BAG Meeting Open House	SERCD, Saratoga
14-Apr-15	Open House	SERCD, Saratoga
24-Apr-15	Brush Creek Water User's	Saratoga Town Hall, Saratoga
11-May-15	BAG Meeting	WWDO Office, Cheyenne
12-May-15	Open House	SERCD, Saratoga
3-Jun-15	Open House	SERCD, Saratoga
23-Jul-15	Open House	SERCD, Saratoga

At each of the meetings, ACE representatives were available to discuss the project one on one with landowners/stakeholders and to initiate development of watershed plan alternatives. Presentations summarizing the status of the project and the next steps to be accomplished were also completed. The project GIS was demonstrated when appropriate to keep landowners up to date on the information which would ultimately be incorporated within it. Following each meeting, discussions and question and answer sessions were held.

2.2 Field Trips and "Tailgate Talks"

Field investigations generally occurred in coordination with scheduled meetings for efficiency. Specific field efforts targeted irrigation inventory, upland livestock/wildlife water opportunities, stream channel conditions, hydrologic investigations (including establishment of temporary stream gages), and storage site investigations.

Individual meetings with landowners were scheduled at landowners' residences and properties where discussions focused on land and water resource concerns and issues specific to the landowner. Usually, the landowner gave a tour of the property to the consultant. During these property visits, initial planning and conceptual project designs were discussed for upland livestock/wildlife and irrigation water improvements. These informal interviews, often held spontaneously while in the field, have become dubbed "tailgate talks" and provide valuable insight into the overall assessment of the watershed.

Throughout the watershed study, local ranchers, irrigators, and residents who invited the study team to visit their properties and discuss issues and concerns demonstrated extensive knowledge and valuable insight about the watershed. Because of the willingness of landowners to share information, insight, and direction, the study team was able to incorporate this knowledge and experience into the study and provide a more effective evaluation of the watershed.

III. WATERSHED DESCRIPTION AND INVENTORY

III. WATERSHED DESCRIPTION AND INVENTORY

3.1 Introduction and Purpose

A considerable amount of information exists pertaining to the Upper North Platte River Study Area and its resources. The data spans a wide variety of disciplines and includes basin hydrology, water quality, land use and ownership, geology and soils, and agricultural practices as typical examples. The primary objective of the watershed inventory phase of this project was to accomplish the following objectives:

1. collect, review, and compile pertinent information regarding the study area;
2. collate the data in a single database; and
3. assess the data to characterize the watershed and facilitate identification of existing issues and development of improvements to the watershed.

Throughout the remainder of this chapter, an overview of existing conditions of natural resources found within the study area are discussed. Included are summaries of numerous individual disciplines: vegetation, soils, wildlife, hydrology, ecologic site descriptions, etc. For each discipline, individual maps delineating the character and extent of that watershed attribute were generated within the project GIS. In conjunction with many of the map figures, summary tables have been prepared which tabulate various attributes of the pertinent watershed characteristics.

3.2 Data Collection and Management

3.2.1 Collection of Existing Information

A significant amount of information and pertinent data were available from existing sources at the time this project was initiated. In an effort to collect and incorporate as much of this information as possible, the following sources were either contacted directly or information and documents procured via websites, libraries, or personal contacts:

- U.S. Bureau of Land Management (BLM)
- U.S. Geological Survey (USGS)
- U.S. Department of Agriculture/Natural Resources Conservation Service (NRCS)
- U.S. Department of Agriculture/Farm Service Agency (FSA)
- U.S. Environmental Protection Agency (EPA)
- U.S. Fish and Wildlife Service (FWS)
- U.S. Department of Interior (DOI)
- Wyoming Water Development Commission (WWDC)
- Wyoming Department of Environmental Quality (WDEQ)
- Wyoming Abandoned Mine Land Program (AML)
- Wyoming Game and Fish Department (WGFD)

- Wyoming State Historic Preservation Office (SHPO)
- Wyoming State Engineer's Office (WSEO)
- Wyoming Oil and Gas Conservation Commission (WOGCC)
- Wyoming State Geological Survey (WSGS)
- Wyoming Geographic Information Science Center (WyGISC)
- Wyoming Natural Diversity Database (WYNDD)
- Water Resources Data System (WRDS)
- Carbon County Weed and Pest District
- Carbon County Assessor's Office
- Natrona County Assessor's Office
- Albany County Assessor's Office

3.2.2 Geographic Information System

The results of the data collection efforts were incorporated into a comprehensive Geographic Information System (GIS). A GIS can be thought of as a powerful three- dimensional mapping tool that can be used to evaluate and compare spatial data pertaining to a wide range of topics. Numerous maps can be "stacked" to overlay information; each map, or "theme", incorporates data, or "attributes" pertaining to the theme. For instance, a theme showing the location of irrigation ditches could also include numerical data pertaining to each ditch's irrigated acreage, improvements, problems, etc.

Upper North Platte River watershed GIS was developed with the "clearinghouse" approach in mind. The GIS is intended to incorporate not only the spatial data pertaining to the watershed, but also analytical spreadsheets and documents. Figure 3.2-1 displays this approach graphically. The user can evaluate spatial data with the conventional GIS tools as well as linking to photographs, spreadsheets containing analytical tools and graphical representation of the various data, and the various documents prepared or collected in the course of this investigation.

Spatial data pertaining to the Study Area was collected from a wide range of sources. A significant amount of information was also specifically developed during the course of this investigation. Table 3.2-1 presents a list of the individual themes, maps, and aerial photographs which have been incorporated into the project GIS. All of the map figures presented in this report were prepared within the project GIS and are representative of the information housed within it.

The project GIS was used in the generation of a majority of the figures included in this report. It will be available as a resource for future investigations and a tool for watershed stakeholders to use during pursuit of permits, environmental analyses, mapping projects, etc. GIS software (ArcMap 10.x) is required to view and utilize the data to the maximum of its potential. However, free 'shareware' data viewers (ArcGIS Explorer: http://www.esri.com/software/arcgis/explorer) are available which enable the user limited capabilities to view the data. It must be kept in mind when using the shareware versions of the GIS software that certain data layers symbology will vary from what is presented in this report.

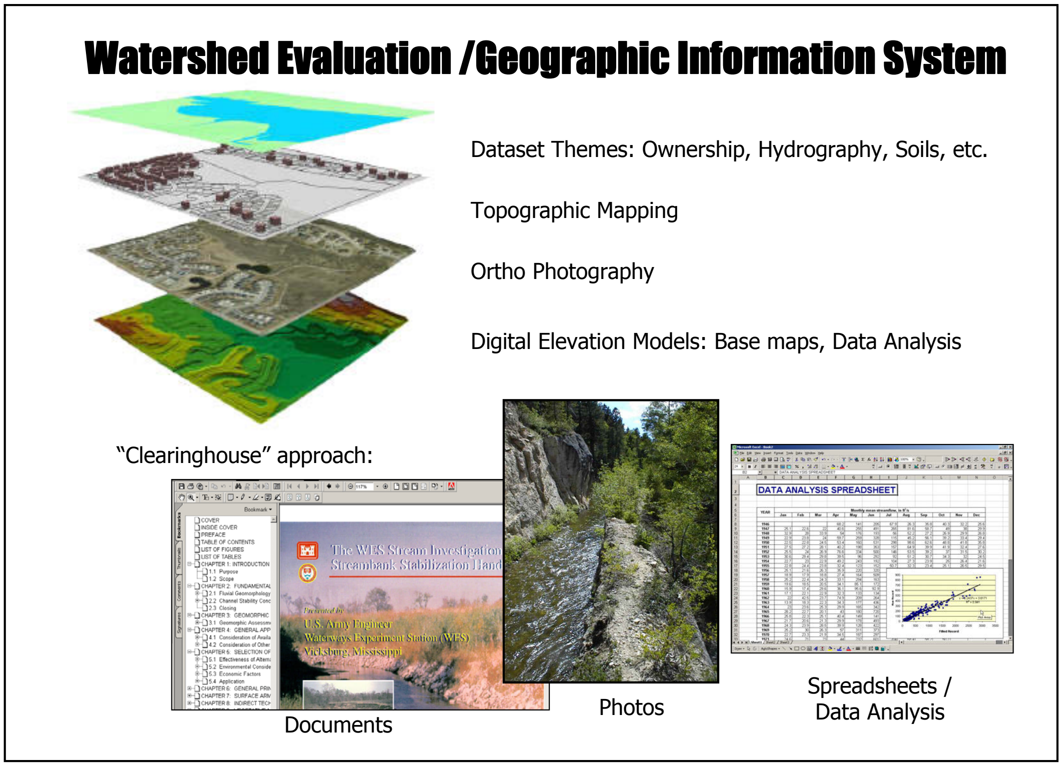


Figure 3.2-1 Example of the Upper North Platte Watershed Study GIS Structure and "Clearinghouse" Capabilities.

The data in the delivered project GIS is stored in an ArcMap 10.2 File Geodatabase. The File Geodatabase format was chosen for a variety of reasons including; optimizing the GIS performance, customizing the data storage structure, and database compactness and portability. The general structure of the geodatabase is pictured below in Figure 3.2-2. Contained within the UNP_Watershed.gdb (file geodatabase) is a series of feature datasets categorized by the agency who supplied the data (BLM, AML). Within each feature dataset are feature classes representing the various geographic data supplied by the agency or developed during the project.

It is also important to note that data presented in the project GIS and within this report are subject to change with time as the agencies creating them continually update their databases. The user is encouraged to obtain the most current data available to meet the needs of future endeavors utilizing the project GIS.

Table 3.2.1 Generalized GIS Contents.

Category	Feature Class	Summary/Description	Category	Feature Class	Summary/Description
Watershed Management Plan	Plan_Component_Locations	General locations of all Plan Component projects related to the Upper North Platte River Watershed Study	Fish and Wildlife	Crucial Stream Corridors	Crucial stream/river corridors for aquatic species - statewide
				WGF_SWAP_2010	Wyoming Fish and Game State Wildlife Action Plan Data
	Plan_Component_Detailed_Points	Detailed locations and descriptions of all proposed projects in the Watershed Management Plan		WY Sagegrouse_current_distribution	Current range of Sage Grouse
				TerrestrialCrucial_hp09	Terrestrial crucial areas - statewide
	Plan_Component_Detailed_Lines	Detailed Proposed Projects Lines		TerrestrialEnhancement_hp09	Terrestrial enhancement areas - statewide
	Plan_Component_Detailed_Poly	Detailed Proposed Projects Polygon		CombEnhancement_hp09	Combined habitat enhancement areas - statewide
Climate	Eco_Site_Precip_Zone	NRCS precipitation zones - statewide		CombCrucial_hp09	Combined habitat crucial areas - statewide
	Observation_Stations	Meterological Stations obtained from the High Plains Regional Climate Center		AquaticCrucial_hp09	Aquatic crucial areas - statewide
	precip_a_wy	Average Annual Precipitation 1971-2000- WY		AquaticEnhancement_hp09	Aquatic enhancement areas - statewide
	Precip_a_co	Average Annual Precipitation 1971-2000- CO		WGFD_blue_ribbon_streams	Blue ribbon streams in Wyoming - Statewide
	US Drought Monitor 2015_06_02	USDA dataset showing general drought conditions countrywide		WHMAs14	Wildlife Habitat Management Areas
Communications	am	AM Radio Tower		USGS-WY Basin Ecoregional Assesment Data	Series of rasters depicting sage grouse roost site probability occurences and general use abundance statistics provided by USGS
	fm	FM Radio Tower		Antelope Habitat Data	Series of datasets showing WGF antelope data (migration barriers, migration routes, parturition areas, crucial range, seasonal range, hunt area/herd units)
	cellular	Cellular Tower		Elk Habitat Data	Series of datasets showing WGF Elk data (migration barriers, migration routes, parturition areas, crucial range, seasonal range, hunt area/herd units)
	lm_comm	Land Mobile Radio Service Antenna- Commercial		Mule Deer Habitat Data	Series of datasets showing WGF Mule Deer data (migration barriers, migration routes, parturition areas, crucial range, seasonal range, hunt area/herd units)
	lm_private	Land Mobile Radio Service Antenna - Private		Moose Habitat Data	Series of datasets showing WGF Moose data (migration barriers, migration routes, parturition areas, crucial range, seasonal range, hunt area/herd units)
	microwave	Microwave Tower		small_upland_gamefb10ma	Small upland game and furbearers management areas
	TV_NTSC	TV (NTSC) Antenna		black_bear14hm	Black Bear Hunt Area / Herd Unit
	asr	Antenna Structure Registration Location		bis08hh	Bison Hunt Area / Herd Unit
Fieldwork	Fieldwork_Pts (Various Dates)	Project data collected during fieldwork (various point features collected)		WYNDD _original	Wyoming Natural Diversity Database query for study area
Infrastructure	Wy_Highways	Major Highways in Wyoming - statewide		KNWA	Key non-game wildlife ares
	WY Roads 100K	Roads 100K scale - statewide	Geology and Soils	Faults	Fault Line - statewide
	Railroads	Railroads - statewide		Landslide_WSGS	Landslide Area - statewide
Energy Development	PA_Wells_3_3_15_UNP	Permanently Abandoned Well Head within the Upper North Platte Watershed Study Area attributed with the well pad revegetation analysis results as of 3/3/15		Dikes	Geologic Dikes - statewide
	CBM_Wells_3_3_15_UNP	CBM Well Heads		ANSS_earthquakes	Advanced National Seismic System earthquake data located within the study area
	Wellheads_3_3_15_UNP	Operative Oil and Gas Wellheads as of 3/3/15		ANF	Earthquake events recorded through the USArray project within the State of Wyoming
	EPCA1_4basins_gross	Rocky Mtn. Basins Oil/Gas Fields (EPA Source)		WSGS100 Years	
	Pipelines_WY_2007	WSGS dataset showing oil/gas pipelines for state of Wyoming		Soils_250K	NRCS 250K Soils Data - statewide
	Power Generation	WSGS dataset showing all electric power generating facilities in Wyoming over 1 megawatt		Natrona_24K_soils	Natrona County 24K Soils data
	wy_transmission	Electric Transmission Corridors		Albany_24K_soils	Albany County 24K Soils data
	WY_WindTurbinesLocations_2012	Wyoming wind turbine locations - statewide		Carbon_24k_soils	Carbon County 24K Soils data
	blm-energy projects	BLM Wyoming NEPA projects 2011 (background image)		Surficial_Geology_500K_WYGISC	Surficial Geology 500K scale -statewide
				Bedrock_Geology_500K_WYGISC	Bedrock Geology 500K scale -statewide
				ESD_UNP	Ecological Site Description classifications for study area

Table 3.2.1 Generalized GIS Contents (continued).

Category	Feature Class	Summary/Description
Geomorphology	Rosgen_Streams_UTM	Rosgen analysis for selected streams within study area
	Geomorphology (pts)	points with linked photos of all Rosgen analyzed streams
	USGS_PFCs_Lotic	Proper Functioning Condition data: flowing water
	USGS_PFCs_Lentic	Proper Functioning Condition data: still water
Grazing	Watersources_Pts	Existing Watersources-ACE compiled. Includes springs from various source, reservoirs and reservoir analysis data
	Watersources_Pts_1_Mile_Buffer	Existing Watersource 1 Mile Buffer
	WaterSource_lines	Compiled file of all pipeline projects in the watershed
	SEO_wells_sep29_2014	WY State Engineers Office groundwater wells
	BLM_Allotment_statewide	Bureau of Land Management Grazing Allotments statewide
	RMU_AUM_2012	Rangeland Management Units for Medicine Bow - Routt National Forests and Thunder Basin National Grassland
Historic and Cultural	shpo_cultural_2015_Statewide	State Historic Preservation Office: Eligible Sites per PLSS Section
	Historic_Forts	Historic Forts locatin in Wyoming
	Monuments_Markers	Historic Monuments and Markers (WY)
	historic_pts_NPS	National Registry of Historic Places (US)
	Pioneer_Trails_Clean	Historic Pioneer Trails (WY)
Hydrology	UNP_streams_UTM	Primary streams of importance in Upper North Platte Watershed Study Area
	NHDStreamGageEvents	water related points for National Hydrography Dataset
	BLM_wtr_pts and lines	BLM supplied water points and pipeline projects (springs, reservoirs, tanks)
	USGS_Stream_Gage_2006	USGS Streamgages Locations with links to online gage data
	WYPDES_all_6-19-2015	WYPDES Outfalls as of 6-19-2015
	DEQ_Stream_Class	Wyoming Department of Environmental Quality Surface Water Classifications
	ephemeral_Statewide	ephemeral streams statewide
	rad_303d_line	EPA 303D Streams
	rad_303d_point	EPA 303d Point
	rad_303d_area	EPA 303d Area
	UNP_Study_area	Upper North Platte River Watershed Study Area
	USGS_Springs_statewide	USGS springs
	Lakes	Lakes in the state of wyoming
	HUC 12_statewide	HUC 12 subwatershed boundaries statewide
	HUC12clip	HUC 12 subwatershed boundaries clipped to study area
	HUC10	HUC 10 watershed boundaries
	HUC_250k	HUC 250K watershed boundaries
	miller_regions	Hydrologic Regions of Wyoming (background image)

Category	Feature Class	Summary/Description
Irrigation	POD	Irrigation Points of Diversion within the state of wyoming
	Irrigation_districts	Irrigation districts within the state of wyoming
	Irrigated Lands	Irrigated Lands within the state of wyoming
Land Cover and Land Class	WLCI Integrated Assessment-HUC6	Wyoming Landscape Conservation Initiative data analysis results by HUC 6 boundaries
	CONUS wetlands polygon	Wetland Polygons for the conterminous United States
	LANDFIRE EVT	LANDFIRE Existing Vegetation Type (Raster)
	gaplndcv6_2y	Wyoming digital landcover data set (Raster)
	WY_Landcover	Wyoming GAP landcover analysis
	EcoRegions_wy	Wyoming Ecoregions (areas with general similarity in ecosystems)
Land Management	NLCD_CLIP2.img	National Landcover Database raster
	WY_BLM_field_office_boundary	Bureau of Land Management Field Office Boundary
	Stateownership_Surface	Public/Private Land Ownership
	Wild Horse Management Areas	Statewide Wild Horse Management Areas
	Warden_districts13	Game warden districts
	Warden_Regions	Game warden regions
	Wilderness_Boundaries	USFS managed Wilderness Areas - statewide
	WSAs	Wilderness Study Areas-BLM statewide
	State_Conservation10	State Conservation Districts
	State_improvement10	State Improvement Districts
Land Surface Ownership	SpecialMgmtAreas	Special Managemnet Areas-Compiled data
	Carbon County Ownership	Carbon County Private Ownership
	Natona County Ownership	Natrona County Private Ownership
Mining	Albany County Ownership	Albany County Private Ownership
	WYOMING_ACTIVE_COAL_PERMIT_BOUNDARIES_FEBRUARY 2015	Active Coal Mines in state of wyoming WyDEQ Data
	WDEQ_LQD_mine_permit_locations	WYDEQ Land Quality Division mine permit locations
	mrds_fUS56_1_29_15	USGS Mineral Resource Data System (MRDS) data query - statewide
	Abandoned Mine Lands datasets	Series of statewide datasets depicting known abandoned mine lands in the state of Wyoming.

Table 3.2.1 Generalized GIS Contents (continued).

Category	Feature Class	Summary/Description	Category	Feature Class	Summary/Description
Boundaries	counties_wygisc	Wyoming County Boudaries	Background Maps and Aerial Photos	Carbon County NAIP Imagery	2012 True color 1m imagery and 2009 Color Infrared 1m Imagery for Lincoln County.
	qqsection	Publlic Land Survey System (PLSS) Qtr/Qtr sections - statewide		Natrona County NAIP Imagery	2012 True color 1m imagery and 2009 Color Infrared 1m Imagery for Sweetwater County.
	section	Publlic Land Survey System (PLSS) Sections - statewide		Albany County NAIP Imagery	2012 True color 1m imagery and 2009 Color Infrared 1m Imagery for Uinta County.
	twnshp	Publlic Land Survey System (PLSS) Township/Range - statewide		USGS_10M DEM	USGS 10M DEM covering the study area
	utm	Universal Transverse Mercator Zones - worldwide		Topographic Maps	Countywide 24K USGS topo maps for Lincoln, Uinta and Sweetwater counties.
	WY_SP_Zones	Wyoming State Plane Coordinate Zones			
	city	Statewide city locations			

Figure 3.2-2 Upper North Platte River Watershed Study Project GIS Geodatabase Structure.

3.2.3 Digital Library

The Digital Library is a collection of documents, plats, maps, figures, spreadsheets, etc., pertaining to the project. Documents reviewed during the completion of this project were scanned and included in the Digital Library to the extent possible. Copyright protected documents were not included in the Library; however documents published by public agencies were included where feasible. The Digital Library consists of a spreadsheet listing the available documents and links to each; it can be searched or sorted depending upon the user's needs. Individual document files can be directly accessed via the Digital Library or directly by "browsing" on any IBM based computer. Documents included in the Digital Library were obtained from the agencies listed in Table 3.2-2, among others.

Table 3.2-2 Selected Sources of Information Included in the Digital Library.

USDI Bureau of Land Management
United States Army Corps of Engineers
United States Environmental Protection Agency
United States Fish and Wildlife Service
USDI United States Geologic Survey
Wyoming Department of Environmental Quality
Wyoming Department of Game and Fish
University of Wyoming
Wyoming Water Development Commission
Wyoming Weed and Pest Council
Wyoming State Engineers Office
Wyoming State Geological Survey
United States Forest Service
Miscellaneous

3.3 Land Uses and Activities

3.3.1 Land Ownership

The total land area within the project study area is approximately 2,037,166 acres (2,037 square miles). Figure 3.3-1 presents a map indicating the various land ownership categories within the watershed. The study area spans three counties: Carbon (which dominates the area), Natrona and Albany Counties. As indicated in Figure 3.3-2, Carbon County comprises the majority of the area (3,025 square miles or 95.1 percent of the study area. Albany County comprises approximately 145.8 square miles (4.6 percent) and Natrona County comprises the remaining 11.6 square miles (0.4 percent).

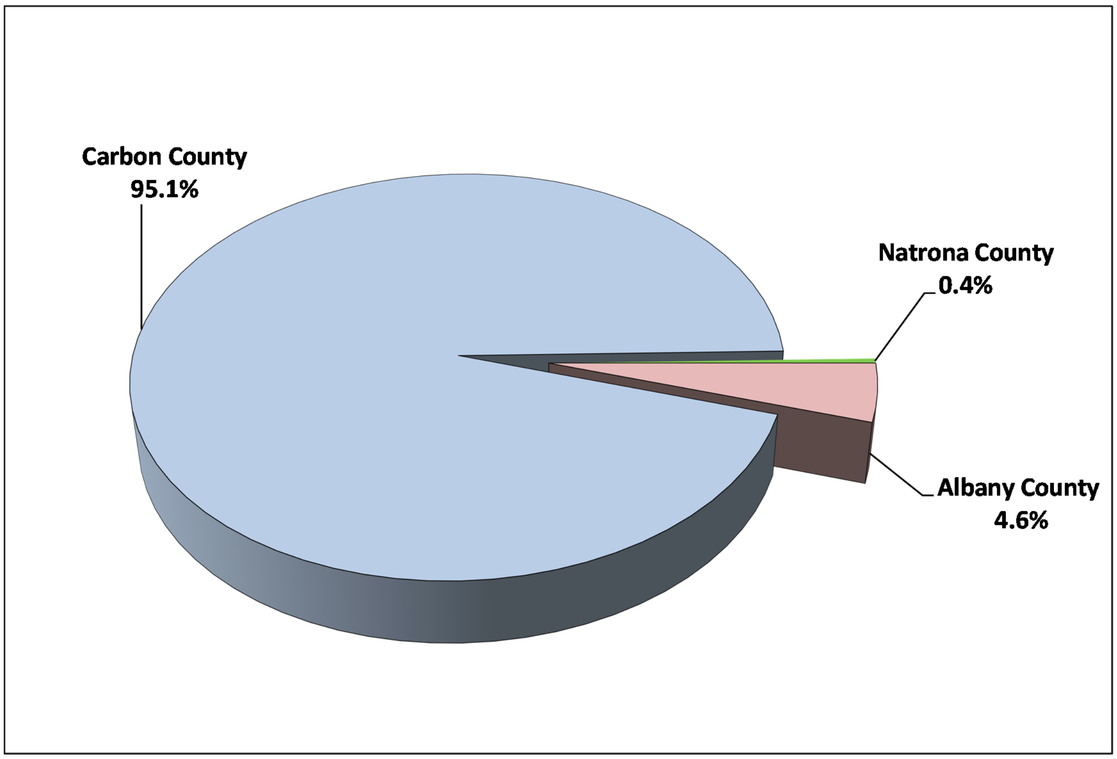


Figure 3.3-2 Distribution of Study Area among Counties.

Land ownership information was obtained from the Bureau of Land Management (BLM) and the assessor's offices of the three counties involved and incorporated into the project GIS. According to this data, Federally owned lands dominate the ownership profile and are tabulated as follows:

- Bureau of Land Management: 938.8 square miles (29.5 percent),
- United States Forest Service: 710.1 square miles (22.3 percent),
- United States Bureau of Reclamation: 36.3 square miles (1.1 percent), and
- United States Fish and Wildlife Service: 3.1 square miles (0.1 percent).

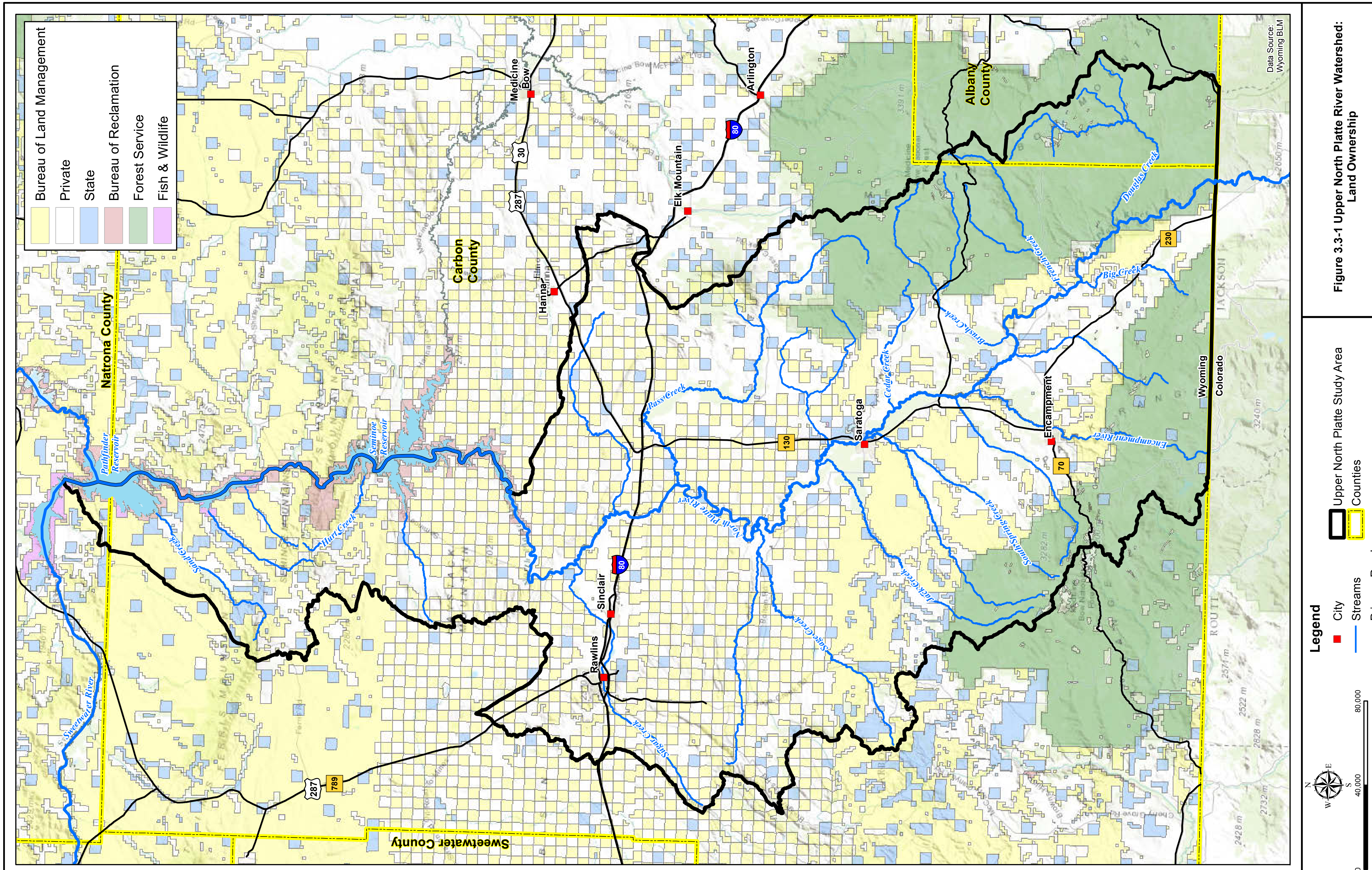


Figure 3.3-1 Upper North Platte River Watershed: Land Ownership

Privately owned lands consist of 1,294.4 square miles (40.7 percent) and 106,318 square miles (5.2 percent) are owned by the State of Wyoming, see Figure 3.3-3.

An extensive portion of the study area is referred to as the "checkerboard" as a result of the landownership pattern of federal and private lands. This pattern is a remnant of the Union Pacific Act of 1862 with which Congress granted every other section (one square mile) of land within ten miles of the railroad to the Union Pacific, which tried to sell it to raise capital for railroad construction. The strip along the railroad was later extended to twenty miles. The premise was that land values would increase following railroad construction and that the railroad company could then sell the land at a profit (BLM, 2014 at www.blm.gov).

Note: The Project GIS includes detailed land ownership information (name, address, etc.) for individual parcels in Carbon, Natrona and Albany Counties. The data were obtained directly from the respective county assessor's offices and reflect ownership status as of the dates of their retrieval (Fall of 2014).

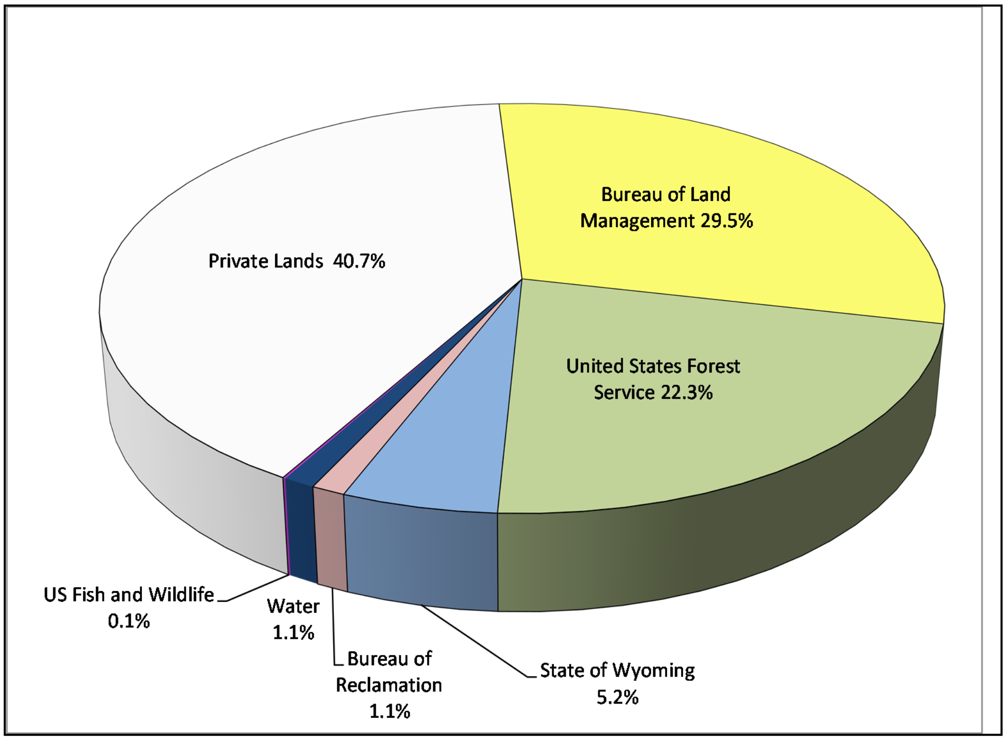


Figure 3.3-3 Distribution of Land Ownership within the Upper North Platte River Study Area.

3.3.2 Transportation, Energy and Communications Infrastructure

Primary paved transportation routes traversing the study area are shown on Figure 3.3-4. Interstate I-80 is the primary east/west transportation route located in the northern portion of the watershed. The watershed is bisected by state route 130 which runs from I80 south to where it splits with state route

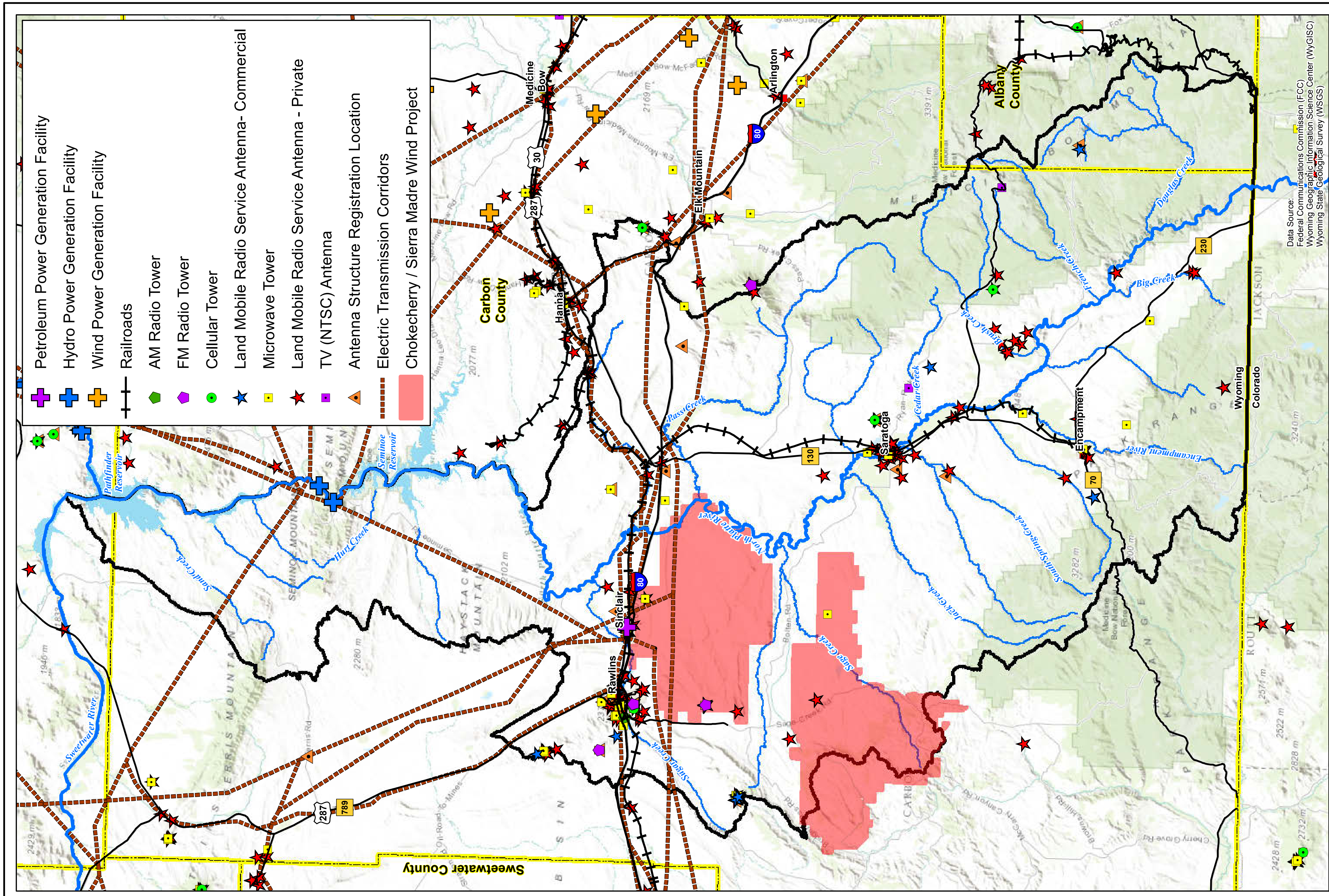


Figure 3.3-4 Upper North Platte River Watershed: Transportation, Energy and Communications Infrastructure

230. At this point 130 heads east over the Medicine Bow Mountains and into Centennial, Wyoming. State route 230 continues southeasterly towards Walden, Colorado. In Encampment state route 70 splits from 230 and continues west over the Park Range and into Baggs, Wyoming.

There are several other improved roads within the watershed but much of the transportation network is made up of unimproved roads of varying quality. Access can be difficult throughout most of the study area during winter or wet conditions. The project GIS contains mapping of unimproved roads in much greater detail than can be displayed at the scale of this figure. The figure also shows the railroad corridors within the watershed. The main active line is the Union Pacific line that runs east/west along the I-80 corridor.

Communications towers are located throughout the watershed, however they are clustered around the population centers of Rawlins and Saratoga.

Power generation facilities within the watershed include two hydro power facilities and one diesel facility. Seminoe and Kortes Dams are two hydro power facilities operated by the Bureau of Reclamation. They both sit on the North Platte River below Seminoe and Kortes Reservoirs respectively. The diesel power facility is located at the Sinclair refinery and it is for internal use only. The planned Chokecherry Sierra Madre Wind Energy Facility when completed will be the largest wind facility in the nation, with a planned 1000 turbines producing 3,000 MW of power. This facility is to be located south of Rawlins and Sinclair in the “checkerboard” area. For more information regarding this project please refer to the Record of Decision (ROD) signed in December of 2014 and other support documents included in the Digital Library delivered with this report.

Several electric transmission corridors are located in the northern portion of the watershed. Mapping of the lines provided by WyGISC is coarse in nature with poor accuracy; presumably for security reasons. Consequently, the lines indicated on Figure 3.3-4 are approximations of alignment only.

3.3.3 Irrigation

Irrigation activities are concentrated primarily in the southern portion of the watershed below I-80, as indicated on Figure 3.3-5. The majority of this irrigated land is located along Jack Creek, Spring Creek, Cow Creek, the Encampment River, Brush Creek, Cedar Creek, Pass Creek, and the North Platte River. Smaller irrigated acreages are located on Big Creek and Lake Creek; however, these are isolated and less extensive than the irrigated areas on the previously mentioned tributaries. Mapping of irrigated acreage within the project study area was obtained from the WWDO basin planning reports for the years 2006 and 2012. Table 3.3-1 tabulates the acreage and changes by subwatershed (HUC10). As indicated in this table, the North Platte River subwatersheds comprise the majority of the irrigated lands within the study area. Of the North Platte River's tributaries, Pass Creek, Spring Creek, and the Encampment River contain the most irrigated lands.

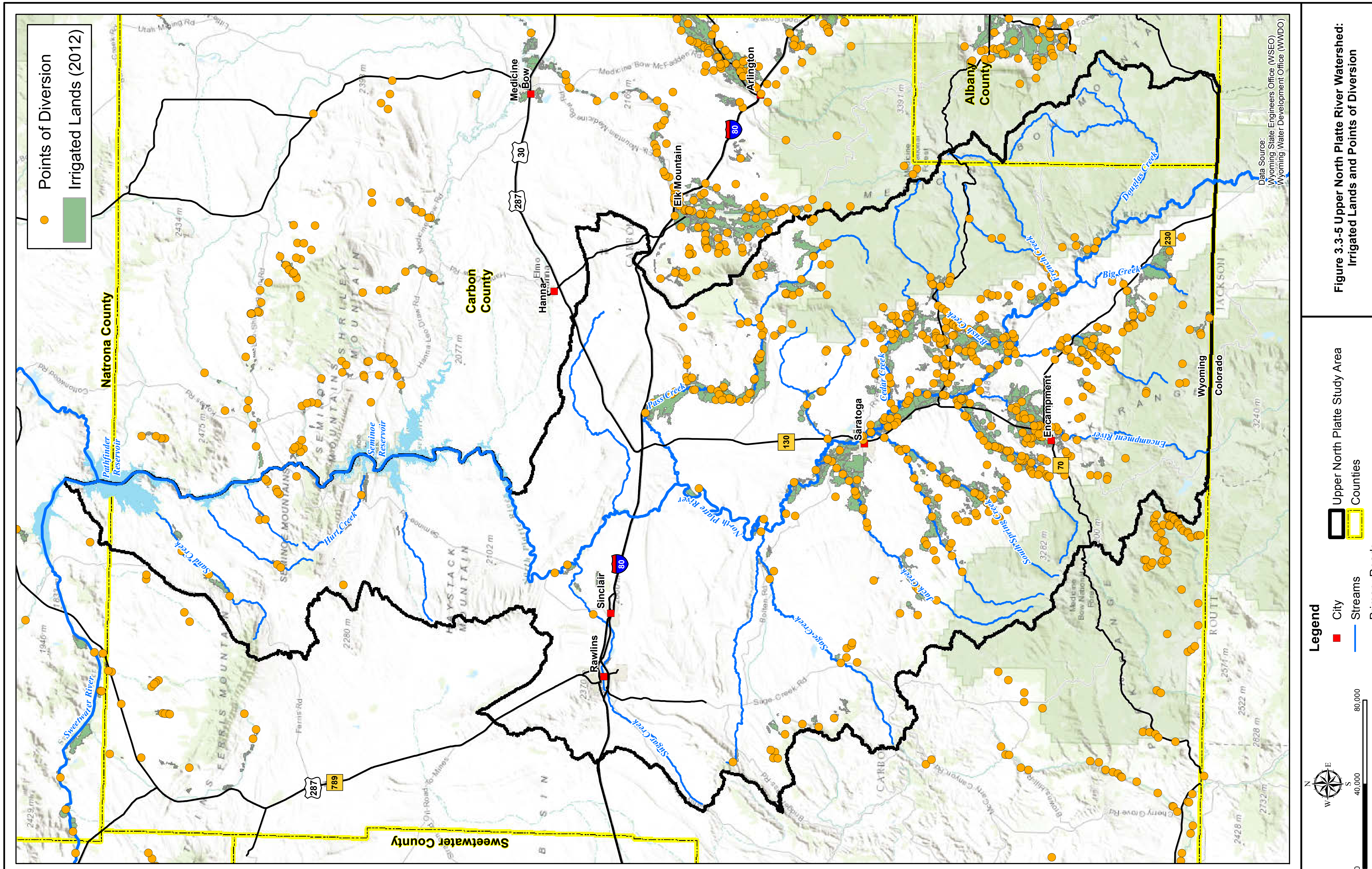


Figure 3.3-5 Upper North Platte River Watershed: Irrigated Lands and Points of Diversion

According to the 2015 Wyoming Irrigation Systems Report, there are no irrigation districts listed above Pathfinder. It is our understanding that formation of a Wagner-Cherokee Ditch District in the vicinity of Encampment is likely. Also, the Highline Watershed Improvement District, which includes lands located east of Saratoga and west of Ryan Park and which is not an irrigation district, is currently in operation. Irrigated pastures and grass hay/alfalfa dominate the irrigated lands usage.

According to WSEO representatives, streams are commonly put into regulation within the project study area; specifically Jack Creek, Pass Creek, Brush Creek, and South Spring Creek. These streams are typically regulated each year. Cooperation among Brush Creek water users has improved the administration of water rights in that area which has resulted in Brush Creek being regulated less frequently.

Table 3.3-1 Irrigated lands in 2012 by Subwatershed.

Watershed (HUC 10)	2006 Points of Diversion per HUC 10	2012 Irrigated Acres
Big Creek	28	4887
Brush Creek	34	3917
Encampment River	55	7579
Jack Creek	19	5494
North Platte River-Cow Creek	138	24875
North Platte River-Douglas Creek	0	0
North Platte River-French Creek	105	8989
North Platte River-Iron Springs Draw	3	508
Pass Creek	70	12749
Pathfinder Reservoir	13	792
Sage Creek	20	1250
Saint Mary's Creek	0	5
Seminoe Reservoir	2	381
Spring Creek	51	7550
Sugar Creek	1	276
Total Irrigated Acreage	539	79252

Typically, the full growing season in the majority of the study area extends from early-May to late September, with the period from mid-July to the end of September defined as late-season when shortages frequently occur. Water supplies are more abundant in April, May and June because of high volumes of snow melt runoff. During these months, water supplies frequently exceed the demand. However, the supply of irrigation water in the basin is substantially reduced during late July, August, and September as snowmelt slows and ceases.

As presented in the North Platte River Basin Plan in a discussion of irrigation practices in the North Platte River watershed upstream of Pathfinder Reservoir (Trihydro, 2006):

> *"according to a 1998 survey, which was completed as part of the Nebraska v. Wyoming litigation process, identified 199 irrigation water right holders in this subbasin. The survey determined that:*
>
> - *a significant portion of irrigation water rights in the subbasin pre-date year 1900;*
> - *most subbasin irrigators use flood irrigation to raise native hay;*
> - *acreages irrigated by permit holders vary widely;*
> - *the subbasin irrigation season for native and mixed grass hay typically begins in early May, depending on snow cover, weather, water availability, and conditions of hay fields;*
> - *the subbasin irrigation season typically ends in early July, based on water availability, the need to allow fields to dry prior to harvest, and the weather; and - most irrigators graze livestock on irrigated land. (Watts, 1998)"*

Based upon evaluation of delineated irrigated acreage provided by the WWDO, there are approximately 107,814 acres within the study area along with 539 points of diversion (PODs). Distribution of PODs is tabulated in Table 3.3-1. Review of aerial photography with respect to the permitted headgate locations indicates that the majority of irrigated acres consist of strips of irrigated pasture within riparian corridors. However there are some larger and more complicated ditch systems that do irrigate more land outside of the riparian corridors.

An historic irrigation supply strategy involving transbasin diversions was to convey water "on-grade" in ditches built along valley side slopes to a point where when released, water would drain into the adjacent drainage. When "released", water would typically drain down steep valley side slopes in an uncontrolled manner forming deep erosional features. General mapping of the transbasin diversions was not readily available at the time this report was prepared.

For example, Figure 3.3-6 displays a photo of the Brush Creek Supply Ditch which conveys water from South Brush Creek to North Brush Creek. This transbasin diversion follows the valley side slope at a low slope and eventually drops irrigation supply down a steep slope before eventually reaching North Brush Creek.

A similar feature existed on the Wiant Ditch within the South Cedar Creek basin. In 2002, design and construction of a pipe drop structure was completed for the Highline Watershed Improvement District with assistance from the WWDC.

Figure 3.3-6 Brush Creek Supply Ditch erosional feature.

The USFS and NRCS representatives presented several additional locations where significant erosional features have formed as a result of similar irrigation conveyance practices, including:

- Kurtz – Chatterton Ditch Diversion
- Billie Creek Diversion
- Brush Creek Supply Diversion

An additional on-going and escalating issue related to the irrigation ditches within the study area is the pine beetle epidemic in the national forest and its related effects on ditch functionality and efficiency. Irrigation ditch maintenance is an expected operating cost for local ditch owners and it is required by the USFS in agreements related to ditches that are located on national forest lands. The pine beetle epidemic has drastically increased the amount of maintenance required for the ditches on forest lands. Within the study area there are approximately 66 miles of ditches that are located Medicine Bow National Forest lands (Figure 3.3-7). As stated in the Medicine Bow-Routt National Forest: 5/10 Year Forest Plan Monitoring Review (2008):

Pine beetle mortality is expected to increase the potential for adverse effects to ditch stability and function. Needle loss from dead trees increases overall debris in ditches. Once the trees start to fall over, the potential for debris dam development increases substantially which can inhibit flows, cause ditch failures through saturation of ditch banks, and overtopping of ditches due to loss of flow capacity. Ditch failures and breaches can significantly affect the soil, water, and aquatic resources through surface erosion and gully development, mass failures, delivery of large quantities of sediment to the stream system, and augmented stream flows to the receiving stream that exceeds the natural stream flow level.

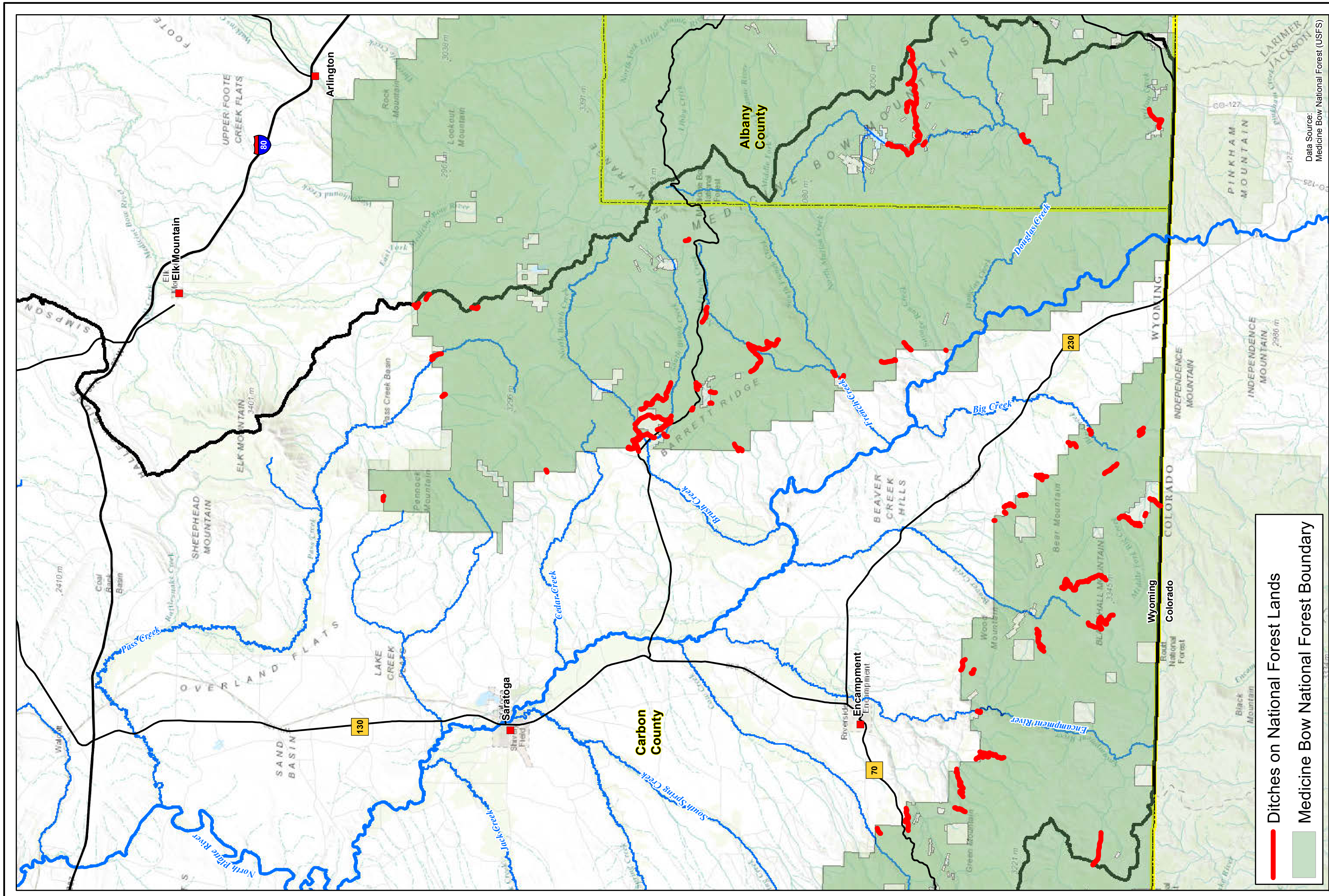


Figure 3.3-7 Upper North Platte River Watershed: Ditches on Medicine Bow National Forest Lands

This pine beetle epidemic will also have effects to the local vegetation and hydrology within the study area. These effects are discussed in Sections 3.4 and 3.5, respectively in this report.

3.3.4 Range Conditions/Grazing Practices

3.3.4.1 Grazing Allotments Administration

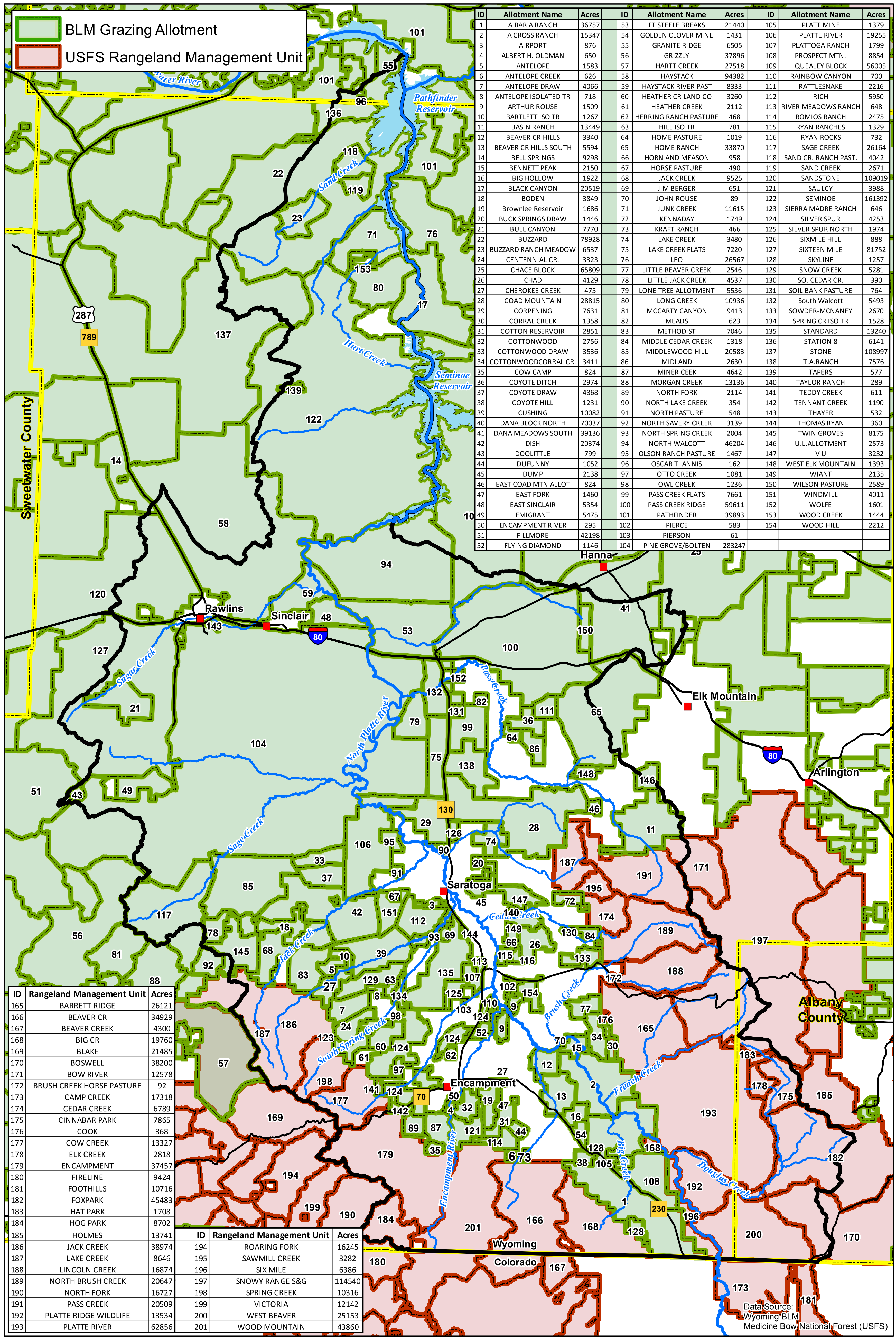
Grazing use in the project area is primarily cattle. Historical use included a greater amount of sheep usage and larger sheep flocks using forest lands would trail through the valley with home ranches in Rawlins, Baggs, and other desert locations. (BLM, 2005).

Grazing on federal lands within the Upper North Platte watershed is administered by the United States Forest Service and the Bureau of Land Management. The USFS-administered allotments (sometimes referred to as rangeland management units or RMUs) are located at higher elevations within the Medicine Bow National Forest surrounding the North Platte River valley in the southern portion of the watershed. There are 37 USFS individual allotments and 154 BLM allotments as indicated in Figure 3.3-8. These allotments consist entirely of federal lands. Note that some of these allotments may be located primarily in adjacent watersheds and "spill" over the watershed divide. Allotment management plans (AMP) are long-term operating plans for grazing allotments on public land prepared and agreed to by the permittee and appropriate agency. Available AMP documents were collected from the managing agencies and linked to the GIS database and also incorporated into the Digital Library delivered with this project.

The BLM-administered allotments are administered by the Rawlins Field Office (Rawlins Resource Management Plan approved in 2008). The Rawlins RMP provides a comprehensive framework for managing and allocating use of public lands and resources administered by the BLM in the Rawlins Field Office.

Under the umbrella of this plan, management of BLM grazing allotments are managed in accordance with the principles of multiple use and sustained yield embodied in the Federal Land Policy and Management Act (1976) and the Taylor Grazing Act (1934). More information describing the BLM's grazing management standards and guidelines can be found online (http://www.blm.gov/wy/st/en/programs/grazing.html). The BLM's grazing management guidelines which are pertinent for this watershed study include the following summaries (BLM, 1997).

- Ensure that conditions after grazing use will support infiltration, maintain soil moisture storage, stabilize soils, release sufficient water to maintain overall system function, and maintain soil permeability rates and other appropriate processes;
- Restore, maintain, or improve riparian plant communities to sustain adequate residual plant cover for sediment capture and groundwater recharge.
- Implement riparian improvements to maintain or enhance stream channel morphology.



ID	Allotment Name	Acres	ID	Allotment Name	Acres	ID	Allotment Name	Acres
1	A BAR A RANCH	36757	53	FT STEELE BREAKS	21440	105	PLATT MINE	1379
2	A CROSS RANCH	15347	54	GOLDEN CLOVER MINE	1431	106	PLATTE RIVER	19255
3	AIRPORT	876	55	GRANITE RIDGE	6505	107	PLATTOGA RANCH	1799
4	ALBERT H. OLDMAN	650	56	GRIZZLY	37896	108	PROSPECT MTN.	8854
5	ANTELOPE	1583	57	HARTT CREEK	27518	109	QUEALEY BLOCK	56005
6	ANTELOPE CREEK	626	58	HAYSTACK	94382	110	RAINBOW CANYON	700
7	ANTELOPE DRAW	4066	59	HAYSTACK RIVER PAST	8333	111	RATTLESNAKE	2216
8	ANTELOPE ISOLATED TR	718	60	HEATHER CR LAND CO	3260	112	RICH	5950
9	ARTHUR ROUSE	1509	61	HEATHER CREEK	2112	113	RIVER MEADOWS RANCH	648
10	BARTLETT ISO TR	1267	62	HERRING RANCH PASTURE	468	114	ROMIOS RANCH	2475
11	BASIN RANCH	13449	63	HILL ISO TR	781	115	RYAN RANCHES	1329
12	BEAVER CR HILLS	3340	64	HOME PASTURE	1019	116	RYAN ROCKS	732
13	BEAVER CR HILLS SOUTH	5594	65	HOME RANCH	33870	117	SAGE CREEK	26164
14	BELL SPRINGS	9298	66	HORN AND MEASON	958	118	SAND CR. RANCH PAST.	4042
15	BENNETT PEAK	2150	67	HORSE PASTURE	490	119	SAND CREEK	2671
16	BIG HOLLOW	1922	68	JACK CREEK	9525	120	SANDSTONE	109019
17	BLACK CANYON	20519	69	JIM BERGER	651	121	SAULCY	3988
18	BODEN	3849	70	JOHN ROUSE	89	122	SEMINOE	161392
19	Brownlee Reservoir	1686	71	JUNK CREEK	11615	123	SIERRA MADRE RANCH	646
20	BUCK SPRINGS DRAW	1446	72	KENNADAY	1749	124	SILVER SPUR	4253
21	BULL CANYON	7770	73	KRAFT RANCH	466	125	SILVER SPUR NORTH	1974
22	BUZZARD	78928	74	LAKE CREEK	3480	126	SIXMILE HILL	888
23	BUZZARD RANCH MEADOW	6537	75	LAKE CREEK FLATS	7220	127	SIXTEEN MILE	81752
24	CENTENNIAL CR.	3323	76	LEO	26567	128	SKYLINE	1257
25	CHACE BLOCK	65809	77	LITTLE BEAVER CREEK	2546	129	SNOW CREEK	5281
26	CHAD	4129	78	LITTLE JACK CREEK	4537	130	SO. CEDAR CR.	390
27	CHEROKEE CREEK	475	79	LONE TREE ALLOTMENT	5536	131	SOIL BANK PASTURE	764
28	COAD MOUNTAIN	28815	80	LONG CREEK	10936	132	South Walcott	5493
29	CORPENING	7631	81	MCCARTY CANYON	9413	133	SOWDER-MCNANEY	2670
30	CORRAL CREEK	1358	82	MEADS	623	134	SPRING CR ISO TR	1528
31	COTTON RESERVOIR	2851	83	METHODIST	7046	135	STANDARD	13240
32	COTTONWOOD	2756	84	MIDDLE CEDAR CREEK	1318	136	STATION 8	6141
33	COTTONWOOD DRAW	3536	85	MIDDLEWOOD HILL	20583	137	STONE	108997
34	COTTONWOODCORRAL CR.	3411	86	MIDLAND	2630	138	T.A.RANCH	7576
35	COW CAMP	824	87	MINER CEEK	4642	139	TAPERS	577
36	COYOTE DITCH	2974	88	MORGAN CREEK	13136	140	TAYLOR RANCH	289
37	COYOTE DRAW	4368	89	NORTH FORK	2114	141	TEDDY CREEK	611
38	COYOTE HILL	1231	90	NORTH LAKE CREEK	354	142	TENNANT CREEK	1190
39	CUSHING	10082	91	NORTH PASTURE	548	143	THAYER	532
40	DANA BLOCK NORTH	70037	92	NORTH SAVERY CREEK	3139	144	THOMAS RYAN	360
41	DANA MEADOWS SOUTH	39136	93	NORTH SPRING CREEK	2004	145	TWIN GROVES	8175
42	DISH	20374	94	NORTH WALCOTT	46204	146	U.L.ALLOTMENT	2573
43	DOOLITTLE	799	95	OLSON RANCH PASTURE	1467	147	V U	3232
44	DUFUNNY	1052	96	OSCAR T. ANNIS	162	148	WEST ELK MOUNTAIN	1393
45	DUMP	2138	97	OTTO CREEK	1081	149	WIANT	2135
46	EAST COAD MTN ALLOT	824	98	OWL CREEK	1236	150	WILSON PASTURE	2589
47	EAST FORK	1460	99	PASS CREEK FLATS	7661	151	WINDMILL	4011
48	EAST SINCLAIR	5354	100	PASS CREEK RIDGE	59611	152	WOLFE	1601
49	EMIGRANT	5475	101	PATHFINDER	39893	153	WOOD CREEK	1444
50	ENCAMPMENT RIVER	295	102	PIERCE	583	154	WOOD HILL	2212
51	FILLMORE	42198	103	PIERSON	61			
52	FLYING DIAMOND	1146	104	PINE GROVE/BOLTEN	283247			

ID	Rangeland Management Unit	Acres
165	BARRETT RIDGE	26121
166	BEAVER CR	34929
167	BEAVER CREEK	4300
168	BIG CR	19760
169	BLAKE	21485
170	BOSWELL	38200
171	BOW RIVER	12578
172	BRUSH CREEK HORSE PASTURE	92
173	CAMP CREEK	17318
174	CEDAR CREEK	6789
175	CINNABAR PARK	7865
176	COOK	368
177	COW CREEK	13327
178	ELK CREEK	2818
179	ENCAMPMENT	37457
180	FIRELINE	9424
181	FOOTHILLS	10716
182	FOXPARK	45483
183	HAT PARK	1708
184	HOG PARK	8702
185	HOLMES	13741
186	JACK CREEK	38974
187	LAKE CREEK	8646
188	LINCOLN CREEK	16874
189	NORTH BRUSH CREEK	20647
190	NORTH FORK	16727
191	PASS CREEK	20509
192	PLATTE RIDGE WILDLIFE	13534
193	PLATTE RIVER	62856

ID	Rangeland Management Unit	Acres
194	ROARING FORK	16245
195	SAWMILL CREEK	3282
196	SIX MILE	6386
197	SNOWY RANGE S&G	114540
198	SPRING CREEK	10316
199	VICTORIA	12142
200	WEST BEAVER	25153
201	WOOD MOUNTAIN	43860

Figure 3.3-8 Upper North Platte River Watershed: BLM Grazing Allotments and USFS Rangeland Management Units

- Develop springs, seeps, reservoirs, wells or other water development projects in a manner protective of watershed ecological and hydrological functions.
- Implement range improvements away from riparian areas to avoid conflicts in achieving or maintaining riparian function.
- Adopt management practices and implement range improvements that protect vegetative cover and thereby maintain, restore, or enhance water quality.

A set of six standards have been established to meet the above guidelines (BLM, 1997). Each standard sets a specific objective, explains the function and importance of the objective, and provides indicators to assess the attainment of the objective. Detailed information regarding the BLM standards and guidelines is available in the Standards for Healthy Rangelands and Guidelines for Livestock Management document provided in the Digital Library delivered with this report.

On USFS lands, livestock grazing is permitted and governed through a permit system, Allotment Management Plans (AMPs) and Annual Operating Instructions. General grazing management on Medicine Bow National Forest lands is addressed in the Medicine Bow National Forest Final Environmental Impact Statement included in the Digital Library delivered with this report.

State Grazing Leases. Most of the state lands within the study area are leased to private landowners for grazing. These leases are typically issued by the Board of Land Commissioners and administered by the Wyoming OSLI. Management practices and improvements on state lands are usually established and implemented by the lessee. Improvements are typically paid for and owned by the lessee. Upon transfer of the state lease, the new lessee reimburses the previous lessee for improvements.

Grazing on Private Lands. Grazing practices on private lands are established by the landowner, often with technical assistance from the local NRCS staff and/or a range consultant. Range improvement projects implemented under NRCS programs (e.g., EQIP or PL566) follow the guidelines established in the plan of operations developed for the property and/or applicable NRCS technical guidelines as adapted for local conditions.

3.3.4.2 Existing Upland Water Supply

Numerous upland water supply sources currently exist within the study area, and many range improvement projects have been completed which utilize these existing water sources (springs, wells, perennial streams, etc.). Typical projects include livestock/wildlife water tanks and/or livestock/wildlife reservoirs, spring developments with pipelines providing water to remote stock tanks, well construction, etc.

Mapping of existing sources was completed to provide valuable information for completion of the watershed management plan:

- Mapping of stock reservoirs, and stock tanks/troughs was initially obtained from the Rawlins Field Office of the BLM (Figure 3.3-9). Note that springs mapping data was also received but not included in the figure, due to not being able to confirm whether the spring is a viable or developable water source without field verification. These data are, however, available within the Project GIS for review, use, and analysis.
- Mapping of wells with a designated stock use was obtained from the Wyoming State Engineers Office (SEO).
- Interviews with landowners were conducted during project meetings, and in the field. During these interviews, locations of existing sources were documented and the information incorporated into the project GIS.
- In addition, aerial photography was reviewed within the GIS environment to document visible features (i.e. stock reservoirs), and give an initial assessment of their condition.

Not all landowners participated in the project; consequently, the mapping is not expected to be an exhaustive accounting of all available sources. Mapping of all stock tanks/troughs within the study area was beyond the scope and feasibility of this study. These features are generally not visible during the review of the aerial photography and at this time, comprehensive mapping of these sources has not been previously completed. However, the information provides a starting point upon which to evaluate the watershed.

The results of this effort indicated the presence of 882 stock reservoirs/ponds. Field inspection of the sites was beyond the scope and budget of this project, however, a reasonable estimate of the viability of the reservoirs was desired.

Using the project GIS, mapping of the reservoir sites was overlain on multiple years of recent high resolution aerial photography (July/August 2009, June 2011 and July / August 2012). This was done in order to more accurately determine the status of each reservoir over time and reduce error as much as possible due to dry or wet water years. Reservoirs containing water in multiple years of photography or showed no signs of physical breaches or sedimentation were determined to be functional water sources. Physical breaches were visible on several of the reservoirs resulting in a classification of “non-functional”. Likewise, if a reservoir was visibly filled with sediment it also classified as “non-functional”. Reservoirs containing water in one year of photography or showed no visible signs of damage were classified as “potential” water sources, as firm conclusions on water reliability could not be drawn. Figure 3.3-10 displays an example of this process.

Figure 3.3-11 displays a map of the study area showing the results of this classification. Based upon this analysis, it appears that a minimum of 657 reservoirs remain “functional” water sources and 67 are “potential” water sources. This analysis also indicates that 158 reservoirs are “nonfunctional” water sources as they are either breached, sediment filled, or in need of site visits to determine their status. Appendix 3A presents the results in a tabular format.

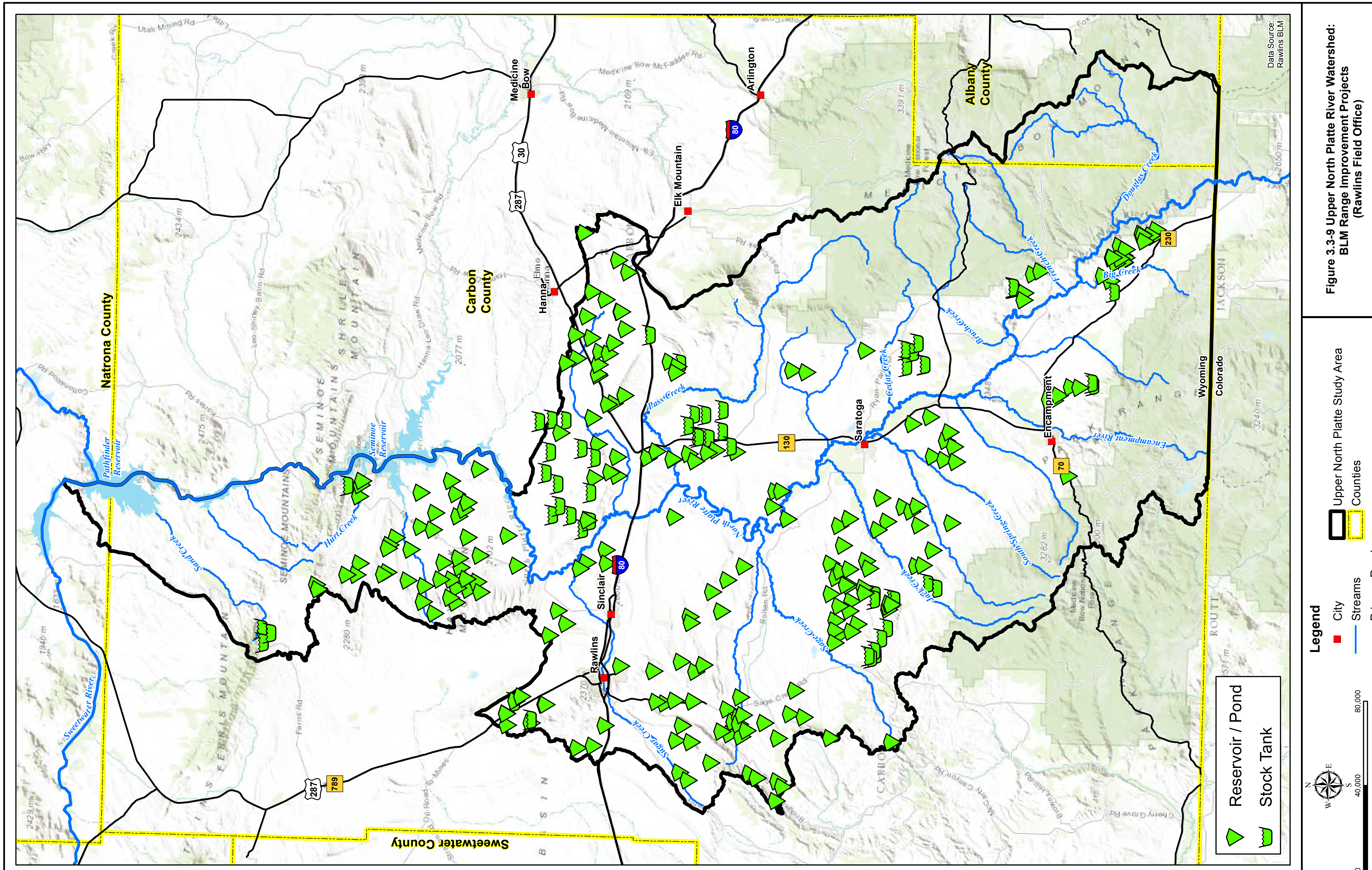


Figure 3.3-9 Upper North Platte River Watershed:
BLM Range Improvement Projects
(Rawlins Field Office)
Upper North Platte Study Area
Counties
Legend
City
Streams
Primary Roads
Reservoir / Pond
Stock Tank
0
40,000
80,000
Feet
Data Source:
Rawlins BLM
Natrona County
Carbon County
Albany County
Sweetwater County
Wyoming
Colorado
Medicine Bow
Arlington
Elk Mountain
Hanna
Elmo
Sinclair
Rawlins
Saratoga
Encampment
Pathfinder Reservoir
Seminoe Reservoir
Sweetwater River
North Platte River
Sand Creek
Hurt Creek
Pass Creek
Sage Creek
Sugar Creek
Jack Creek
Cedar Creek
South Spring Creek
Encampment River
Brush Creek
French Creek
Big Creek
Douglas Creek
80
30
287
130
230
70
789

Figure 3.3-10 Evaluation of Stock Reservoirs within the GIS Environment.

Based upon the reservoir analysis effort, mapping data obtained from the BLM and the SEO office, and landowner input, the existing water sources are displayed in Figure 3.3-12. Note that this figure does NOT include surface water sources such as perennial streams, intermittent streams, or springs because a primary objective of this study is to evaluate opportunities that provide wildlife and livestock water in addition to these sources. Because they do not presently appear to provide sources of water to livestock or wildlife, reservoirs which appeared to be either breached, filled with sediment, or otherwise non-functioning, are not included in this figure.

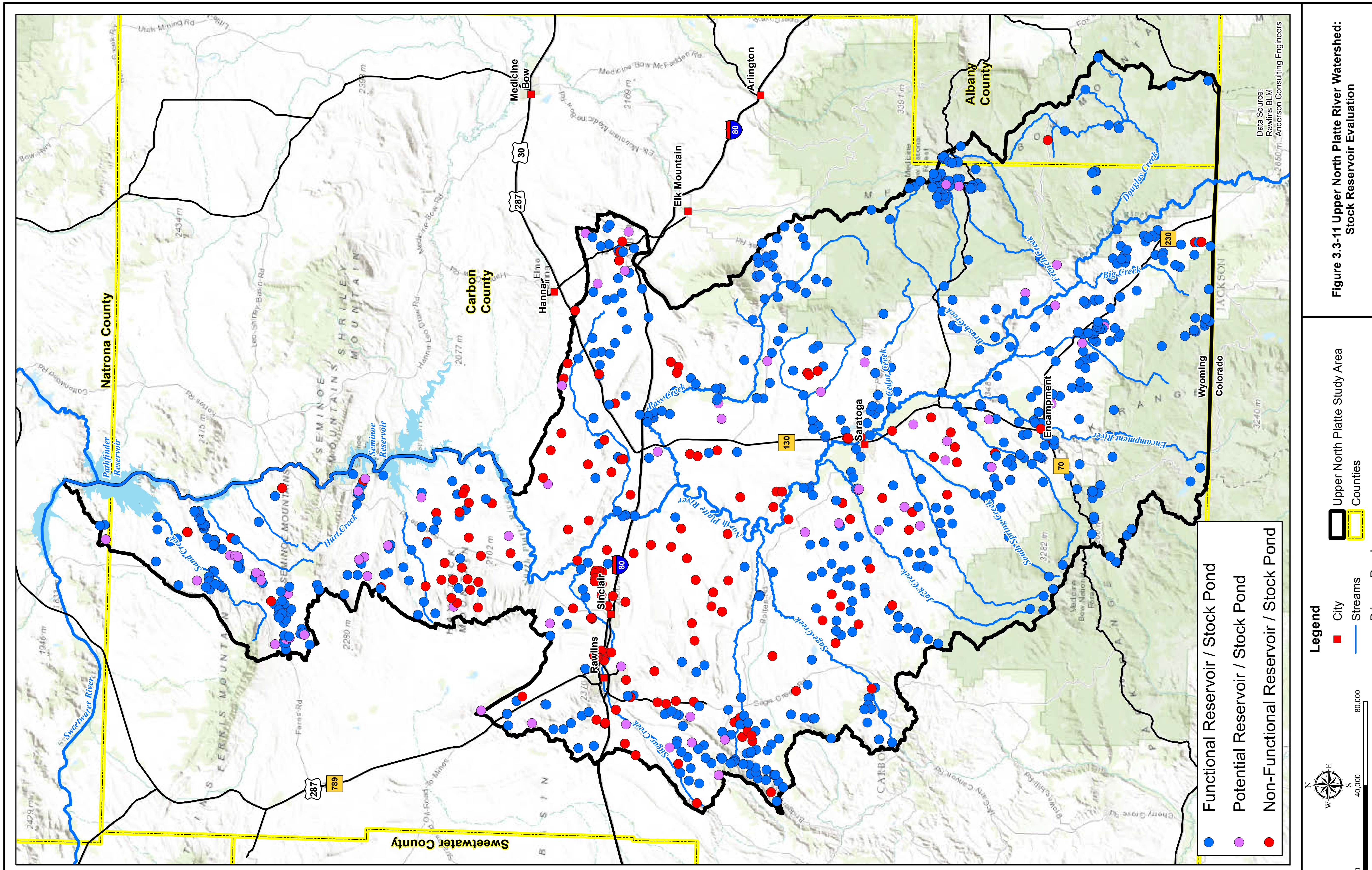


Figure 3.3-11 Upper North Platte River Watershed: Stock Reservoir Evaluation

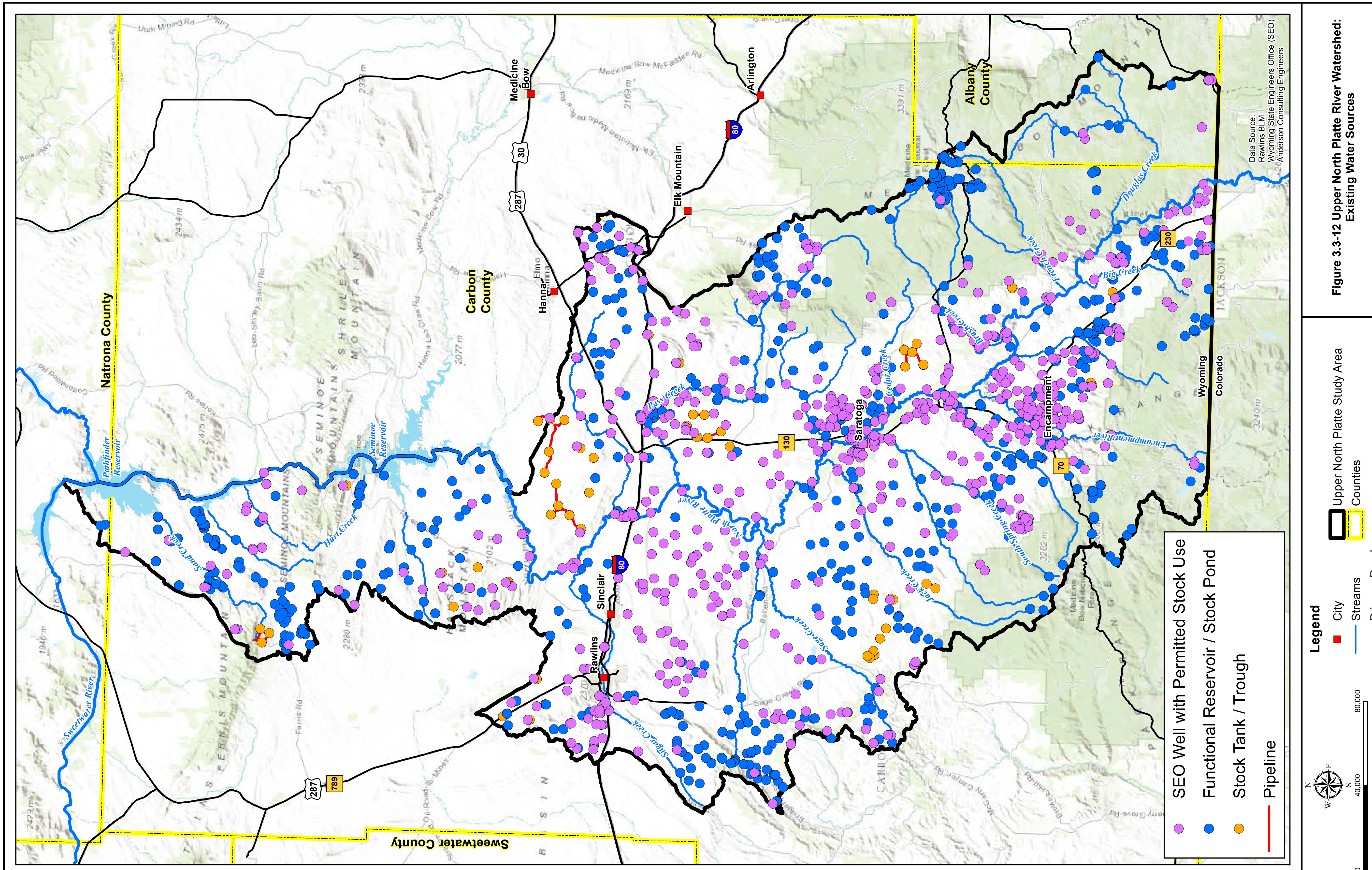


Figure 3.3-12 Upper North Platte River Watershed:
Existing Water Sources
Upper North Platte Study Area
Counties
Legend
City
Streams
Primary Roads
SEO Well with Permitted Stock Use
Functional Reservoir / Stock Pond
Stock Tank / Trough
Pipeline
Data Source:
Rawlins BLM
Wyoming State Engineers Office (SEO)
Anderson Consulting Engineers
0
40,000
80,000
Feet
Natrona County
Carbon County
Albany County
Sweetwater County
Wyoming
Colorado
Medicine Bow
Arlington
Elk Mountain
Hanna
Elmo
Sinclair
Rawlins
Saratoga
Encampment
Pathfinder Reservoir
Seminoe Reservoir
Sweetwater River
North Platte River
Pass Creek
Cedar Creek
Sage Creek
Sugar Creek
Jack Creek
Hurt Creek
Sand Creek
Big Creek
Douglas Creek
French Creek
Encampment River
Brush Creek
South Spring Creek
Seminoe Mountains
Shirley Mountains
Ferris Mountains

3.3.4.3 Ecological Site Descriptions

The concept of "Ecological Sites" is described by the NRCS as follows:

> *"A distinctive kind of land with specific soil and physical characteristics that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation, and in its ability to respond similarly to management actions and natural disturbances."*

Ecological sites incorporate environmental factors such as climate, soils, landform, hydrology, vegetation, and natural disturbance regimes that together define the site and its relationships between these factors and how they influence plant community composition [Caudle et al., 2013]. The characteristics differentiating ecological sites and their features are documented as an ecological site description (ESD), which includes the following:

- Data used to define the distinctive properties and characteristics of the sites;
- Biotic and abiotic characteristics that differentiate the site (i.e., climate, physiographic, soil characteristics, plant communities); and
- Ecological dynamics including how changes in climate, disturbance processes and management can affect the site.

An ESD includes interpretations about the land uses that a specific ecological site can support and management alternatives for achieving objectives. ESDs are valuable tools that can be used to help landowners and managers make decisions through evaluating the condition or health of a range or forest site by comparing the current vegetation composition to the type of plants the site is capable of growing. The ecological sites and associated descriptions were developed over many years of data collection and range site monitoring and are dependent on the location of a site within defined precipitation zones and existing soil characteristics.

Ecological Site Descriptions (ESDs) reports are available from the NRCS that describe the following for each Ecological Site:

- Site Characteristics: Identifies the site and describes the physiographic, climate, soil, and water features associated with the site.
- Plant Communities: Describes the ecological dynamics and the common plant communities comprising the various vegetation states of the site. The disturbances that cause a shift from one state to another are also described.
- Site Interpretations: Interpretive information pertinent to the use and management of the site and its related resources.
- Supporting Information: Provides information on sources of information and data utilized in developing the site description and the relationship of the site to other ecological sites (NRCS, 2009).

ESDs are available from the NRCS at:
https://esis.sc.egov.usda.gov/Welcome/pgReportLocation.aspx?type=%20ESD
The ESDs can be used to compare what is growing on the rangeland with what each site is capable of growing. By comparing the present vegetative composition to the potential compositions, the relative health of the range resource can be evaluated. Production of each site is closely related to the ecological condition of the site. Ecological Sites are defined based upon their location within defined Ecological Precipitation Zones and soil characteristics. Figure 3.3-13 displays the ecological precipitation zones found in the Study Area.

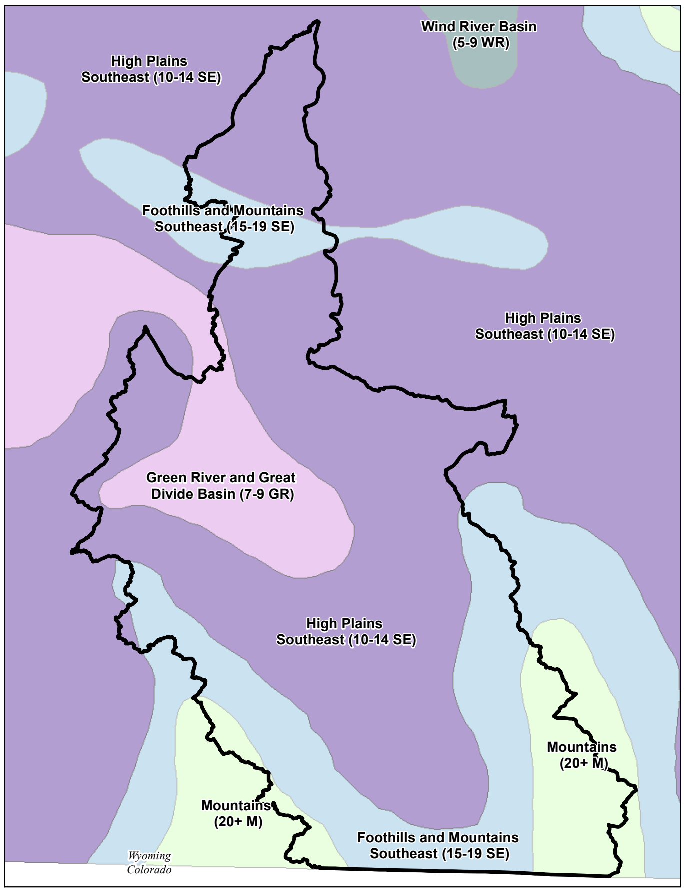


Figure 3.3-13 Ecological Precipitation Zones.

Using database tools provided by the NRCS, the available soils mapping was evaluated and Ecological Sites defined within the study area. Detailed soils mapping was available for only approximately 37% of the study area. ESD's were not able to be produced for the remaining 63% of the watershed due to lack of available soils data (Please refer to Section 3.4.4 for a discussion of soils mapping availability). Also please note that even if there is soils data available there may not be an associated ESD that can be calculated. For example the Badlands soil type, mines, dumps, urbanland, and water are all values in the soil data for which ESD's cannot be calculated. Figure 3.3-14 displays the locations of the major ecological sites where the 1:24,000 soils mapping was available.

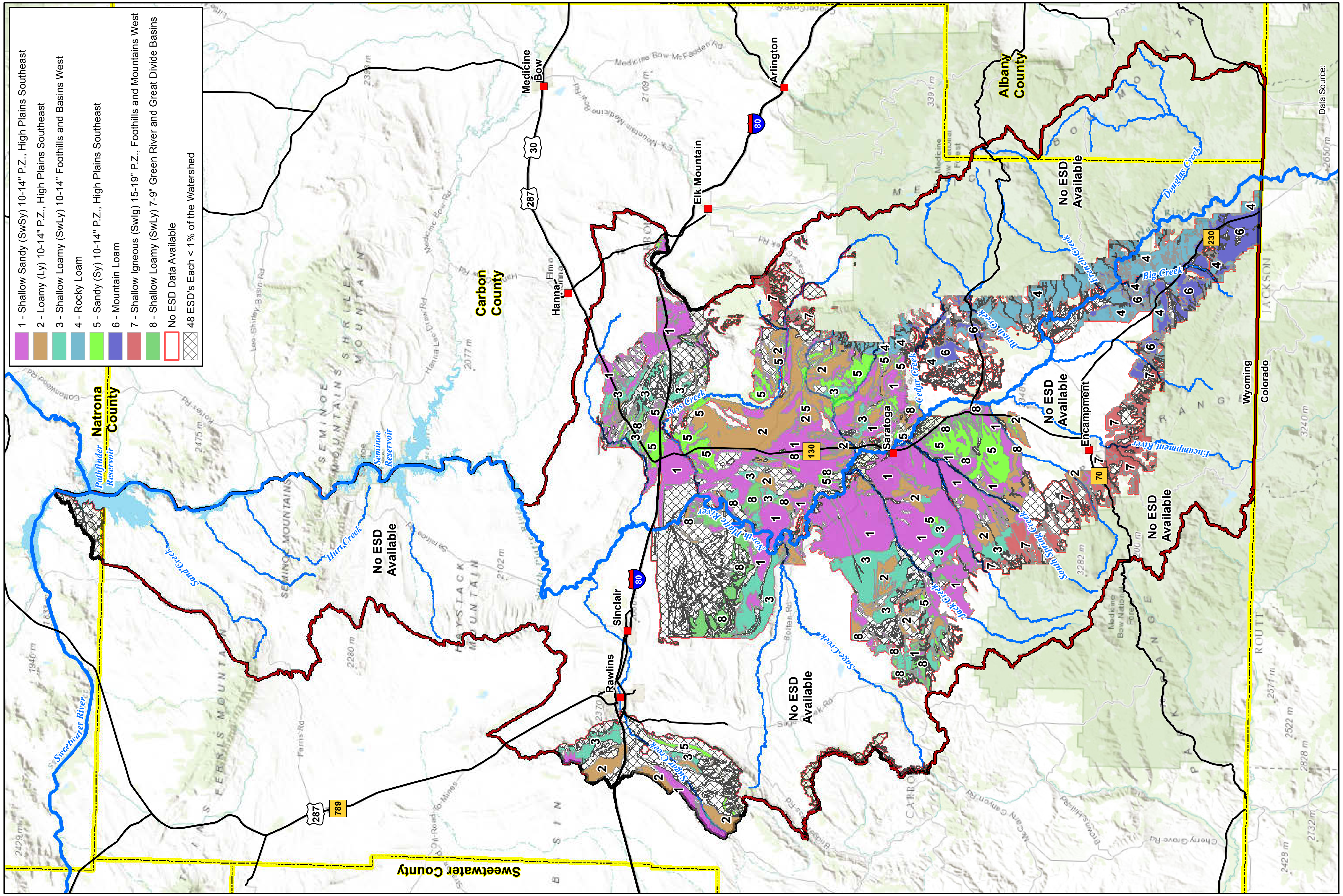


Figure 3.3-14 Upper North Platte River Watershed: Predominant Ecological Sites of Management Relevance

Legend
City
Streams
Primary Roads
Upper North Platte Study Area
Counties
0 40,000 80,000
Feet

Based upon the mapping which is available, the ecological sites which are predominant are:

- Shallow Sandy (SwSy) 10-14" P.Z., High Plains Southeast
- Loamy (Ly) 10-14" P.Z., High Plains Southeast
- Shallow Loamy (SwLy) 10-14” Foothills and Basins West

Specific on-site evaluation of local ESD type and condition is required prior to development of site specific management plans. Ecological Site Interpretations associated with these ESDs are extracted from the NRCS descriptions (NRCS, 2014) and included as Appendix 3B.

3.3.4.4 Range Conditions

Grazing management and the overall health of the watershed may benefit substantially with well-distributed, reliable water. Despite the relatively ample water supplies within upper portions of the watershed, good grazing systems control both the time (amount of time spent in an area), and the timing (the time of the year) that the livestock / wildlife spend in any given area. Grasses and other plants need to recover from the last livestock / wildlife grazing event before being grazed again because food reserves in the roots must be utilized for new plant growth. If root reserves are not restored, the plants are weakened and may eventually die. Less desirable plants can potentially invade and take over and plant densities decrease. In the absence of well-distributed livestock /wildlife water, areas near water (frequently riparian areas) are potentially grazed heavily while many other areas may be underutilized. As stated above, water sources must also be reliable so that each pasture can be used as needed in a grazing rotation.

Due to the fact that plants grow rapidly during the growing season, re-growth is frequently grazed multiple times during each grazing period, resulting in depleted root reserves. Because of this, it is often desirable to combine herds so livestock can spend shorter time periods in one pasture. This requires adequate quantities of water to accommodate larger herds. Within the central and lower portions of the watershed, conditions are dryer and water supplies are extremely limited.

In addition to restoration of more healthy conditions, continuing adjustments in overall range management will contribute to the maintenance, recovery or improvement of a variety of interrelated aspects of watershed function, including but not necessarily limited to:

- Improved infiltration of snowmelt and rainfall;
- Retention of soil moisture;
- Groundwater recharge;
- Sustained release of soil moisture and groundwater as seeps/springs; and
- Stabilization of soils against erosion into streams.

In general, most range improvement practices which improve watershed and livestock values also improve wildlife habitat values. With important and sensitive species found within the watershed, such as sage grouse, care must be taken to ensure that practices are beneficial rather than detrimental to their habitat values. Examples of this include the need for mixed age stands of sagebrush, adequate vegetative residues, wildlife escape ramps from livestock tanks, and provisions for wildlife water.

Alternatives to address the need for additional wildlife/livestock watering sites are presented in Section 4.3. Potential management practices and improvements to address other rangeland/grazing related issues are included in Section 4.7. It is important to consider that to be cost-effective any range improvement practices/facilities that may be implemented must be followed up with a good grazing system. Otherwise, any short term gains will be lost, and often made worse. The key to any good grazing system is often a good, reliable livestock water system; this usually is the most cost-effective practice to initiate the process. The best value for the investment of resources frequently occurs on the more productive land. Land that is too steep or shallow can only show limited returns on investments.

3.3.5 Oil and Gas Production and Resources

There are numerous pipelines within the study area for crude oil, natural gas, and other fuel products. As shown on Figure 3.3-15, most of the pipelines are located along the main transportation route I-80.

Mapping of the lines provided by Wyoming State Geological Survey (WSGS) are coarse in nature with poor accuracy; presumably for security reasons. Consequently, the lines indicated are approximations of alignment only. This figure also displays the numerous oil fields documented within the study area. Note that at this scale, differentiation and identification of the individual fields is cumbersome. The project GIS facilitates review of the more useful mapping scales.

The locations of all active and permanently abandoned oil and gas wells were obtained from the Wyoming Oil and Gas Conservation Commission (WOGCC) website: http://wogcc.state.wy.us/. Active wells and permanently abandoned wells within the study area are shown on Figure 3.3-16.

In an effort to assist the conservation districts in their ongoing efforts to monitor conditions of existing resources, project team conducted a preliminary screening of reclamation success associated with abandoned oil and gas field wells. Within the project GIS and using available aerial photography, analysts visually evaluated each site to assess its degree of vegetation establishment. Using locations of all abandoned wells in the study area (WOGCC, 2015), each site was designated one of four vegetation categories. The categories are described as follows:

Vegetated:	Obvious vegetation establishment and a lack of discernible erosional features.
Partially Vegetated:	Mixed establishment of vegetation and / or minor erosional features visible.
No Vegetation:	Distinct lack of established vegetation and / or obvious erosional features.
Redeveloped:	Previously abandoned site has been redeveloped with a new well head.

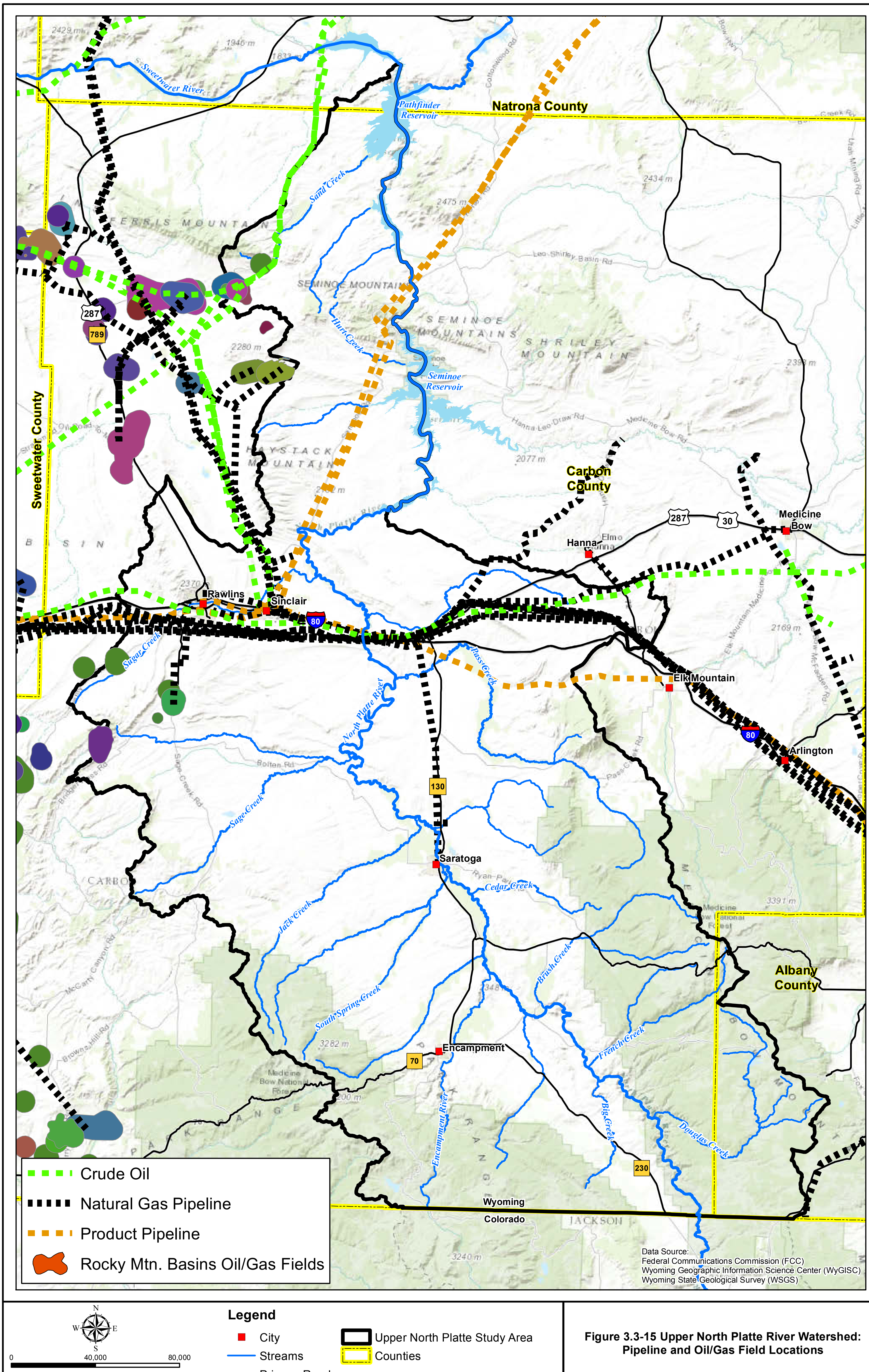


Figure 3.3-15 Upper North Platte River Watershed: Pipeline and Oil/Gas Field Locations

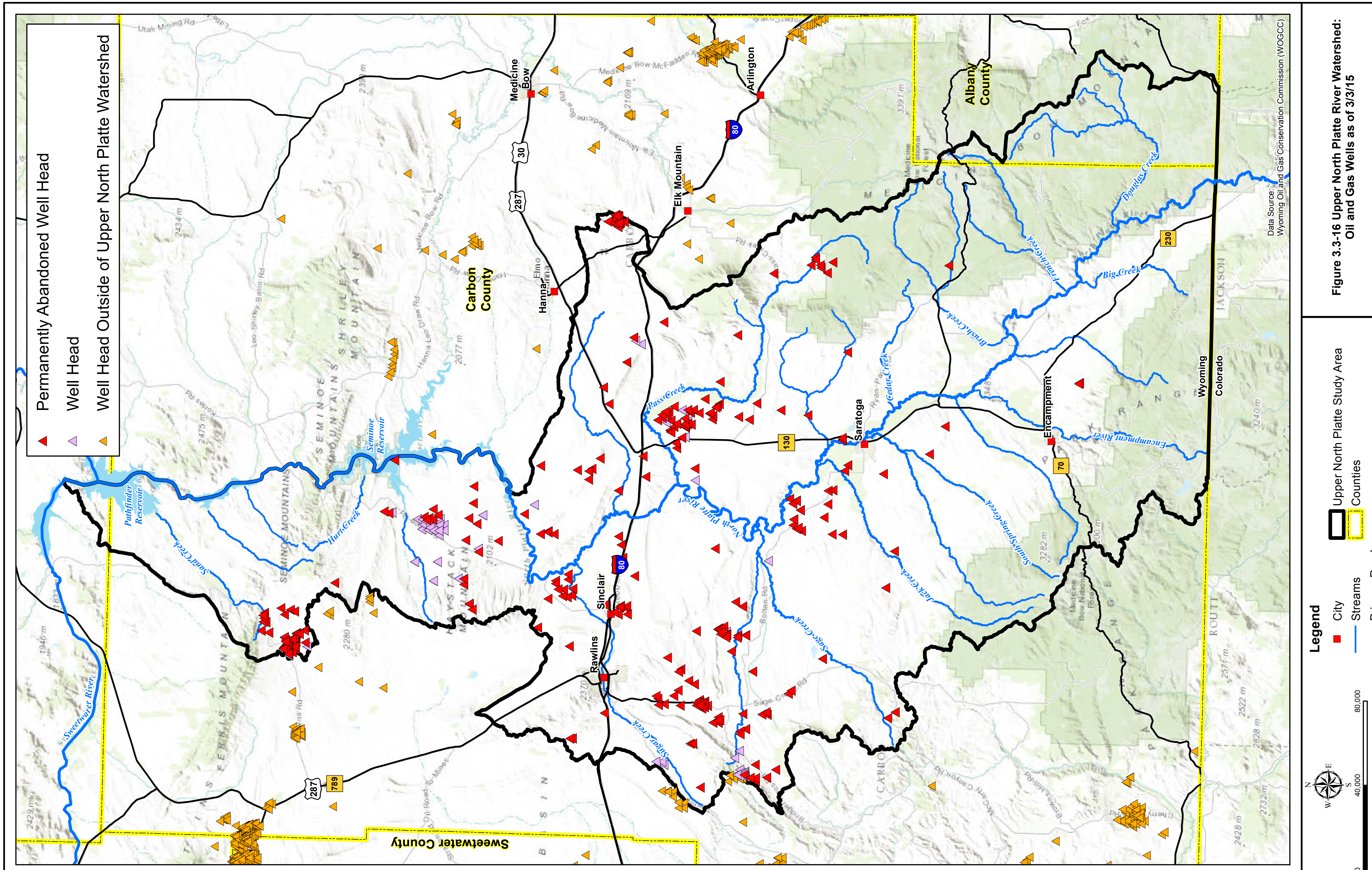


Figure 3.3-16 Upper North Platte River Watershed: Oil and Gas Wells as of 3/3/15

Figure 3.3-17 displays and example of this process. Note that all references to relative extent in vegetative cover are made in relation to the surrounding native ground. In addition, one must keep in mind that the plant species cannot be determined using this process, only the relative cover. Consequently, a fully vegetated abandoned well pad could be covered with non-desirable weed species and be classified as vegetated under this procedure. Using these visual classifications, each of the abandoned well sites was evaluated. As of March 2015, of a total of 307 abandoned sites, 232 appeared to have obtained a reasonably level of vegetation cover; 54 showed a partial level of cover; 17 appeared to be devoid of vegetation and/or exhibiting visual erosional features and 4 have been redeveloped with another well head or some other type of construction. The 17 classified as "No Vegetation" represent the sites that the conservation district could flag for potential site visits to confirm site-specific conditions. Figure 3.3-18 presents the results of this analysis graphically.

Figure 3.3-17 Example analysis of abandoned oil/gas well site. The site on the left displays vegetation cover equivalent with its surroundings, while the site on the right displays little, if any, vegetation establishment.

3.3.6 Mining and Mineral Resources

At the time of this report, there were fourteen active mines within the study area on record with the WDEQ Land Quality Division (Table 3.3-2). The majority of the active permits were associated with sand and/or gravel operations (6 permits). In addition to these, three coal mine boundaries cross into the northeastern portion of the watershed, two limestone mines, two dirt operations and a feldspar mine are also currently active within the study area. Figure 3.3-19 displays the locations of these mines.

In addition to current WDEQ records, there are numerous abandoned mine features within the study area; also indicated in Figure 3.3-19. These features are related to the area's historic mining legacy when reclamation standards were either less stringent than today's regulatory environment or non-existent. The Wyoming Department of Environmental Quality, Abandoned Mine Lands Division (AML)

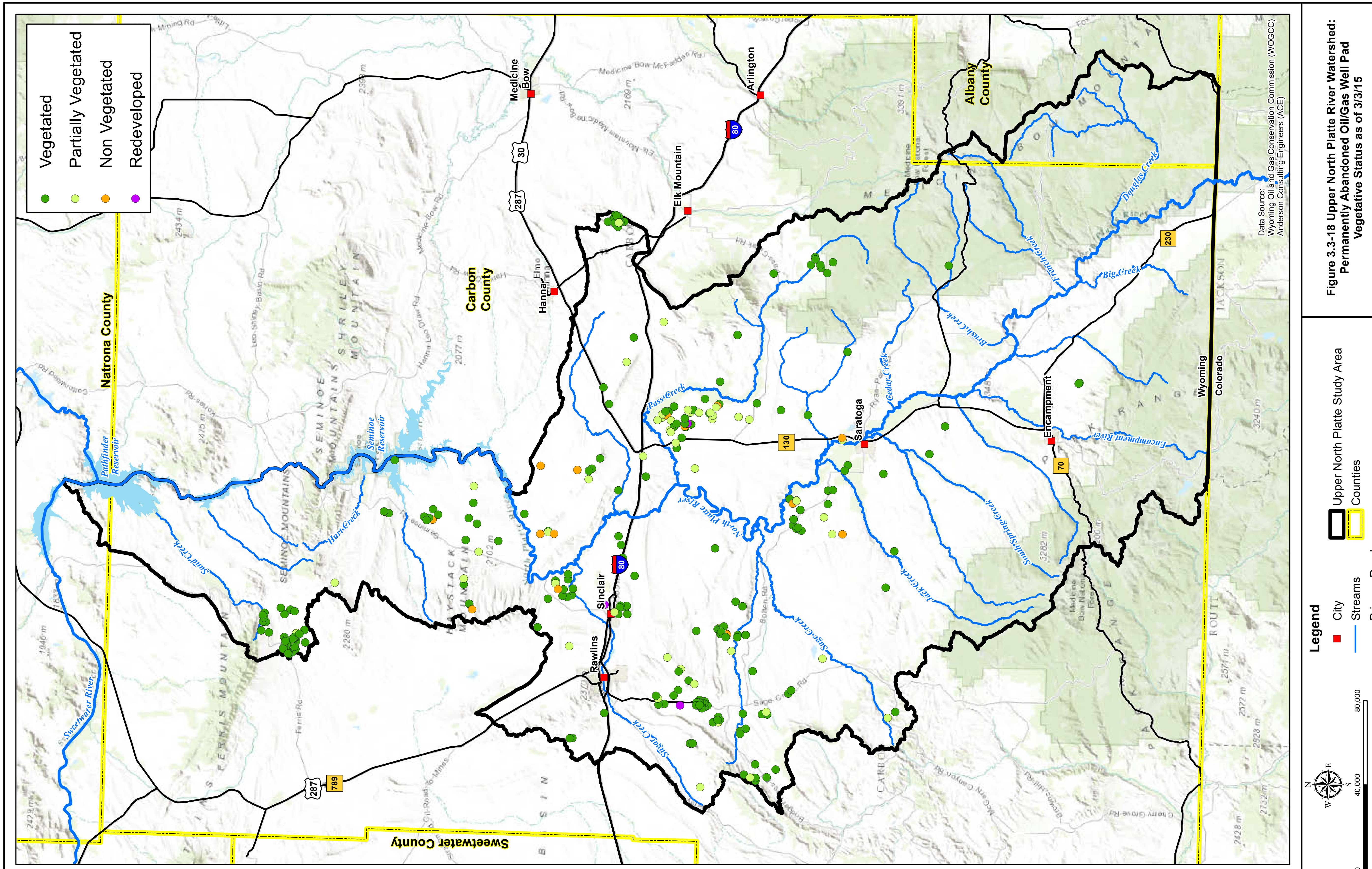


Figure 3.3-18 Upper North Platte River Watershed: Permanently Abandoned Oil/Gas Well Pad Vegetative Status as of 3/3/15

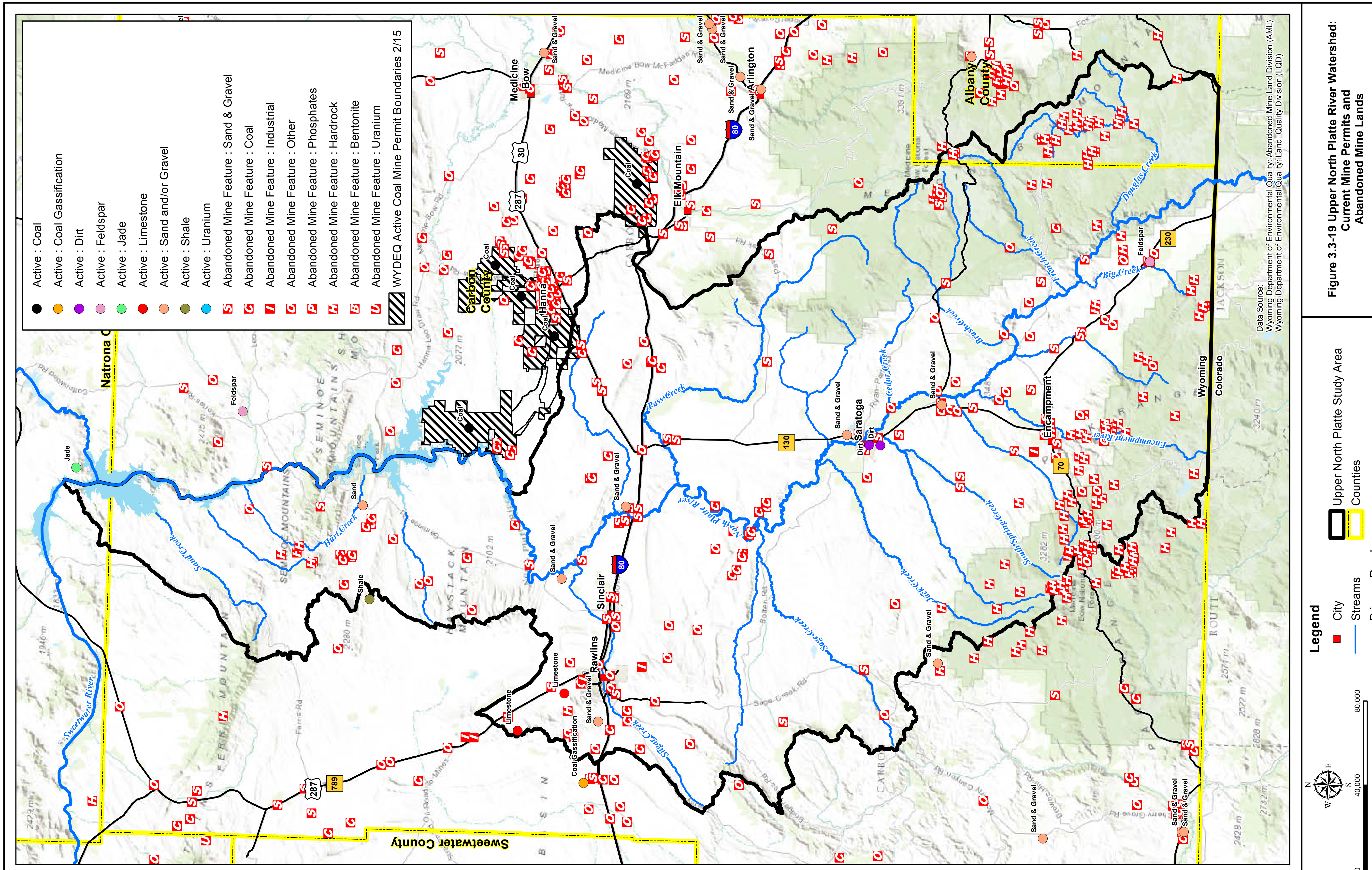


Figure 3.3-19 Upper North Platte River Watershed: Current Mine Permits and Abandoned Mine Lands

mission is to mitigate safety hazards and repair environmental damage from past mining activities, and to assist communities impacted by mining. Many of the sites within the study area are eligible for mitigation through the AML program.

Table 3.3-2 Tabulation of Existing Mine Permits (WDEQ, 2015).

Permit Number	Company Name	Mine Name	Mine Type	Mineral	Acres	Status
PT0331	ARCH OF WY LLC	MEDICINE BOW	Large Mine	Coal	20,352	Active
PT0334	ENERGY DEVELOPMENT CO	EDC	Large Mine	Coal	13,250	Active
PT0730	ARCH OF WY LLC	CARBON BASIN	Large Mine	Coal	17,154	Active
ET1417	ARTHUR M INGLEBY (RODS BACKHOE)	INGLEBY	Limited Mine Operation(ET)	Dirt	2	Active
ET1496	QUALITY LANDSCAPE & NURSERY INC	STEVENS	Limited Mine Operation(ET)	Dirt	1	Active
ET1397	FISHER SAND & GRAVEL CO	CODY RESOURCES	Limited Mine Operation(ET)	Feldspar	10	Active
PT0574	PETE LIEN & SONS INC	RAWLINS QUARRY	Large Mine	Limestone	795	Active
ET1586	MCMURRY READY MIX, CO	ANSELMI	Limited Mine Operation(ET)	Limestone	15	Active
ET1468	DANS TRUCKING INC	CARPENTER	Limited Mine Operation(ET)	Sand	1	Active
ET0558	PLATTE VALLEY FOREST MANAGEMENT LLC	BUCHOLZ	Limited Mine Operation(ET)	Sand & Gravel	5	Active
ET1386	TILTON READY MIX	FT. STEELE PIT	Limited Mine Operation(ET)	Sand & Gravel	10	Active
ET1442	QUALITY LANDSCAPE & NURSERY INC	RANDY STEVENS	Limited Mine Operation(ET)	Sand & Gravel	10	Active
ET1471	B C N CONST INC	PETERSON LIVESTOCK	Limited Mine Operation(ET)	Sand & Gravel	10	Active
PT0739	MCMURRY READY MIX CO	WYUTE	Large Mine	Sand & Gravel	360	Active

Of the 260 AML sites located in the study area, 124 of them are associated with hardrock mining activities (Copper, Gold, and other metals). These features are located primarily in the mountains of the southern portion of the watershed. The AML sites can include a variety of mining-related hazards including open shafts, spoil piles, etc. In addition, environmental impacts associated with the historic mines may still exist. Figure 3.3-20 displays an aerial photo of a typical AML coal mine site.

Figure 3.3-20 WDEQ Coal mine reclamation site.

3.3.7 Wildlife

3.3.7.1 General

The Wyoming Game and Fish Department (WGFD) maps the seasonal ranges by herd unit for each big game species and makes special note of areas listed as crucial habitat and parturition (birthing areas). WGF's Crucial habitat or range is defined as those seasonal ranges or habitats (mostly winter range) that have been documented as the determining factor in a population's ability to maintain itself at a certain level over a long period of time. In the Upper North Platte River watershed the primary big game present are Antelope, Big Horn Sheep, Elk, and Mule Deer. Within the watershed, approximately 525,346 acres (roughly 26 percent of the study area) have been determined to be crucial habitat for one or more of Antelope, Big Horn Sheep, Elk, or Mule Deer. Two of the big game species (Big Horn Sheep and Elk) have parturition areas within the watershed totaling 95,000 acres (approximately 5% of the study area). According to the Game and Fish data provided, Moose and White Tail Deer will utilize the watershed area but only as seasonal range.

Figures 3.3-21 through 3.3-26 display the WGF seasonal range, crucial range, parturition areas, migration corridors and migration barriers for Antelope, Big Horn Sheep, Elk, and Mule Deer, Moose, and Whitetail Deer within and immediately adjacent to the study area. Examination of these figures shows that the majority of the watershed is classified as seasonal range for the big game species. The crucial ranges and parturition areas of the primary big game species within the watershed were aggregated individually and are shown in Figure 3.3-27. The figure shows that the crucial range of the four primary species is concentrated in the central river valley along the North Platte River, expanding significantly to encompass more area around Pass Creek and its tributaries. The parturition areas for Big Horn Sheep and Elk are primarily located in the south eastern portion of the watershed in the transition zones between forested terrain and the North Platte River valley.

The Wyoming Natural Diversity Database (WYNDD) lists numerous non-game species of concern within the watershed, including amphibians, birds, fish, insects, mammals, mollusks, and reptiles. Originally initiated by the Nature Conservancy, the WYNDD became a research and service unit of the University of Wyoming in 1998. Appendix 3C presents the results of a database query conducted by the WYNDD for the watershed. Included in this list are all species of concern or species of potential concern which have been documented in the study area. The WYNDD does list one endangered species (Black-footed Ferret) as being sited within the watershed a total of 19 times between 1955 and 1983. It should be noted that of these 19 sightings, 13 were classified as reports that were "vague and unsubstantiated, reliability of observer is unclear". Please see the WYNDD GIS data included in the project GIS for more information.

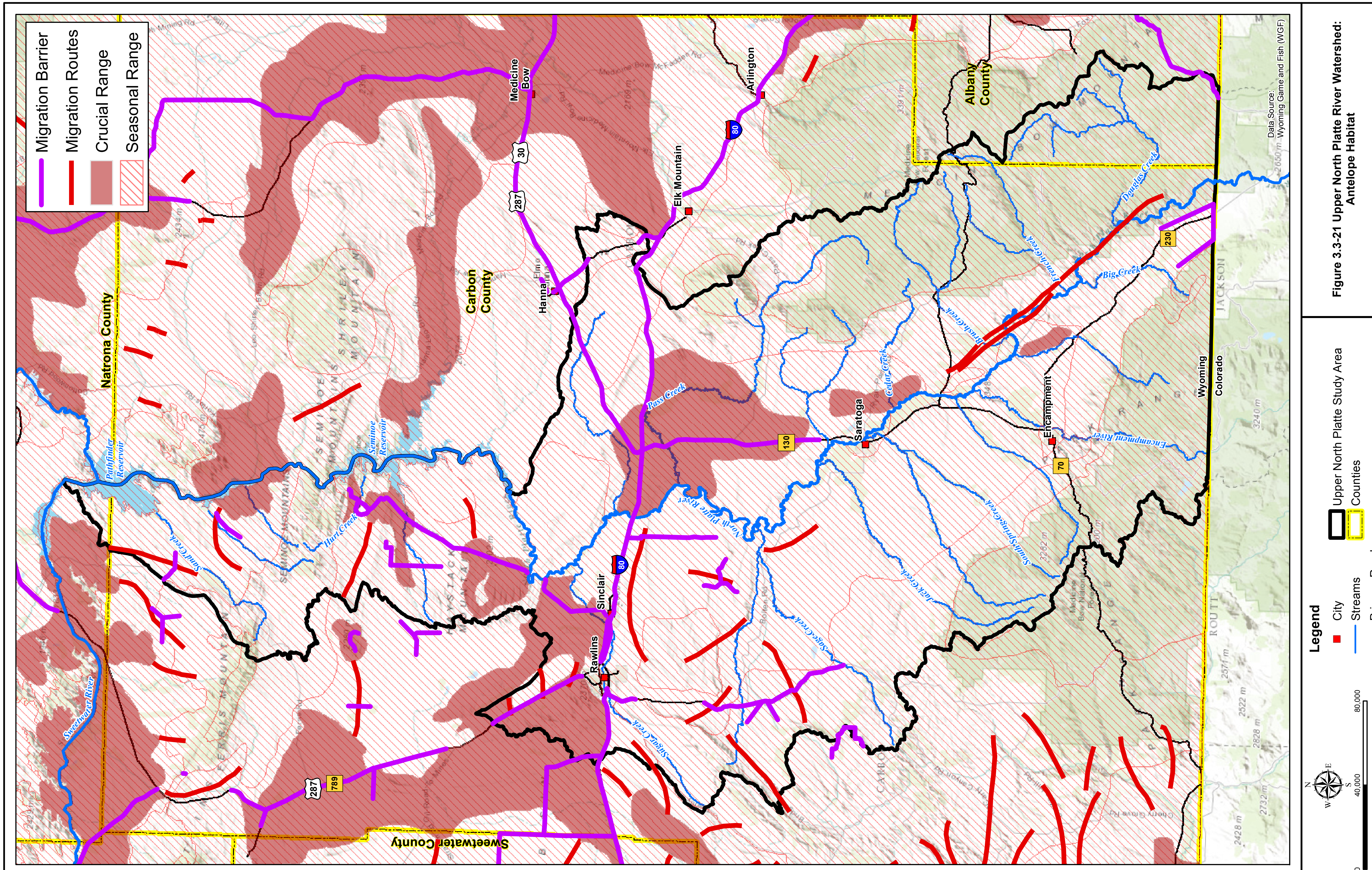


Figure 3.3-21 Upper North Platte River Watershed: Antelope Habitat

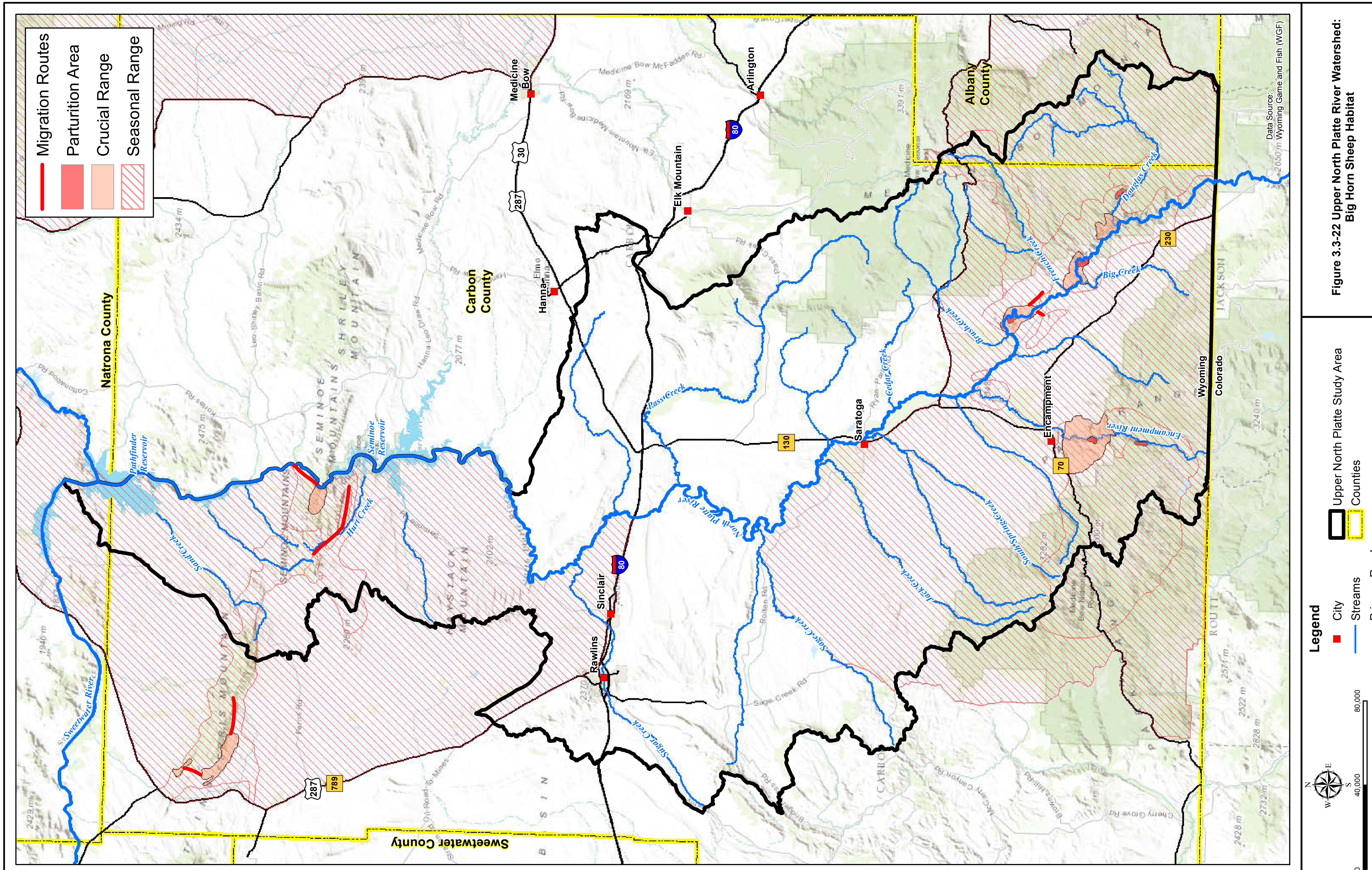


Figure 3.3-22 Upper North Platte River Watershed: Big Horn Sheep Habitat

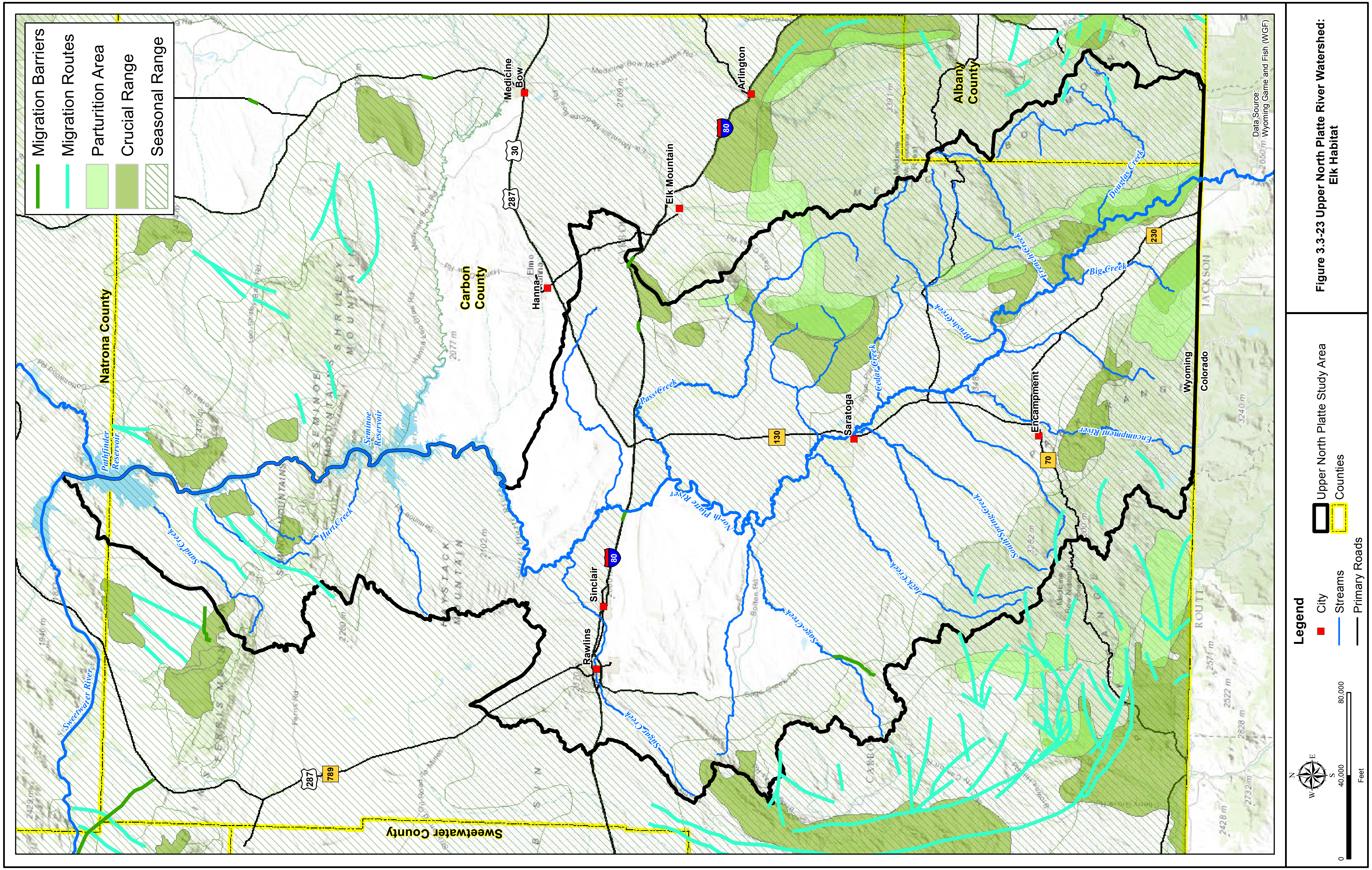


Figure 3.3-23 Upper North Platte River Watershed: Elk Habitat

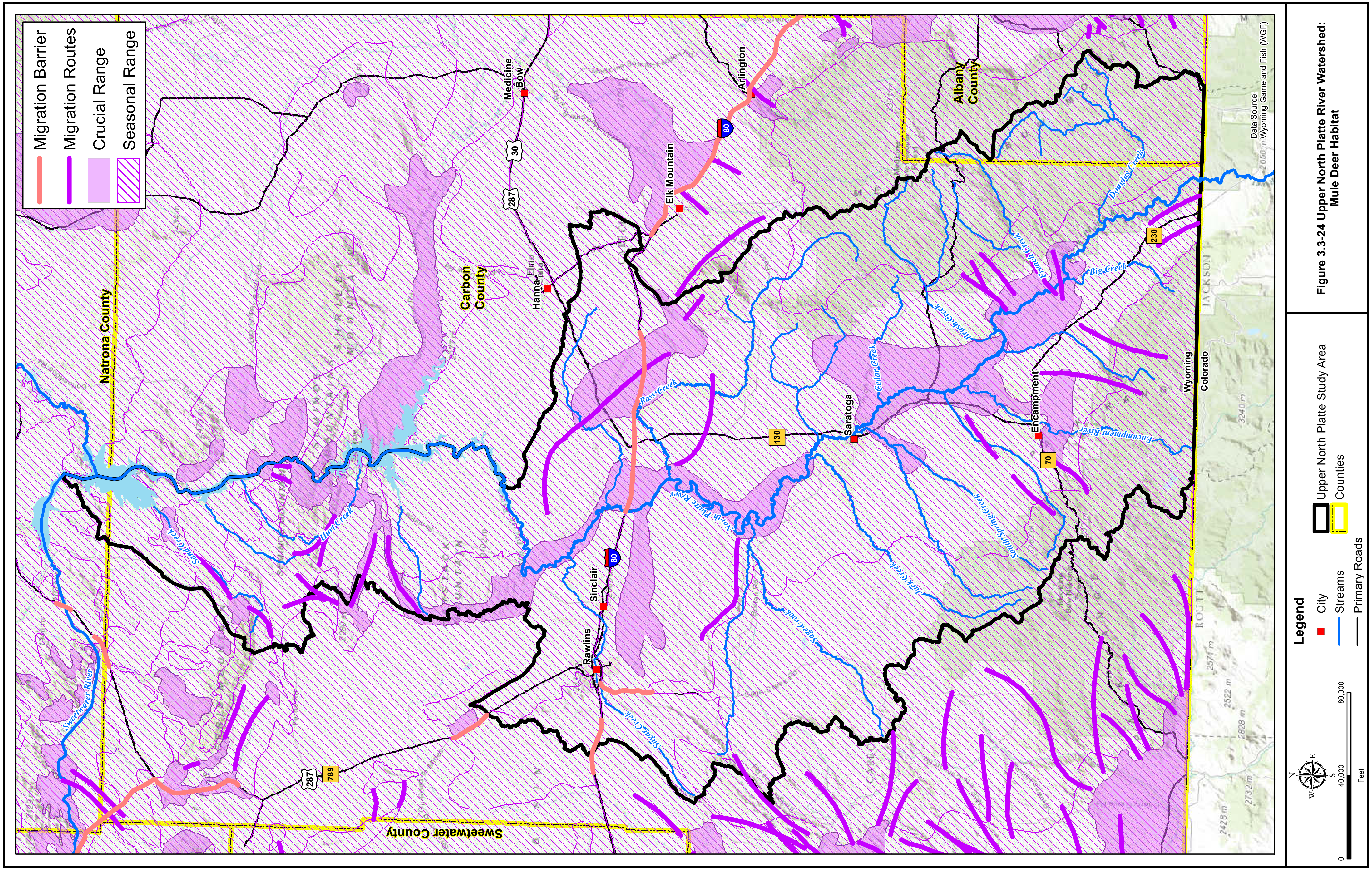


Figure 3.3-24 Upper North Platte River Watershed: Mule Deer Habitat

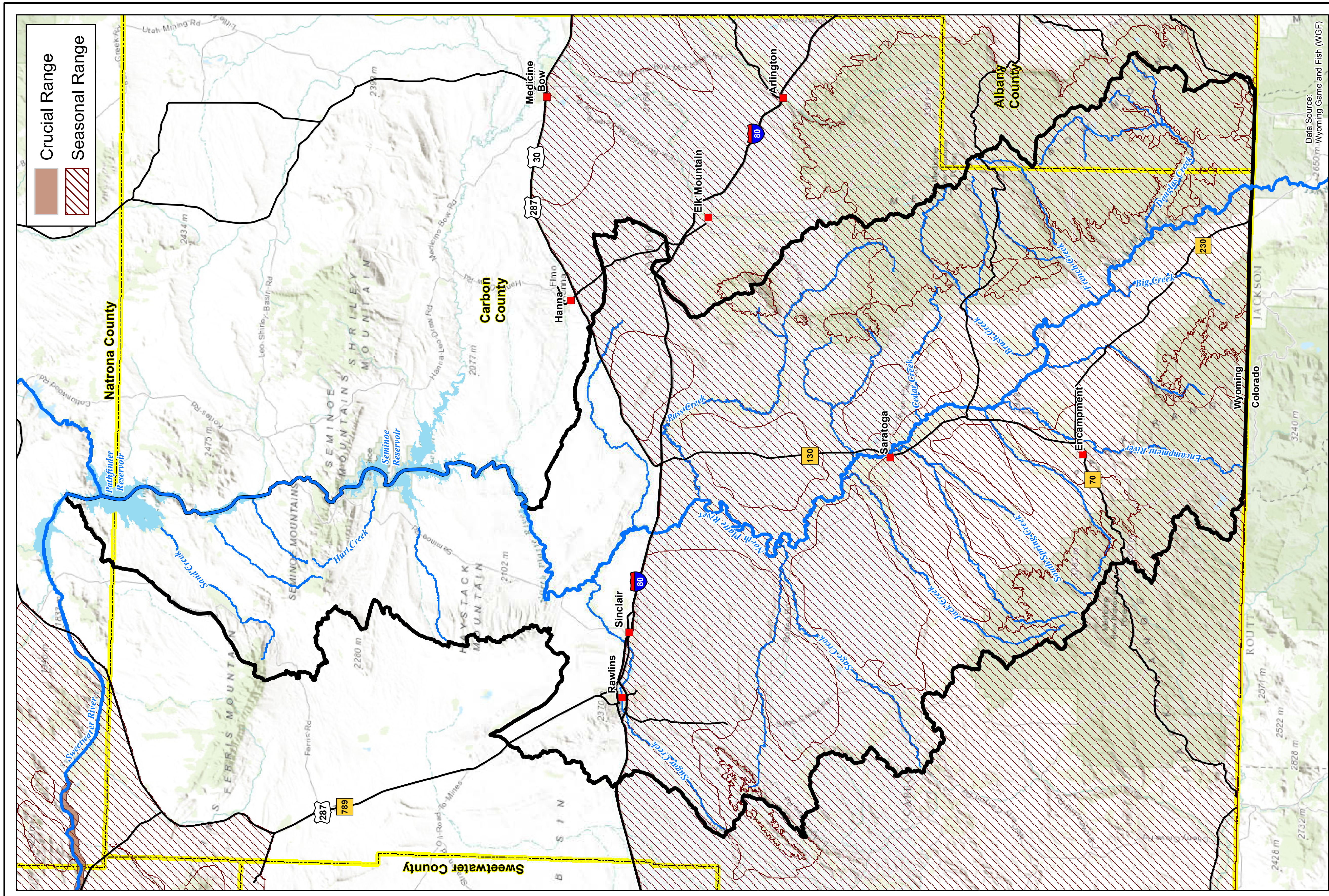


Figure 3.3-25 Upper North Platte River Watershed: Moose Habitat

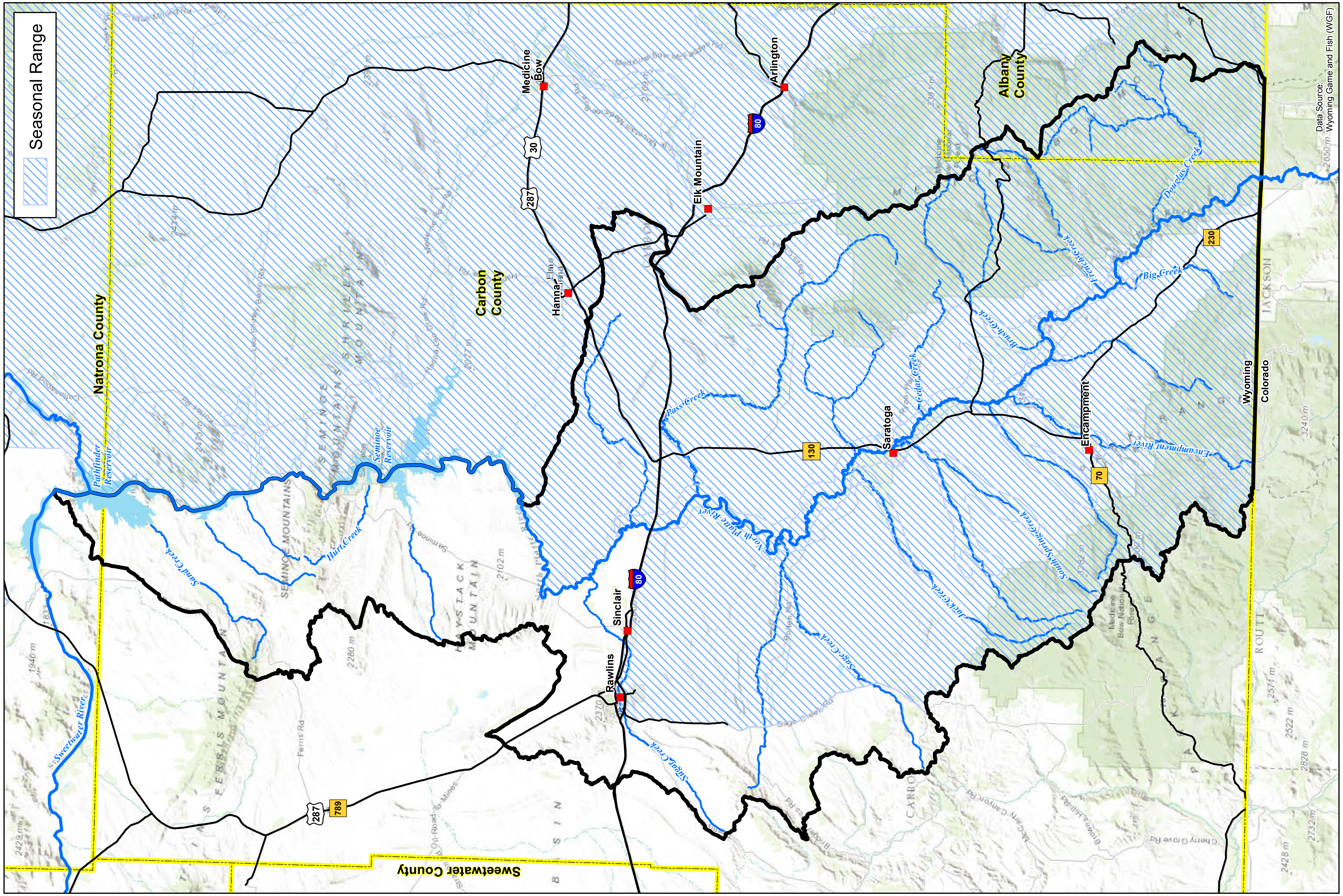


Figure 3.3-26 Upper North Platte River Watershed: White Tail Deer Habitat

Legend
- City
- Streams
- Primary Roads
- Upper North Platte Study Area
- Counties

0 40,000 80,000 Feet

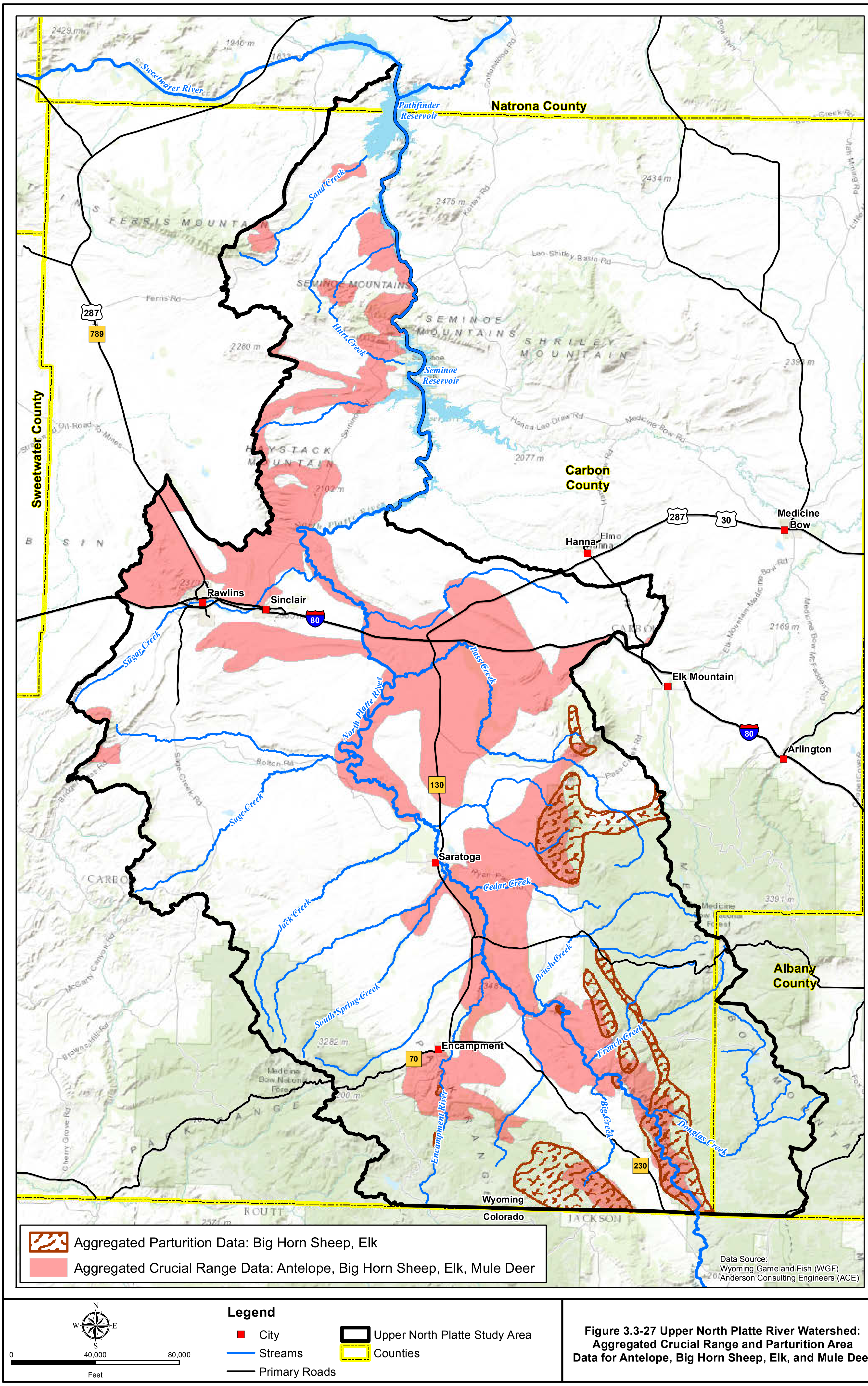


Figure 3.3-27 Upper North Platte River Watershed: Aggregated Crucial Range and Parturition Area Data for Antelope, Big Horn Sheep, Elk, and Mule Deer

3.3.7.2 Sage Grouse

Areas of known greater sage grouse (Centrocercus urophasianus) leks are displayed in Figure 3.3-28. The US Department of Interior decided in September of 2015 that the sage grouse does not require federal protection under the Endangered Species Act. However, it is recognized as a sensitive species / species of concern by the BLM and a species of concern by WGFD. In June 2008, Executive Order 2008-2 was signed by the Governor which stresses additional management consideration to sage grouse and sage grouse habitat statewide. This original executive order has been extended most recently by Executive Order 2015-4 signed by Governor Mead in July of 2015. The Order includes requirements of state agencies to encourage development outside of the Core areas and to focus management to the greatest extent possible on the maintenance and enhancements of habitat within them. The Core Sage Grouse Population Areas within the study area are delineated in Figure 3.3-28. As is evident in this figure, the Sage Grouse Core areas affect a large portion of the central watershed, from the state line north through Saratoga and surrounding Seminoe Reservoir. In total there are 892,123 acres of Sage Grouse Core area located within the Upper North Platte watershed, making up 44% of the total watershed area. While there are occupied Sage Grouse Leks located just south of Rawlins and Sinclair (as seen in Figure 3.3-28), these are not considered part of the core areas by the Wyoming Game and Fish Department.

The BLM definition of a sensitive species is as follows: species that could easily become endangered or extinct in the state, including: (a) species under status review by the FWS/National Marine and Fisheries Service; (b) species whose numbers are declining so rapidly that Federal listing may become necessary; (c) species with typically small or fragmented populations; and (d) species inhabiting specialized refuge or other unique habitats.

WGFD lists the greater sage grouse as: species that are widely distributed, with population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance. The sage grouse is not listed as a Threatened or Endangered species and does not receive any protections from the Endangered Species Act; however, BLM and WGFD have developed restrictions/recommendations to help protect the sage grouse.

3.3.7.3 Wild Horses

Following passage of the Wild, Free-Roaming Horse and Burro Act in 1971, BLM was charged with management of wild horses or burros in "herd management areas" (HMAs). The BLM establishes an "appropriate management level" (AML) for each HMA. The AML is the population objective for the HMA that will ensure a “thriving ecological balance among all the users and resources of the HMA”. For example, wildlife, livestock, wild horses, vegetation, water, and soil. Wyoming has no wild burros (BLM, 2012). Should any wild horses be found within this study area, they would be removed by BLM. Within the project study area, there are no HMAs as indicated in Figure 3.3-29.

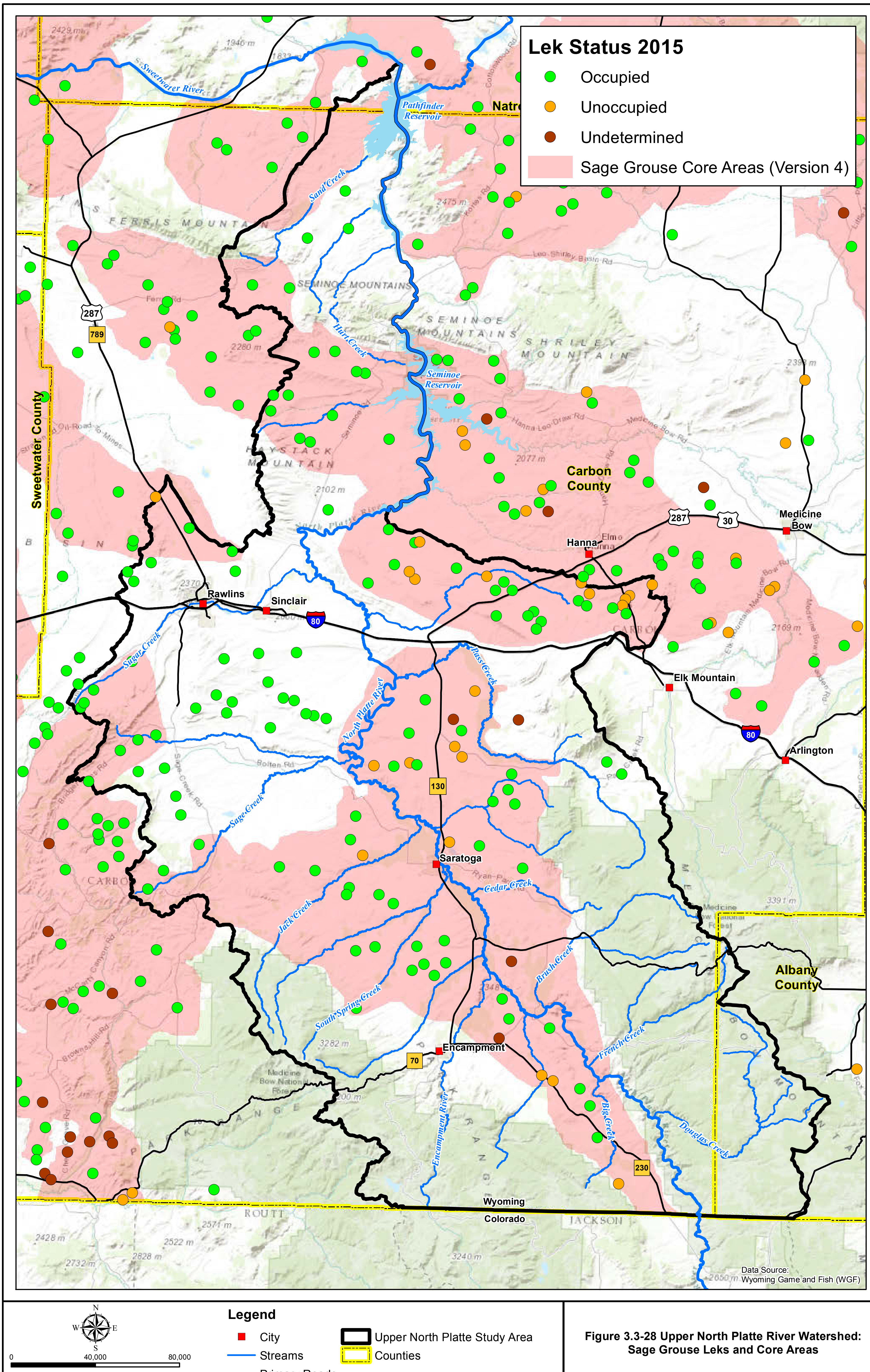


Figure 3.3-28 Upper North Platte River Watershed: Sage Grouse Leks and Core Areas

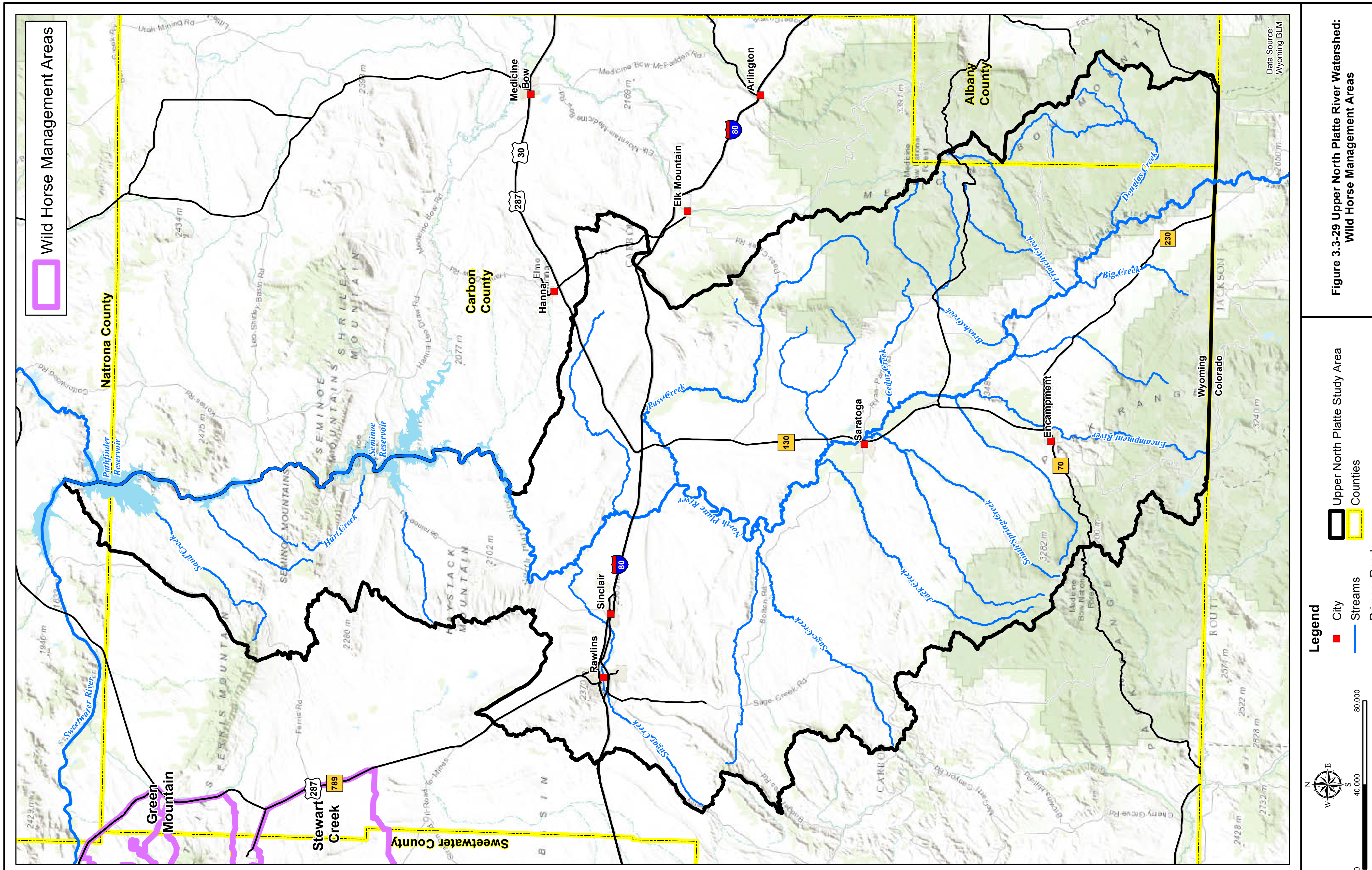


Figure 3.3-29 Upper North Platte River Watershed: Wild Horse Management Areas

3.3.7.4 WGF Crucial Habitat Areas

As part of the WGFD Strategic Habitat Plan (2009), areas within the State which have been determined to be Crucial Priority Areas or Enhancement Priority Areas for both riparian and terrestrial terrain were delineated (Figure 3.3-30). "Combined" areas were created where significant overlap occurred between aquatic and terrestrial areas. As defined by WGFD at: https://wgfd.wyo.gov/Habitat/Habitat-Plans/Habitat-Priority-Areas

> *"Crucial Priority Areas are based on significant biological or ecological values. These are areas that need to be protected or managed to maintain viable healthy populations of terrestrial and aquatic wildlife for the present and future. They represent habitat values and identify where those values occur on the landscape. Examples of values include crucial winter range, sage grouse core area seasonal habitats, Species of Greatest Conservation Need (SGCN) diversity and uniqueness, quality and condition of vegetative communities, movement corridors, quality of watershed hydrologic function, etc. The Department will concentrate habitat protection and management activities in these areas."*

> *"Enhancement Habitat Priority Areas represent those with a realistic potential to address wildlife habitat issues and to improve, enhance, or restore wildlife habitats. These areas offer potential for improving habitat and focusing Department habitat efforts. They may overlap crucial areas or be distinct from them. Enhancement areas are based on habitat issues. Like crucial areas where values are key, issues were identified by regional personnel and used to select enhancement habitat areas. Examples of issues include loss of aspen communities, habitat fragmentation, development, loss of connectivity, water quality effects, water quantity limitations, beetle killed conifer, lack of fish passage, loss of fish to diversions, degraded habitat, etc."*

Review of the WGF Crucial Habitat Area Narratives (available at https://wgfd.wyo.gov/Habitat/Habitat-Priority-Areas/Statewide-Maps/Laramie) provides the following information regarding sensitive habitat within the study area. The paragraphs were extracted directly from the narrative for Combined Crucial Habitat Area found within the project study area:

Upper North Platte Watershed

- **Habitat Value:**
  Functioning stream habitat to support and maintain wild trout fisheries, functioning riparian community, functioning wetland habitats for native amphibians, Saratoga sage grouse core area, intact shrublands and grasslands for grassland and sagebrush obligate species, important white-tailed prairie dog complexes, portions of crucial winter range for elk and mule deer, and forest habitat for big-game species.

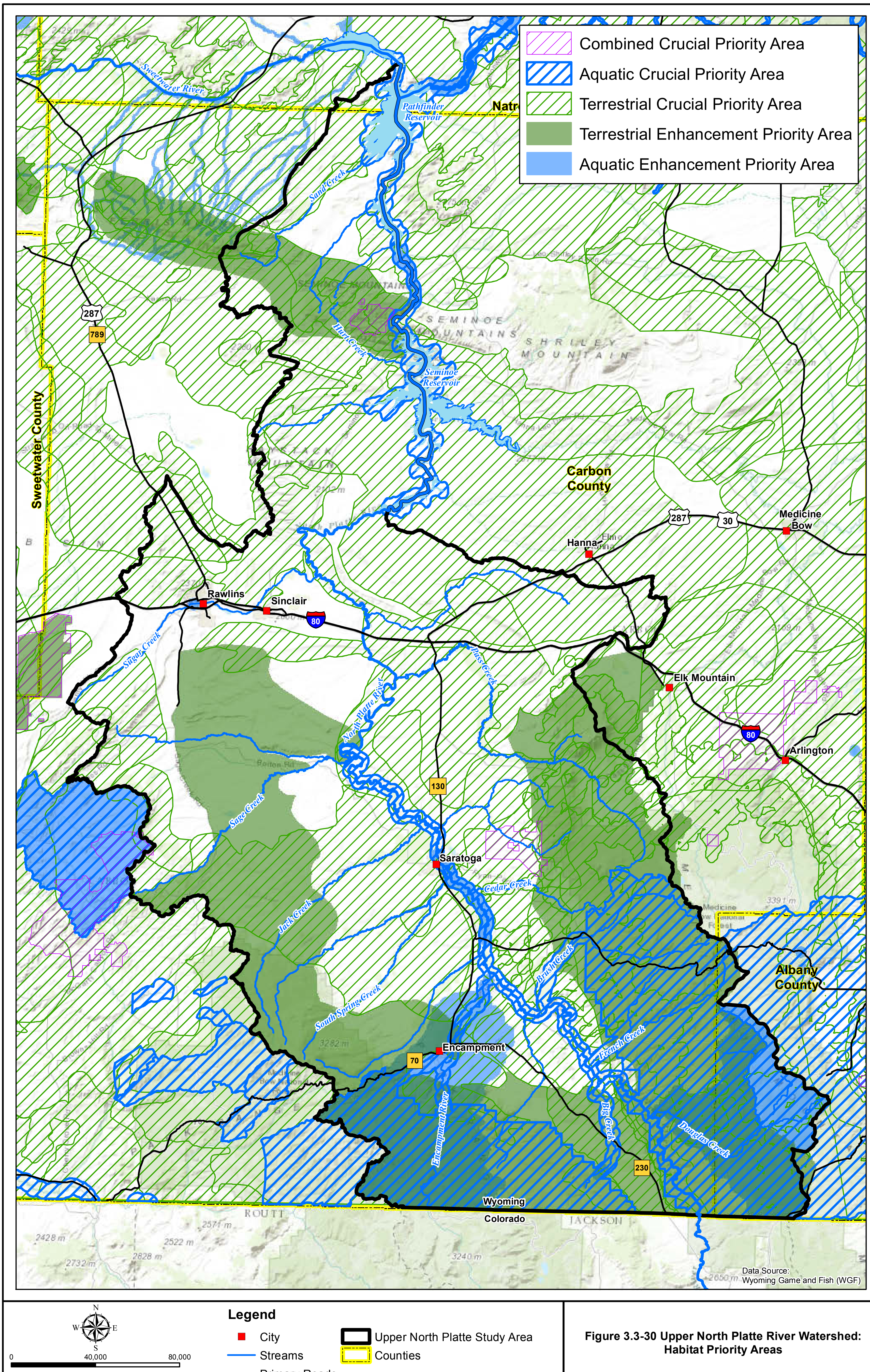


Figure 3.3-30 Upper North Platte River Watershed: Habitat Priority Areas

- **Reason Selected:**
  Provides a high diversity and abundance of aquatic and terrestrial wildlife and habitats. It provides crucial winter range for elk and mule deer and Governor's Saratoga sage grouse core habitat. It also provides spring, summer and fall range for mule deer and pronghorn. The river and connected tributaries provide a range of habitats and natural processes that maintain high wild trout populations. Also, an important number of migratory game birds use the area. The area faces a number of threats e.g. habitat fragmentation and degradation caused by residential and industrial energy development, a mountain pine beetle epidemic, etc. therefore, recognizing and conserving the existing wildlife values is important.

- **Primary species or assemblages of species:**
  SGCN species: boreal toad, bald eagle, great blue heron, Virginia rail, peregrine falcon, Brewer's sparrow, greater sage grouse, sage sparrow, sage thrasher, swift fox, sagebrush vole, white-tailed prairie dog, bighorn sheep, pine marten, moose, northern pintail, canvasback, redhead and lesser scaup. Rainbow trout, brook trout, brown trout, elk, mule deer, pronghorn, mountain lion, black bear, dark geese, herons and bitterns.

- **Solutions or actions: (partial list)**
  -Secure permanent conservation easements from willing landowners.
  -Maintain or improve natural patterns (e.g. seasonal migrations), functions (e.g. cover/food), and processes (e.g. fire) throughout the watershed for aquatic and terrestrial species.
  -Promote and facilitate riparian and channel habitat exclusion (e.g., corridor or tract fencing), or reduced frequency, duration, and intensity grazing management strategies to disperse herbivory and passively restore upland, riparian, and channel.

- **Additional Information:**
  The Pennock Mountain WHMA is located in the northeast portion of the Upper North Platte crucial habitat area. Sage grouse habitat improvement projects should be implemented on the Pennock Mountain WHMA.

3.3.8 Cultural Resources

The Wyoming State Historic Preservation Office (SHPO) maintains an in-progress database of inventoried historic sites within the state. A determination of each site's eligibility for inclusion in the National Register of Historic Places (Register) is included in the database. SHPO makes available a spatial data file which generalizes the cultural resource inventory to the section level. This "location fuzzing" of the archaeological data is to protect the sites from unauthorized disturbance. The attributes recorded for each section include: site count, inventory acres, report numbers, and eligible site number. Figure 3.3-31 displays the results of the database retrieval in a graphical format. Each square mile section within the study area has been color coded based upon the number of sites within it determined to be eligible for inclusion on the Register.

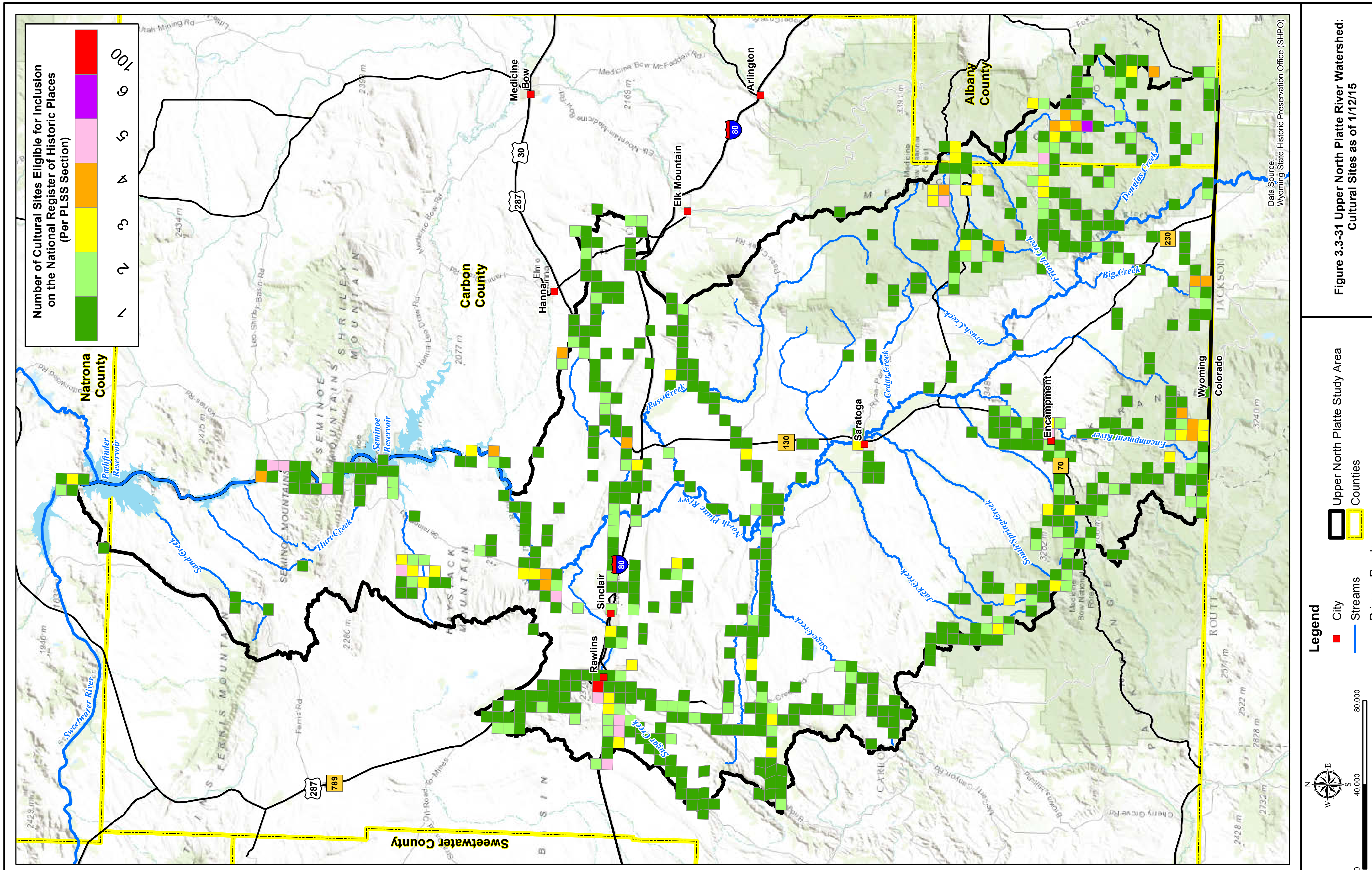


Figure 3.3-31 Upper North Platte River Watershed: Cultural Sites as of 1/12/15

The National Register of Historic Places is the nation's official list of cultural resources worthy of preservation. Administered on a federal level by the National Park Service and managed locally by the State Historic Preservation Office, the National Register is part of a program to coordinate and support both public and private efforts to identify, evaluate, and protect historic and archeological resources. The National Register recognizes the accomplishments of those who have contributed to the history and heritage of the United States, the state, and local communities.

In addition, the State of Wyoming Trails Department has created a database of historic forts within the state. One of these historic forts is located in the Upper North Platte watershed. The Fort Fred Steele historic site is located 13 miles east of present day Rawlins. The fort was established on June 20, 1868 by Colonel Richard I. Dodge, who selected this site on the west bank of the North Platte River, and named the fort for Major General Frederick Steele, 20th U.S. Infantry, a Civil War hero. Fort Fred Steele was occupied until August 7, 1886 by soldiers who were sent by the U.S. Government to guard the construction of the transcontinental railroad against attack from Indians.

BLM has also mapped the historical trails in Wyoming and 4 of these trails travel through the Upper North Platte watershed. The historic trails crossing the study area are: Cherokee Trail Northern and Southern Routes, Overland, and the Rawlins-Ft. Washakie Stage Road. Figure 3.3-32 displays the historic trails, sites listed on the National Registry of Historic Places, and historic monuments and markers within the State of Wyoming.

Listing a property on the National Register of Historic Places is a form of acknowledgment and prestige, which places no restraints on the property. The National Register does not restrict the rights of property owners to use, develop, or sell the property. Although placing a property on the National Register neither stops alterations to a building nor requires owners to provide the public access to the property, it can provide the owner with eligibility for certain financial incentives (NPS, 2009 at http://www.nps.gov/history/nr/).

To date, 22 sites within the study area have been included in the Register (see Table 3.3-3).

3.4 Natural Environment

3.4.1 Climate

The Upper North Platte Watershed study area contains topography ranging in elevation from 5,860 msl feet along the banks of Pathfinder Reservoir to over 12,000 msl feet in the Snowy Range of the Medicine Bow Mountains. The highest point within the study area is Medicine Bow Peak sitting at 12,012 feet.

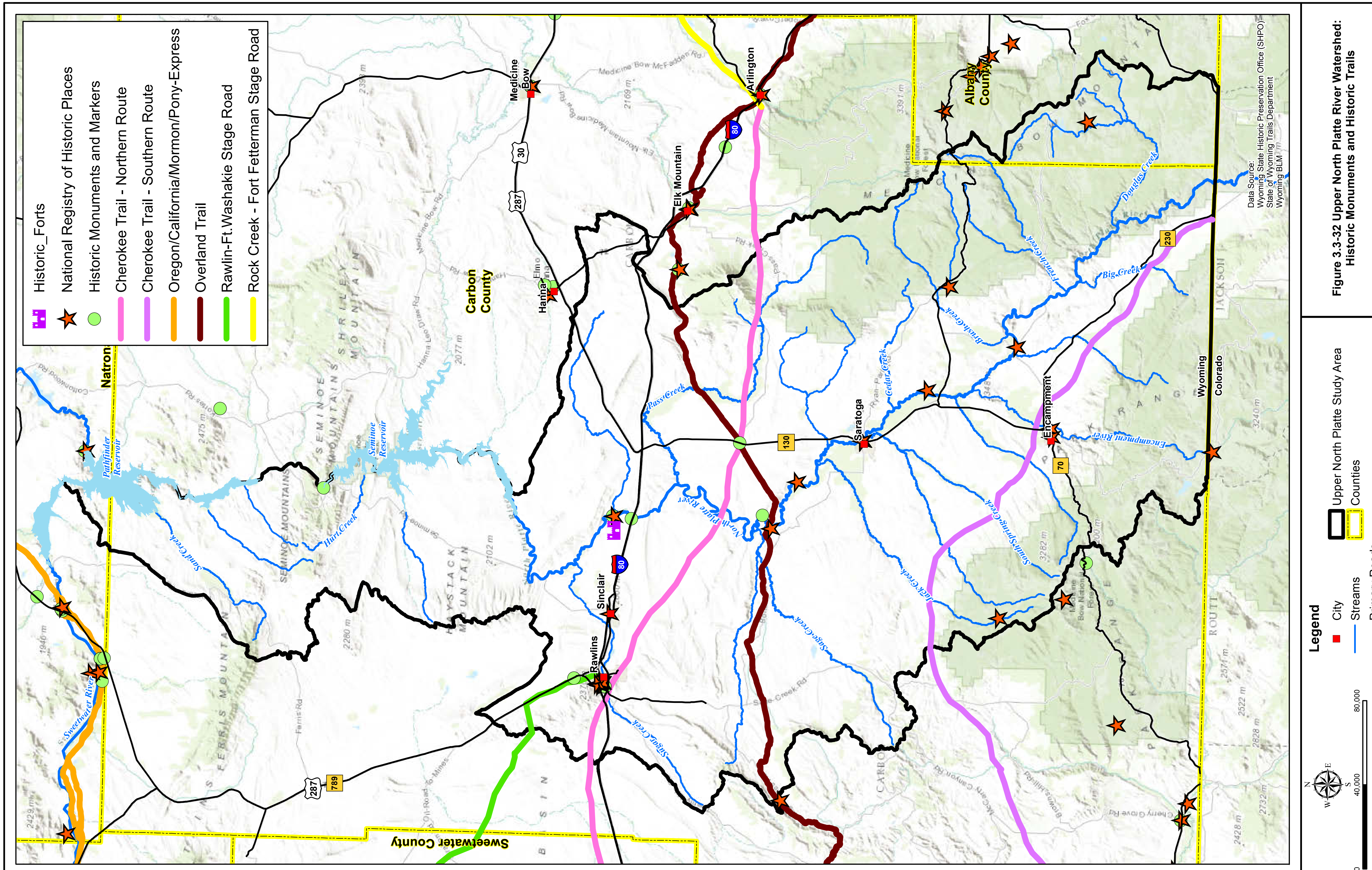


Figure 3.3-32 Upper North Platte River Watershed: Historic Monuments and Historic Trails

Table 3.3-3 National Register of Historic Places: Upper North Platte River Watershed.

National Register of Historic Place	Description
Bridger's Pass	Bridger's Pass was second in importance only to South Pass as a major central passageway over the continental divide during the period of westward development and migration that occurred in the United States around mid-nineteenth century.
Brush Creek Work Center	The work center was originally built by the Civilian Conservation Corps from 1937-1940 as an administrative facility for the Brush Creek Ranger Distric
DMJ Pick Bridge	Bridges built in the first three decades of the twentieth century (1905-1935). One feature that all steel truss bridges shared was their versatility. Quickly erected, they could also be dismantled and moved if necessary.
DML-Butler Bridge	Bridges built in the first three decades of the twentieth century (1905-1935). One feature that all steel truss bridges shared was their versatility. Quickly erected, they could also be dismantled and moved if necessary.
Downtown Rawlins Historic District	The Downtown Rawlins Historic District comprises the central business district of Rawlins, Wyoming and dates from the 1880s.
Downtown Rawlins Historic District (Boundary Increase)	Downtown Rawlins Historice District expansion
George Ferris Mansion	George Ferris Mansion and carriage house are excellent examples of the popular Victorian architectural style known as Queen Anne. George Ferris was one of Wyoming's more prominent businessmen.
Fort Steele	Fort Fred Steele contributed to national history in the areas of United States Military and Indian affairs, transcontinental transportation and communication, and its history also relates to the cattlemen's frontier and settlement
France Memorial United Presbyterian Church	The France Memorial United Presbyterian Church in Rawlins is historically significant as it is the structure housing one of the oldest Presbyterian congregations in Wyoming, first organized in 1869
Grand Encampment Mining Region: Boston Wyoming Smelter Site	The Boston-Wyoming Smelter site is a specific point of interest relative to the Grand Encampment Mining District
Hotel Wolf	The Wolf Hotel is a two and a half story, brick and frame building which opened to the public in January 1894.
Hugus Hardware	Shively (Hugus) Hardware is a business anchor for the downtown commercial area and a dominant structure along Bridge Street in Saratoga, Wyoming
Jack Creek Guard Station	The Jack Creek Guard Station is significant because it is an excellent example of a popularized vernacular architectural style for typical early Forest Service overnight cabins.
Keystone Work Center	Structure located in the Little Beaver Creek drainage on the southeastern slopes of the Medicine Bow Range in southern Wyoming. It was originally built as a remote ranger station and converted into a work center when the Keystone Ranger District was discontinued.
Parco Historic District	Sinclair, Wyoming, first known as Parco,was a company-built town designed by the Denver-based architectural firm of Fisher and Fisher. It was financed by oil magnate Frank Kistler.
Platte River Crossing	The significance of the Platte River Crossing Site rests primarily with its being the location where the Overland Trail reached and passed over the North Platte River, a major watercourse along the Trail.
Rawlins Residential Historic District	Also known as the Sheep Hill/Capital Hill Historic District, the Rawlins Residential Historic District is adjacent to the north and east sides of the traditional commercial district of the
Ryan Ranch	Founded in 1874, the Ryan Ranch is one of the oldest ranches in the Upper North Platte River Valley.
Saratoga Masonic Hall	The Saratoga Masonic Hall is a two-story red brick flat-roofed building constructed in 1892. It is representative of late nineteenth century period of construction in Saratoga,
Union Pacific Railroad Depot	Constructed in 1901 with a baggage and telegraph addition to the west side (1901-1903) and an Eating House addition to the east side (1903-1912). The Depot is representative of the influence of the railroad and its transportation connections as related to the development and growth of Rawlins.
Willis House	The Willis House is a two-story modified American Four Square style house built in 1908. The house was built by Mrs. Lydia M. Willis to be a deluxe house of prostitution and the headquarters of the Willis business empire.
Wyoming State Penitentiary District	The Wyoming State Penitentiary is one of Wyoming's most significant historic sites. The penitentiary complex is historically and architecturally important on both a local and regional level.

Figure 3.4-1 displays the isohyetals (lines of equal precipitation) within the study area. This figure clearly shows the relationship between elevation and precipitation amounts. The data used to generate this figure were obtained from the Wyoming Geographic Information Center (WyGISC). These data represent the results of PRISM spatial climate data generated at the Oregon Climate Center, Oregon State University. As indicated in this figure, the mean annual precipitation varies from a minimum of about 7 inches at the lower elevations to over 61 inches at the highest elevations, with approximately 40 percent of the central watershed receiving only 9 to 11 inches of precipitation annually.

Historic climate data for six NOAA Cooperative Weather Stations in and immediately adjacent to the study area was obtained through the Western Regional Climate Center website (http://www.wrcc.dri.edu/). The recorded temperatures at all stations are typically cool, with average daily temperatures ranging between 12°F and 32°F in midwinter and 51°F to 84°F during midsummer. The annual average total precipitation for the study area is 11.06 inches. Table 3.4-1 presents the average temperature range and average total precipitation while Figure 3.4-2 presents the average climatic conditions recorded by the weather stations located within and adjacent to the study area.

Table 3.4-1 Summary of Monthly Climatic Data: Upper North Platte River Watershed.

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Encampment 11 ESE, Wyoming 483045: 8/1/1948 to 10/31/1998													
Average Max. Temperature (F)	33	35.8	41.7	52.6	63.1	72.6	79.7	78.3	70.5	59.5	43.8	35.5	55.5
Average Min. Temperature (F)	10.4	12.2	17.1	24.8	33.4	40.1	46.2	45.1	36.8	27.6	18.1	11.8	27.0
Average Total Precipitation (in.)	0.79	0.81	1.21	1.58	1.77	1.31	1.31	1.37	1.2	1.3	1.07	0.87	14.59
Saratoga 1 Sse, Wyoming 487990: 8/1/1948 to 3/11/2008													
Average Max. Temperature (F)	33.3	36.7	43.8	54.9	65.7	76.1	83.3	80.9	72	59.6	43.7	35.4	57.1
Average Min. Temperature (F)	10.5	13.4	19.7	27.4	35.7	43.5	49.5	47.2	38.6	29.1	19.1	12.2	28.8
Average Total Precipitation (in.)	0.47	0.45	0.73	0.96	1.37	0.94	0.91	0.94	0.9	1.01	0.56	0.44	9.68
Rawlins AP, Wyoming 487533: 3/6/1951 to 1/20/2015													
Average Max. Temperature (F)	30.8	33.7	41.5	52.7	63.9	75.5	84	81.3	70.6	57	40.8	32	55.3
Average Min. Temperature (F)	12.7	14.5	20.5	27.7	36.2	44.5	51.6	50	40.8	31.2	20.5	13.8	30.3
Average Total Precipitation (in.)	0.45	0.51	0.68	1.02	1.28	0.87	0.77	0.74	0.83	0.8	0.56	0.47	8.98
Seminoe Dam, Wyoming 488070: 8/5/1948 to 8/31/2011													
Average Max. Temperature (F)	30.2	33.6	40.7	52.9	63.7	75	83.7	81.4	71.2	57.7	41.5	32.1	55.3
Average Min. Temperature (F)	12.9	15	19.8	28.4	37.4	46.9	53.9	52	42.7	33	22.8	15.3	31.7
Average Total Precipitation (in.)	0.55	0.65	1.11	1.52	2.09	1.38	0.97	0.73	0.97	1.13	0.9	0.66	12.66
Leo 6 SW, Wyoming 485525: 1/1/1930 to 12/31/2014													
Average Max. Temperature (F)	33	37.6	45.3	56.8	67.5	78	86.1	83.3	74.9	62.3	45.4	36.9	58.9
Average Min. Temperature (F)	11.8	15.3	20.3	28.7	36.5	43.8	49.8	48.7	39.9	32.1	20.9	16.3	30.3
Average Total Precipitation (in.)	0.55	0.65	0.85	1.25	1.67	1.07	0.85	0.69	0.82	1.05	0.76	0.59	10.80
Pathfinder Dam, Wyoming 487105: 10/1/1905 to 12/31/2014													
Average Max. Temperature (F)	32.3	35.7	43.7	55.1	65.8	77.4	86.3	84.5	74.3	60.9	45.1	34.8	58.0
Average Min. Temperature (F)	12.3	14.5	21.2	30.3	38.9	48.1	54.9	53.5	43.5	34.1	23.8	15.5	32.6
Average Total Precipitation (in.)	0.3	0.39	0.62	1.18	1.71	1.18	0.93	0.72	0.85	0.95	0.46	0.36	9.65

It must be kept in mind that this information must be viewed in light of the fact that climate changes are occurring and will likely continue to occur into the future. Causal relationships are open to debate, however, according to a recent publication of the University of Wyoming (Gray, S., C. Anderson, 2009):

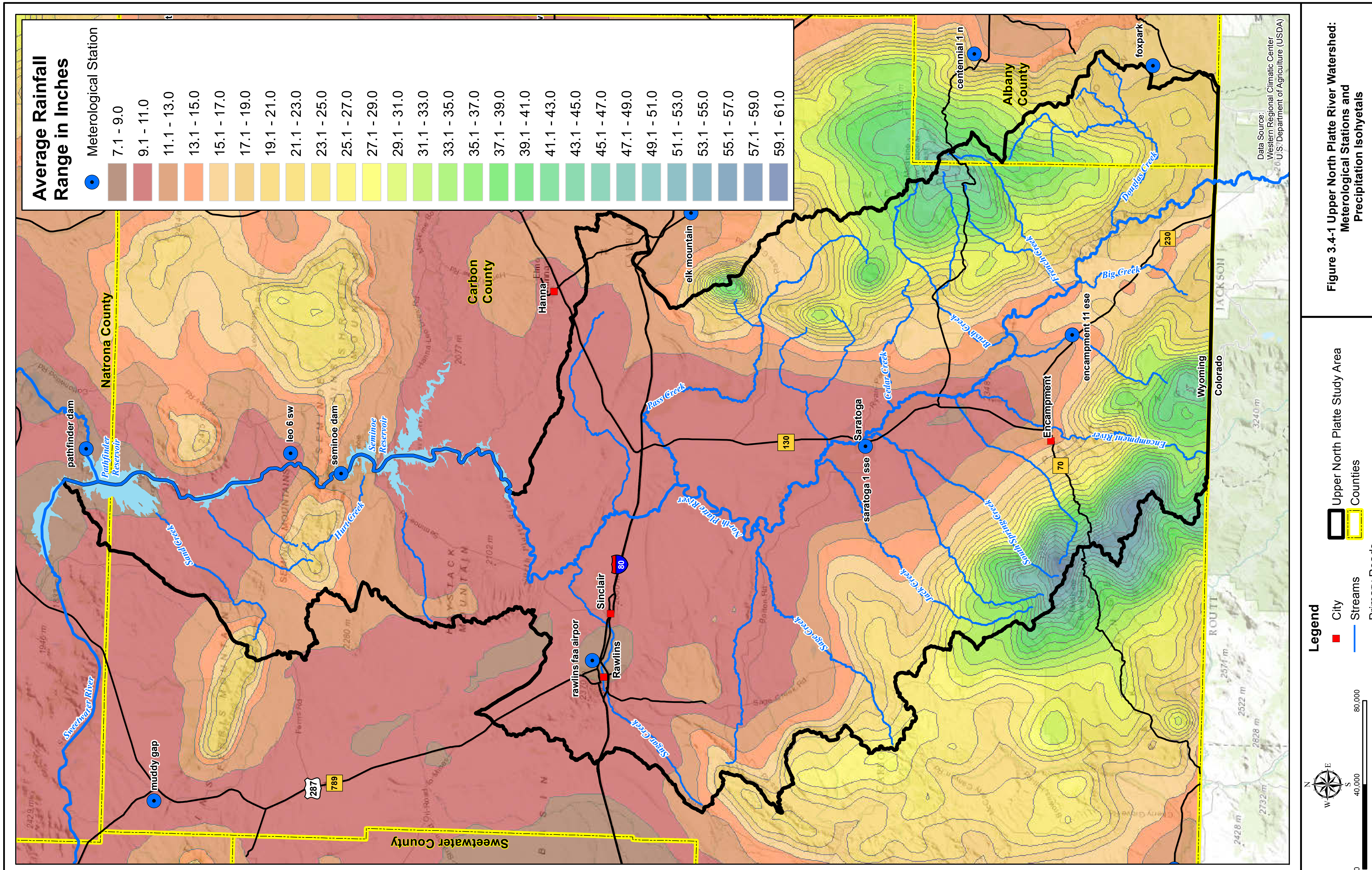
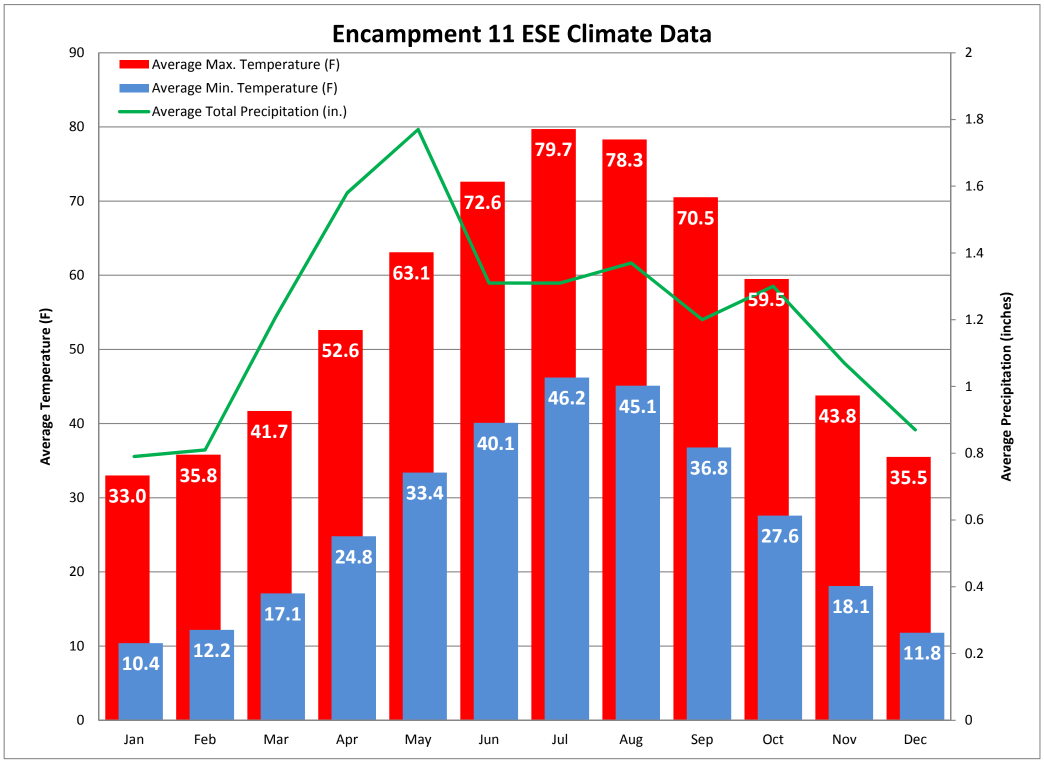


Figure 3.4-1 Upper North Platte River Watershed: Meterological Stations and Precipitation Isohyetals



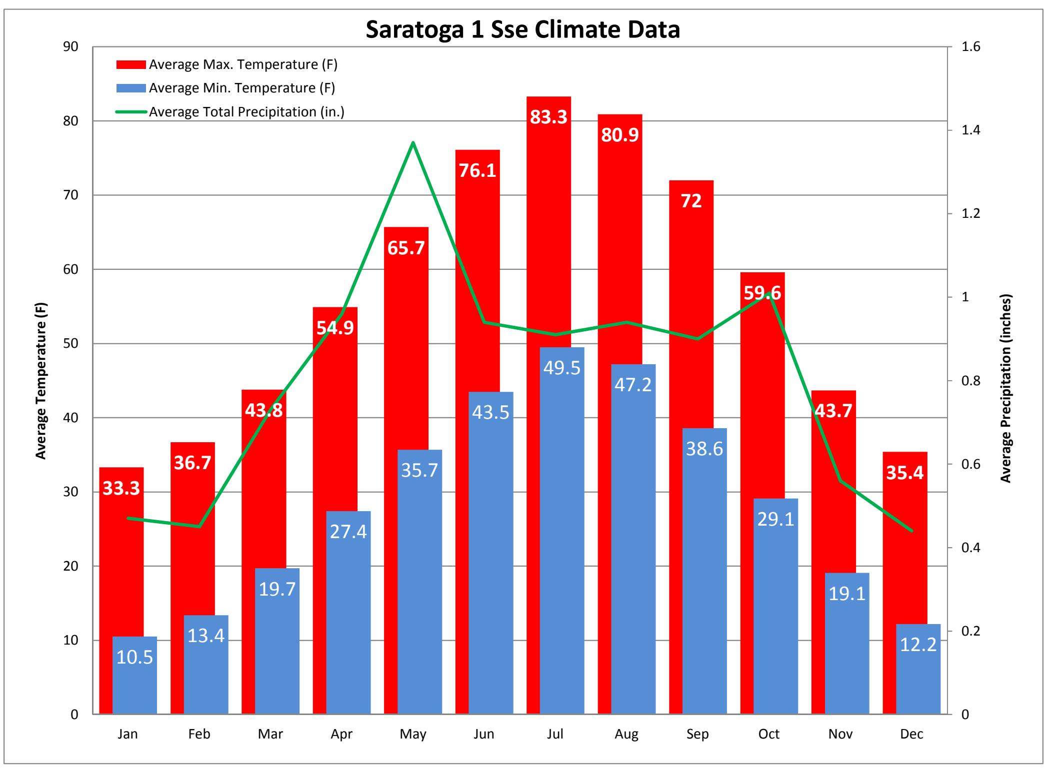
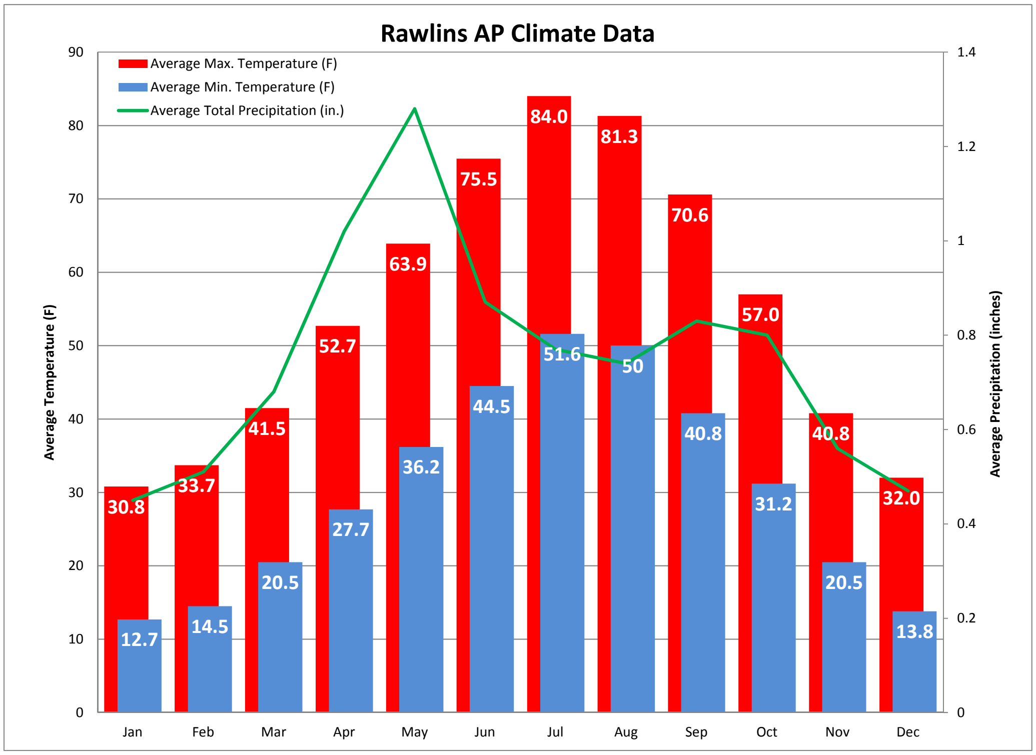


Figure 3.4-2 Mean Monthly Climatic Factors for Upper North Platte River Watershed (1905 – 2015).



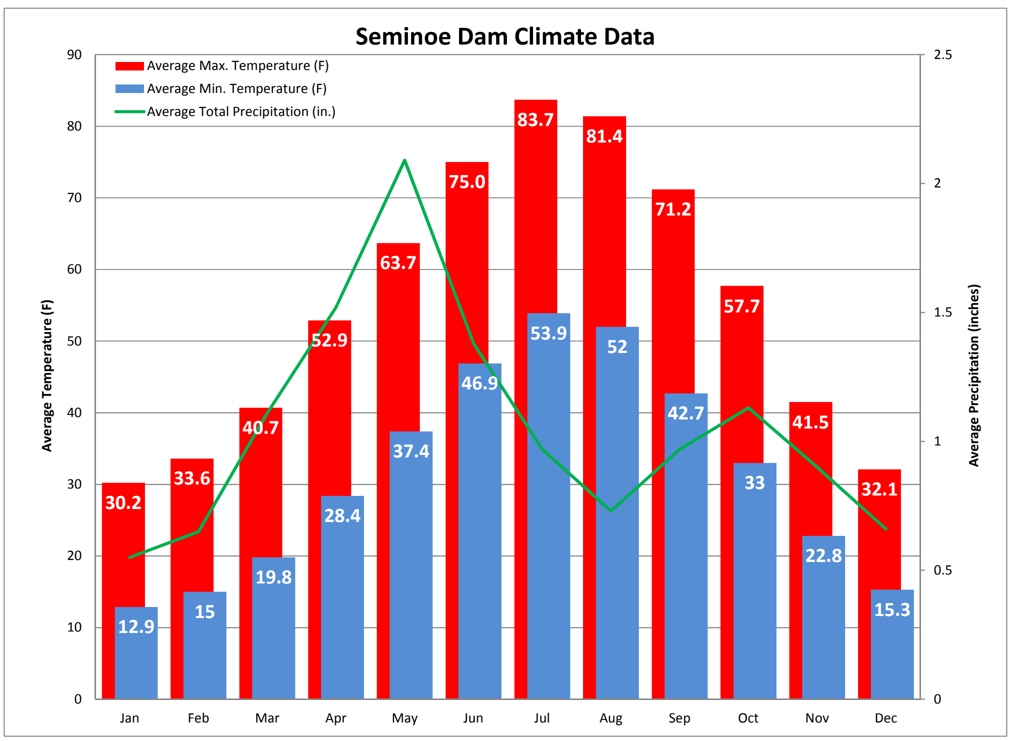
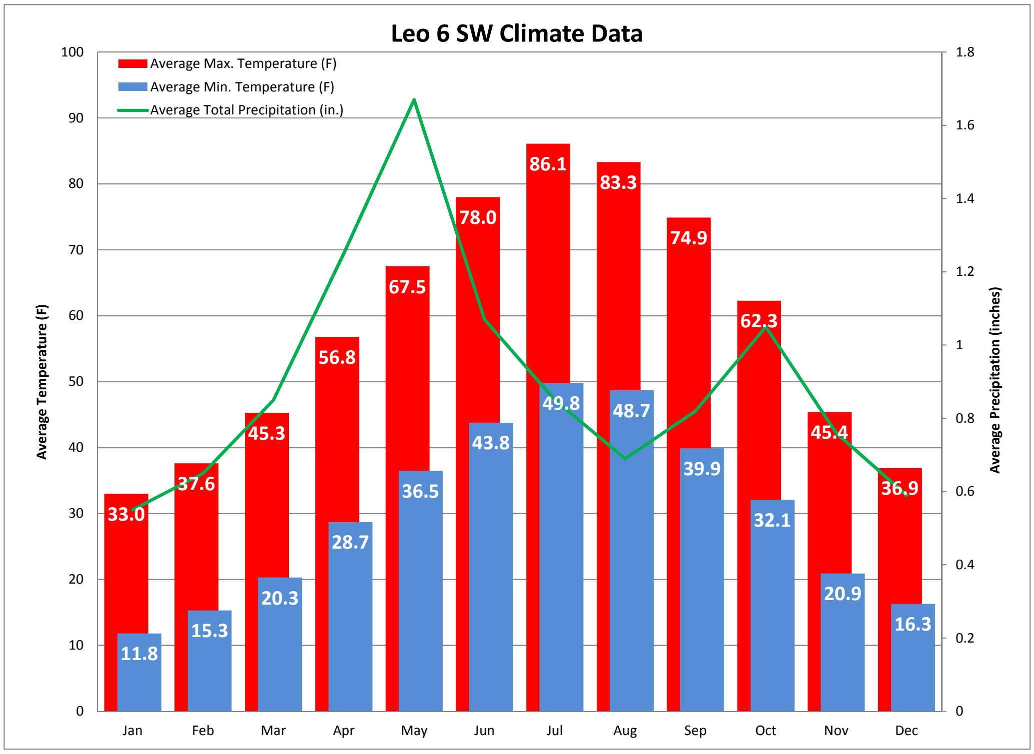


Figure 3.4-2 (continued) Mean Monthly Climatic Factors for Upper North Platte River Watershed (1905 – 2015).



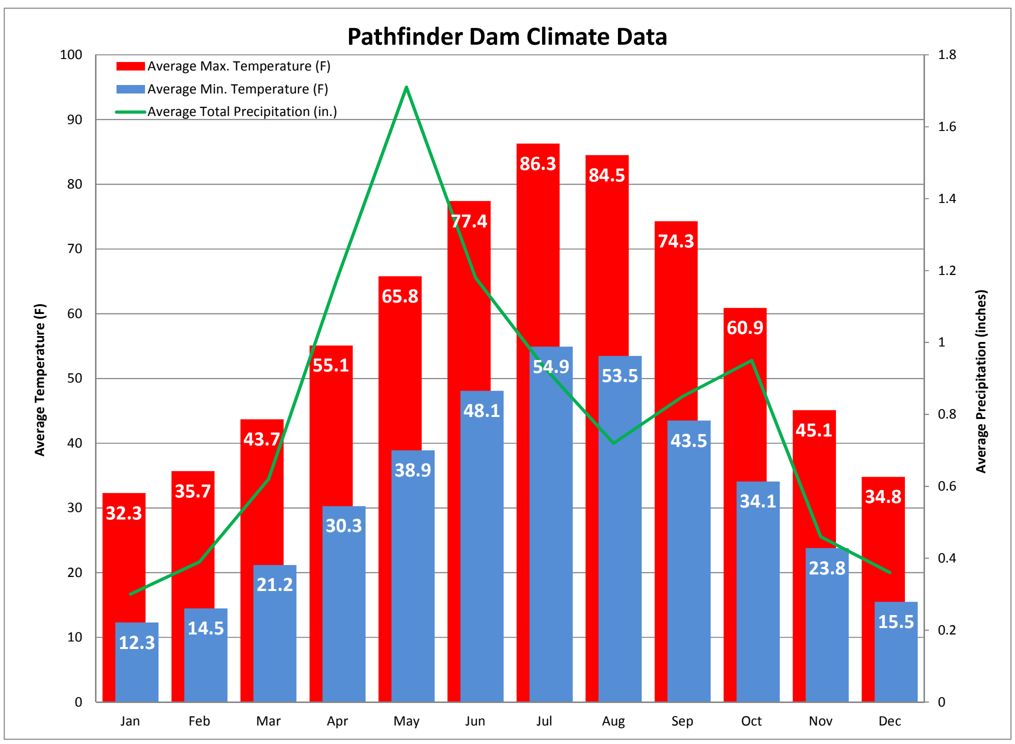


Figure 3.4-2 (continued) Mean Monthly Climatic Factors for Upper North Platte River Watershed (1905 – 2015).

"There is mounting evidence that the earth is experiencing a warming trend. Climate change has resulted in a 1° F increase in average global temperature in the past century, largely in the past 30 years (IPCC 2007). The concern now is that climate change may increase the impact of droughts, just as population growth and other factors have greatly increased the West's vulnerability to water shortages. The impacts of these global changes on Wyoming's weather and river systems include altered precipitation patterns and changes to the timing of snowmelt and river flows, which together will significantly alter Wyoming's water supply."

3.4.2 Vegetation and Land Cover

There are multiple sources of data describing vegetation and land cover for the Upper North Platte River Watershed Study Area. The principle sources are discussed below.

3.4.2.1 National Land Cover Database (NLCD)

Land cover within the watershed was evaluated using the National Land Cover Database (NLCD). The NLCD is distributed by the Multi-Resolution Land Characteristics Consortium (MRLC) and serves as the definitive Landsat-based, 30-meter resolution, land cover database for the Nation. NLCD provides spatial reference and descriptive data for characteristics of the land surface such as thematic class (for example, urban, agriculture, and forest), percent impervious surface, and percent tree canopy cover. NLCD supports a wide variety of Federal, State, local, and nongovernmental applications that seek to assess ecosystem status and health, understand the spatial patterns of biodiversity, predict effects of climate change, and develop land management policy. NLCD products are created by the Multi Resolution Land Characteristics (MRLC) Consortium, a partnership of Federal agencies led by the U.S. Geological Survey. (Homer, C.H., Fry, J.A., and Barnes C.A., 2012, the National Land Cover Database, U.S. Geological Survey FactSheet 2012-3020, 4 p.). Table 3.4-2 presents the results of National Land Cover Database analysis for the study area.

3.4.2.2 LANDFIRE

In order to draw a clearer picture of the land cover within the watershed the vegetative cover within the study area was also evaluated using data obtained through the LANDFIRE project (www.landfire.gov) LANDFIRE (Landscape Fire and Resource Management Planning Tools Project) is an interagency vegetation, fire, and fuel characteristics mapping project. It is a shared project between the Department of Interior (DOI) and Forest Service wildland fire management programs. The primary purpose of the LANDFIRE project is to collect the data necessary to develop wildland fire models. The data are generated using remote sensing techniques with on-the-ground truthing. Data products accessed for this project included 30-meter spatial resolution raster data sets describing vegetation type and cover. LANDFIRE vegetation map units are derived from NatureServe's Ecological Systems classification (Comer and others, 2003). While the geographic resolution (30-meter) of the LANDFIRE data is the same as the NLCD data discussed previously, the classification system used by the LANDFIRE dataset is more highly evolved than the NLCD data. This allows a finer classification of the vegetative cover within the study area.

Table 3.4-2 National Land Cover Database Analysis for the Upper North Platte River Watershed.

Upper North Platte Watershed : National Land Cover Database (NLCD)			
Classification	**Description**	**Acres**	**Percent of Watershed**
Shrub/Scrub	Areas dominated by shrubs; less than 16 feet tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.	1,231,540	60.5%
Evergreen Forest	Areas dominated by trees generally greater than 16 feet tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.	345,859	17.0%
Grassland/Herbaceous	Areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.	254,575	12.5%
Pasture/Hay	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.	69,452	3.4%
Deciduous Forest	Areas dominated by trees generally greater than 16 feet tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.	37,696	1.9%
Emergent Herbaceous Wetlands	Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	26,402	1.3%
Open Water	Areas of open water, generally with less than 25% cover of vegetation or soil.	22,514	1.1%
Woody Wetlands	Areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	21,140	1.0%
Other	Classifications with less than 1% of study area	27,989	1.4%
Total		2,037,166	100%

The LANDFIRE data describes numerous attributes pertinent to this study, including:

- Environmental Site
- Potential Biophysical Settings
- Existing Vegetation Type
- Existing Vegetation Height
- Existing Vegetation Cover

The LANDFIRE "existing vegetation type" (EVT) data were analyzed and the distribution of vegetation classes is summarized in Appendix 3C. The LANDFIRE existing vegetation data indicate a diverse collection of vegetation types totaling 86 different vegetation classes within the Upper North Platte River watershed.

As is clearly indicated in the data, the major sagebrush community (Inter-Mountain Basins Big Sagebrush Shrubland) dominates coverage of the watershed totaling over 32% of the study area. While the fact that the majority of the study area is covered in sagebrush comes as no surprise, the table presents valuable information pertaining to the vegetation types present to a much lesser extent. In order to aid in future analysis and enable the LANDFIRE data to be utilized as a land management/planning tool, the Existing Vegetation Type (EVT) data has been intersected with the sub-watersheds (12 digit hydrologic units) within the study area. The result of this analysis has been included in the project GIS and Digital Library delivered with this report. This data intersection will facilitate a more focused vegetation analysis based on the sub-watersheds within the study area.

While the LANDFIRE data provides valuable insight into watershed conditions, its display is difficult because of the fact the data are represented by a grid with 30 meter spacing. The LANDFIRE data set is included within the project GIS and available for use in subsequent projects and associated efforts. However, for graphical purposes, data obtained through the Wyoming Gap Analysis program are shown on Figure 3.4-3. Analytical tools available within the project GIS facilitate use of the LANDFIRE data for regional watershed planning. For example, areas of the watershed identified as any of several juniper species communities can be identified and evaluated onsite to determine potential encroachment areas. Similar evaluations within the project GIS can be completed for wetland/riparian communities in order to determine areas where the SERCD may concentrate future planning efforts.

3.4.2.3 GAP Analysis

The Wyoming GAP dataset was produced "with an intended application at the state or ecoregion level - geographic areas from several hundred thousand to millions of hectares in size. The data provide a coarse-filter approach to vegetation analyses, meaning that not every occurrence of habitat is mapped; only large, generalized distributions are mapped, based on the USGS 1:100,000 mapping scale in both detail and precision. Therefore, this dataset can be used appropriately for coarse-scale (> 1:100,000) applications, or to provide context for finer-level maps or applications" (University of Wyoming, Spatial Data Visualization Center, 1996). For the purposes of this project however it is the most display friendly vegetative dataset available and provides generalized distributions of the vegetative land cover located within the Upper North Platte River watershed. Figure 3.4-3 displays the Wyoming Gap Analysis results for the study area. Note that the classifications in the figure are listed in their order of abundance within the watershed. Of the 25 different GAP classifications present in the watershed, three dominate the landscape and make up a combined 63% of the study area. The dominant GAP classifications are Wyoming Big Sagebrush (36%), Lodgepole Pine (14%), and Mountain Big Sagebrush (13%).

Distinct plant communities within the study area are influenced by characteristics such as soil depth, texture, and salt content; climate variables, particularly temperature, total and seasonal distribution of precipitation, and wind; and topographic features, most importantly elevation, aspect, and slope. Plant communities respond to other environmental influences such as wildlife foraging, rodent burrowing, and ant hills. Plants themselves also influence soil chemistry and soil resistance to wind and water erosion. Vegetation management goals, objectives and actions related to the study area are available in the Rawlins BLM Resource Management Plan (2008) located in the Digital Library delivered with this report.

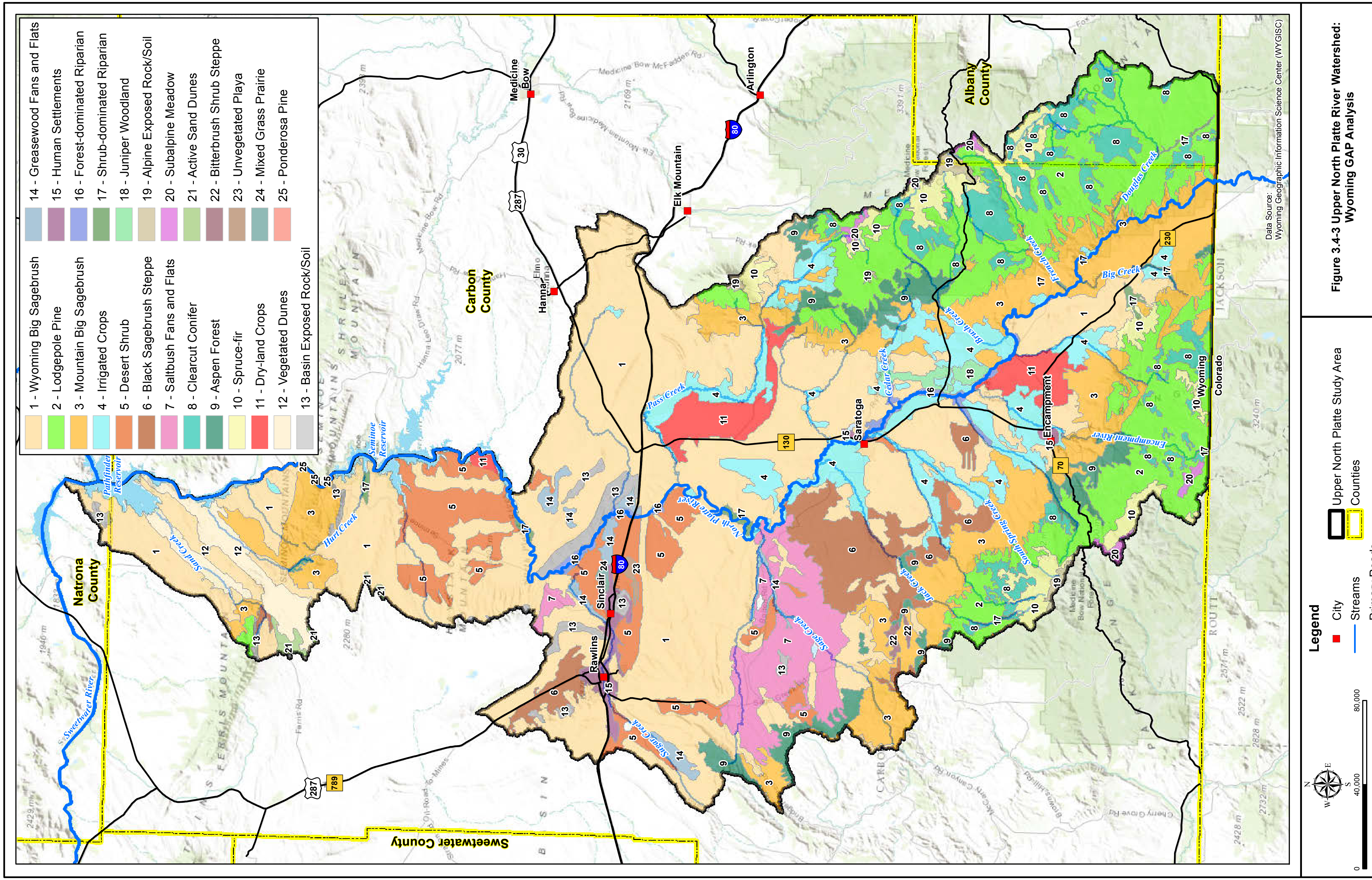


Figure 3.4-3 Upper North Platte River Watershed: Wyoming GAP Analysis

3.4.2.4 Wyoming Natural Diversity Database (WYNDD)

The Wyoming Natural Diversity Database (WYNDD) lists vegetative species of concern or species of potential concern which have been documented within the study area. The database was queried and the results are presented in Appendix 3D.

3.4.2.5 Pine Beetle Epidemic and Vegetation

The discussion of vegetation and land cover would not be complete without addressing the mountain pine beetle epidemic occurring on the forested lands within the study area. The Medicine Bow National Forest makes up 22% of the landownership within the study area and is located primarily in the southern portion of the basin. The following regarding the outbreak and its history is extracted from: Review of the Forest Service Response: The Bark Beetle Outbreak in Northern Colorado and Southern Wyoming (USDA 2011). This report is also included in the digital library delivered with this report.

A mountain pine beetle outbreak in three national forests in the Rocky Mountain Region (Region 2) of the U.S. Forest Service—the Arapaho-Roosevelt, Medicine Bow-Routt and White River—was initially detected in 1996. By 2010 it had spread to about four million acres.

Factors that helped set the stage for a large-scale outbreak included:

- Consecutive years of severe drought in the late 1990s and through the middle of the first decade of the 2000s, putting already densely populated stands under severe stress.
- Funding for pre-commercial and commercial thinning to reduce stand density during the decade leading up to and including the outbreak did not keep pace with the rate of bark beetle outbreak spread.
- Limited accessibility of terrain (only 25% of the outbreak area was accessible due to steep slopes, lack of existing roads, and land use designations such as Wilderness that precluded treatments needed to reduce susceptibility to insects and disease).
- Decline in public acceptance of large-scale timber management practices in the last part of the 20th century. This lack of public acceptance, compounded by national and international market forces and the relatively low commercial value of lodgepole pine, contributed to a corresponding decline in the timber industry. (The timber industry in the Rocky Mountain Region has declined by 63 percent since 1986).

Historical land uses involving mining and the railroad construction in the area also contributed to setting the stage for a large scale epidemic.

The tie hacking industry in the area of Wyoming and Colorado that is now the Medicine Bow National Forest began in 1868 with the construction of the Transcontinental Railroad. During the peak construction years, 1868 to 1870, timber for 3 million railroad ties was removed. Between 1869 and

1902 (the year the Medicine Bow National Forest was established), timber for another 10 million railroad ties was taken, representing 90-95% of the total volume of forest products.

This scale of tree removal, and the clearing of large areas to expose the geology for mining exploration and extraction, resulted in a "regeneration event" in thousands of acres of pine forests—in other words, whole forests started over with seedlings. This contributed to the current stand structure where a mature overstory is the prevalent condition (USDA 2011).

In order to understand the extent of the change occurring in the forest, Table 3.4-3 presents the summary characteristics related to basal area for 4 watersheds within the study area between 2002 and 2012. Note that this table has been edited to show only watersheds within the study area. The full report (Troendle & Nankervis, 2014) is available in the digital library delivered with this report. The basal area of a tree is defined as the cross-sectional area of a single tree at breast height. This measurement can be used to determine forest stand density and can be linked to timber stand volume and growth. As seen in the table, the watersheds within the study area have seen significant basal area reductions between 2002 and 2012.

Table 3.4-3 Summary Characteristics of Four Watersheds between 2002 and 2012.

Watershed	Watershed Area mi^2	Forested Area mi^2	Percent Area Forested	Percent Change in Basal Area
North Platte River	1430.0	644.0	45	-48.7
North Brush Creek	37.5	37.5	100	-37.0
Encampment River above Hog Park	72.8	72.1	99	-66.5
Encampment River at Mouth	261.8	193.7	74	-59.6

Any analysis of vegetative cover within this watershed must keep in mind that the forests located in the southern portion of the watershed are in a transition phase. A mountain pine beetle outbreak of this scope is unprecedented in this area, making accurate predictions regarding the future forest makeup difficult at best.

At larger scales, lodgepole pine forests affected by mountain pine beetles will regenerate naturally and a new forest will emerge with time. While dead trees on a mountain slope may not be visually appealing, the forest has been reset—not destroyed. (USDA 2011)

The effects of the pine beetle epidemic on irrigation and watershed hydrology are discussed in Sections 3.3 and 3.5 respectively in this report.

3.4.2.6 Noxious Weeds

Vegetation of particular importance with respect to land use and habitat that were identified by Wyoming Weed and Pest Council.

Designated Noxious Weeds W.S. 11-5-102 (a) (xi) and Prohibited Noxious Weeds W.S. 11-12-104. For more information see: http://www.wyoweed.org

- Field bindweed (Convolvulus arvensis L.)
- Canada thistle (Cirsium arvense L.)
- Leafy spurge (Euphorbia esula L.)
- Perennial sowthistle (Sonchus arvensis L.)
- Quackgrass (Elymus repens (L.) Gould.)
- Hoary cress (whitetop) (Cardaria draba & Cardaria pubescens (L.) Desv.)
- Perennial pepperweed (giant whitetop) (Lepidium latifolium L.)
- Ox-eye daisy (Leucanthemum vulgare Lam.)
- Skeletonleaf bursage (Ambrosia tomentosa Nutt.)
- Russian knapweed (Acroptilon repens L.)
- Yellow toadflax (Linaria vulgaris (P.) Mill)
- Dalmatian toadflax (Linaria dalmatica (L.) Mill.)
- Scotch thistle (Onopordum acanthium L.)
- Musk thistle (Carduus nutans L.)
- Common burdock (Arctium minus (Hill) Bernh.)
- Plumeless thistle (Carduus acanthoides L.)
- Dyer's woad (Isatis tinctoria L.)
- Houndstongue (Cynoglossum officinale L.)
- Spotted knapweed (Centaurea stoebe L. ssp. micranthos (Gugler) Hayek)
- Diffuse knapweed (Centaurea diffusa Lam.)
- Purple loosestrife (Lythrum salicaria L.)
- Saltcedar (Tamarix spp.)
- Common St. Johnswort (Hypericum perforatum L.)
- Common Tansy (Tanacetum vulgare)
- Russian olive (Elaeagnus angustifolia L.)
- Black Henban (Hyoscyamus niger)

Additionally as of February 2015 the Wyoming Weed and Pest Council lists the following weeds as declared weeds by county:

Albany County:

- Plains larkspur/Geyer larkspur (Delphinium geyeri Greene)
- Locoweed (Oxytropis spp.)

- Cheatgrass / downy brome (Bromus tectorum L.)

Carbon County:

- Common cocklebur (Xanthium strumarium L.)
- Halogeton (Halogeton glomeratus (M. Bieb.) C.A. Mey.)
- Plains pricklypear (Opuntia polyacantha Haw.)
- Plains larkspur/Geyer larkspur (Delphinium geyeri Green)
- Wyeth lupine (Lupinus wyethii S. Watson.)

Natrona County:

- Buffalobur (Solanum rostratum Dunal)
- Bulbous Bluegrass (Poa bulbosa L.)
- Curlycup gumweed (Grindelia squarrosa (Pursh) Dunal)
- Curly dock (Rumex crispus L.)
- Dames rocket (Hesperis matronalis L.)
- Foxtail barley 9Hordeum jubatum L.)
- Halogeton (Halogeton glomeratus (M. Bieb.) C.A. Mey.)
- Puncturevine (Tribulus terrestris L.)
- Showy milkweed (Asclepias speciosa Torr.)
- Wild licorice (Glycyrrhiza lepidota Pursh)
- Cheatgrass / downy brome (Bromus tectorum L.)
- Yellow starthistle (Centaurea solstitialis)
- Black medic (Medicago lupulina)

The county Weed and Pest Districts actively conduct control measures to reduce the spread and reproduction of weed species. Carbon County Weed and Pest District maps areas of weed occurrence within the study area. The mapping was not available to be included in this report due to its sensitive nature and private property concerns. Interested landowners should contact Carbon County Weed and Pest District for more information.

3.4.2.7 Wetlands

Existing mapping of wetlands within the study area consisted of the National Wetlands Inventory (NWI) created by the US Fish and Wildlife Service (USFWS). The NWI mapping was completed using aerial photographs within the GIS environment and digitizing by analysts, however due to the relatively limited extent of mapped wetlands in relation to the size of the watershed, the data does not lend itself to presentation at the watershed scale.

Based upon the NWI mapping, approximately 74,931 acres of wetlands exist within the watershed. Figure 3.4-4 presents a pie chart showing the relative distribution of the general wetland types. The major contiguous wetlands in the watershed are located primarily within the floodplain of the North

Platte River in the central part of the valley. However, there are other larger areas of wetland complexes located on South Spring Creek, Cow Creek, Encampment River, and Big Creek higher up in the watershed. It is generally understood by users of the NWI mapping that the data are suitable for broad scale planning efforts such as this Level I investigation; however, before design and completion of any project potentially affecting wetlands, detailed onsite delineation should be conducted.

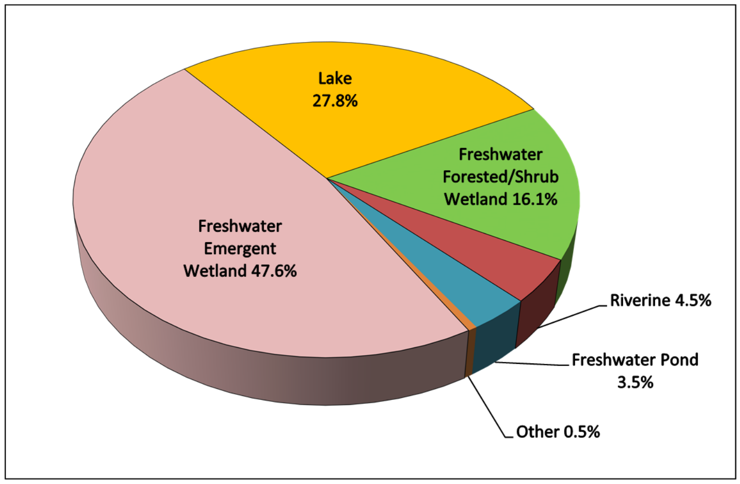


Figure 3.4-4 Percent of NWI wetlands types.

The Nature Conservancy utilized the existing NWI data as the basis for their 2010 Wetland Complex dataset in which they identified 222 wetland complexes in the State of Wyoming. This dataset is presented in order to provide a general location of the wetland complexes located within the Upper North Platte River Watershed (Figure 3.4-5). The Wetland Complex dataset includes attributes such as:

- Number of Wyoming Species of Greatest Conservation Need (SGCN) in the complex
- Number of rare species of Greatest Conservation Need (SGCN). See Copeland et al (2010) Ecological Indicators pub for a list of rare species
- Biological diversity ranking of the complexes
- Vulnerability of complexes to oil and gas development, residential development, and drought

This dataset has been included in the project GIS for further analysis.

The LANDFIRE data includes a limited determination of wetlands as well. The LANDFIRE data does not graphically represent well at the watershed scale, therefore the riparian/wetland vegetation communities in the dataset are presented in Table 3.4-4.

The US Army Corps of Engineers has adopted a 'watershed approach' to wetland classification which includes consideration of the 'hydrogeomorphic character' of the various wetland types. According to the USACE manual (USACE, 1995):

> *"The hydrogeomorphic classification is based on three fundamental factors that influence how wetlands function, including geomorphic setting, water source, and hydrodynamics. Geomorphic setting refers to the landform of a wetland, its geologic evolution, and its topographic position in the landscape. For example, a wetland may occur in a depressional landform or a valley landform and may occur at the top, middle, or bottom of a watershed."*

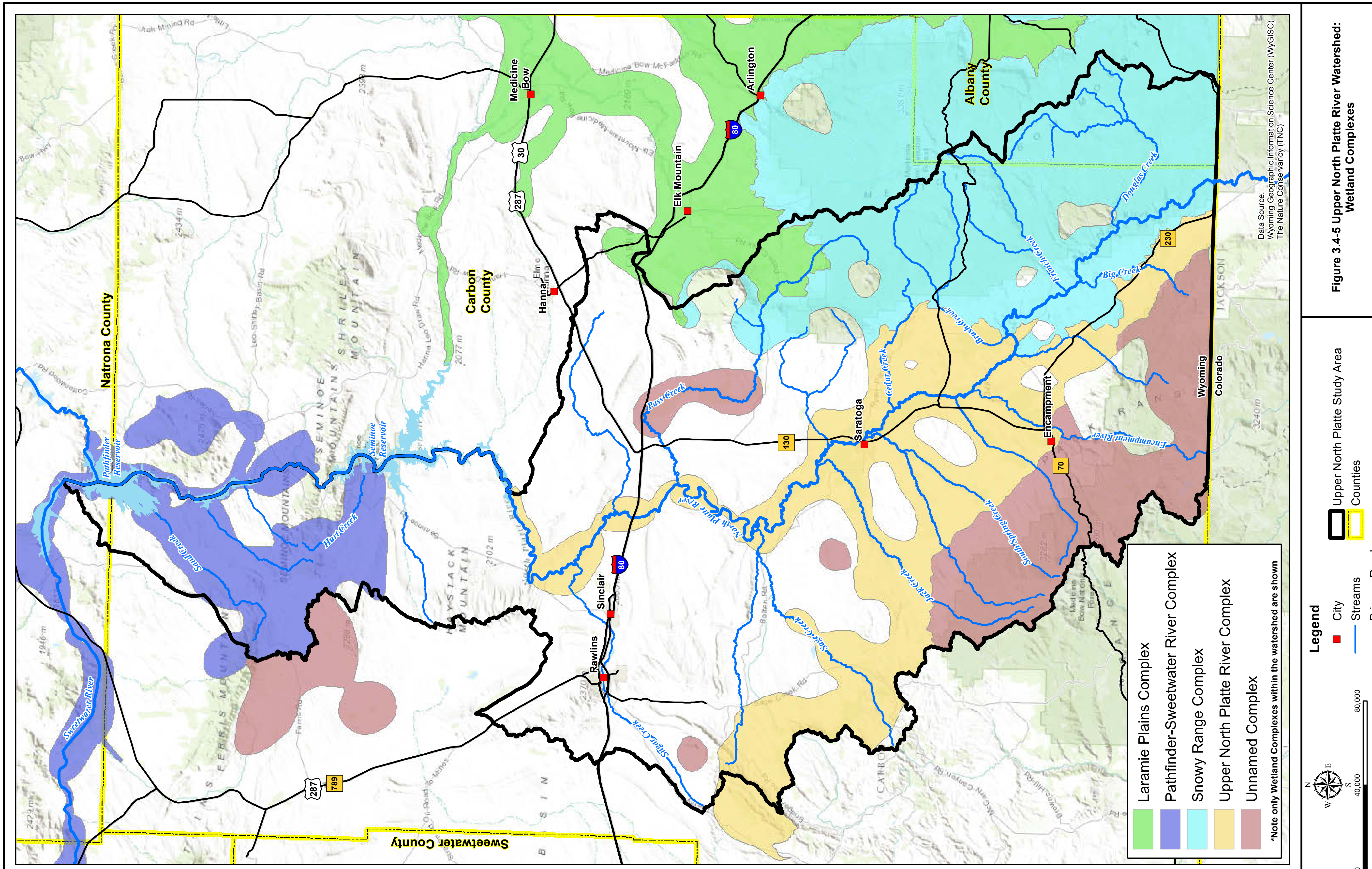


Figure 3.4-5 Upper North Platte River Watershed: Wetland Complexes

Table 3.4-4 LANDFIRE Riparian/Wetlands Classifications.

Upper North Platte River Watershed : LANDFIRE Wetlands				
Existing Vegetation Type	**Physiognomy (form/morphological structure of vegetation)**	**Acres**	**Percent of Watershed**	**Cumulative Percent**
Rocky Mountain Subalpine/Upper Montane Riparian Shrubland	Riparian	12421.07	0.610%	0.61%
Rocky Mountain Montane Riparian Forest and Woodland	Riparian	11630.44	0.571%	1.18%
Western Great Plains Floodplain Forest and Woodland	Riparian	8428.48	0.414%	1.59%
Rocky Mountain Wetland-Herbaceous	Riparian	3714.23	0.182%	1.78%
Western Great Plains Floodplain Herbaceous	Riparian	2023.51	0.099%	1.88%
Western Great Plains Depressional Wetland Systems	Riparian	1168.13	0.057%	1.93%
Rocky Mountain Subalpine/Upper Montane Riparian Forest and Woodland	Riparian	869.81	0.043%	1.98%
Western Great Plains Floodplain Shrubland	Riparian	444.04	0.022%	2.00%
Rocky Mountain Montane Riparian Shrubland	Riparian	396.22	0.019%	2.02%
Introduced Riparian Forest and Woodland	Riparian	14.67	0.001%	2.02%

Seven wetland types have been defined using the classification system adopted by the USACE: Riverine, Slopes, Lacustrine Fringe, Depressional, Tidal Fringe, Mineral Flats, and Organic Flats. Within the study area, the following three types are likely to be encountered: slope wetlands, depressional wetlands, and riverine wetlands. Appendix 3E contains the USACE's descriptions of these wetland types.

The classification system discussed by the USACE also incorporates consideration of the various 'functions' of the wetland types:

> *"Wetland functions are defined as the normal or characteristic activities that take place in wetland ecosystems or simply the things that wetlands do. Wetlands perform a wide variety of functions in a hierarchy from simple to complex as a result of their physical, chemical, and biological attributes. For example, the reduction of nitrate to gaseous nitrogen is a relatively simple function performed by wetlands when aerobic and anaerobic conditions exist in the presence of denitrifying bacteria. Nitrogen cycling and nutrient cycling represent increasingly more complex wetland functions that involve a greater number of structural components and processes. At the highest level of this hierarchy is the maintenance of ecological integrity, the function that encompasses all of the structural components and processes in a wetland ecosystem."*

Figure 3.4-6 provides a figure extracted from the USACE manual depicting the hierarchy of wetland functions associated with the example cited above regarding the nitrogen cycle. Additional information regarding the wetlands classification scheme is contained in the USACE document included in the digital library delivered with this report and also available at: http://el.erdc.usace.army.mil/elpubs/pdf/wrpde9.pdf.

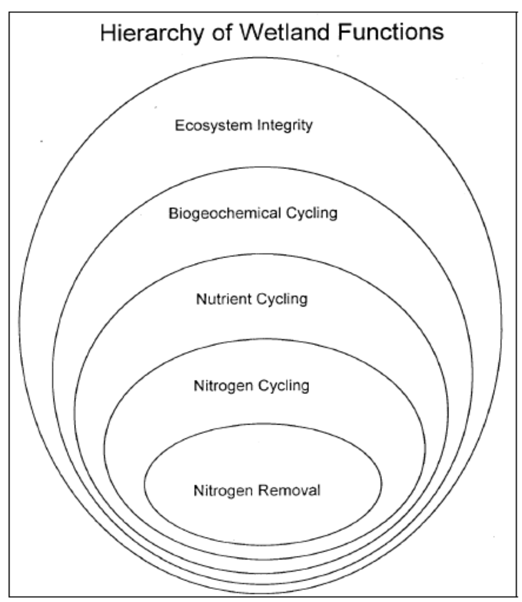


Figure 3.4-6 Hierarchy of Wetland Functions (USACE, 1995).

Delineation of wetlands and classification by function was beyond the scope of this study. However, based upon the project team's familiarity of the basin and the hydrologic regime of the watershed, it can be assumed that the majority of the wetlands in the study area consist primarily of riverine and slope wetlands found along the water courses and associated with springs outside of the riparian zones.

3.4.3 Geology

3.4.3.1 Surficial Geology

The surficial deposits found within the Upper North Platte watershed are presented on Figure 3.4-7. The figure shows the wide distribution of alluvium, colluvium (slope deposits), residuum (weathered bedrock), grus, alluvial fan deposits, terrace deposits, and exposed bedrock. These sediment types represent the dominant natural surfaces within the watershed.

Each type of surficial deposit produce soils and vegetation as a function of its physical and chemical composition, slope, slope aspect, local precipitation and other climatic factors, age, etc. which vary widely across the study area.

Although of limited areal extent, alluvium is one of the most important surficial materials due to its association with active streams and important riparian habitat elements. Alluvium is found adjacent to surface drainages and is of fluvial origin (produced by the action of a stream or river). The extent of the alluvial deposits varies with the size of the respective fluvial system. Headwater deposits are typically narrower and shallower compared to downstream areas in the watershed. Where associated with an active stream, these deposits may be eroding or aggrading with the continuing fluvial action. Fluvial aggradation includes flooding (vertical deposition) and point-bar migration (lateral deposition).

Colluvium exists throughout the watershed and has a genetic origin related to mass wasting mechanisms. These sediments were derived from the movement of material down slope under the influence of gravity. The colluvial deposits are composed of material derived from bedrock at higher elevations. Grain sizes range from silt to gravel, and grain shape is predominantly angular to subangular. As one would expect, much of the mapped colluvium is coincident with mapped landslide deposits (Figure 3.4-8).

Residuum is an in-situ deposit formed from the weathering of bedrock. Soluble components of the bedrock were transported from the area by fluvial, fluvioglacial, and groundwater processes. The insoluble portions of the rock experienced some mechanical weathering from freeze-thaw and rain-drop impact with little to no transport of the remaining materials. The residuum deposits within the study area occur over many different geologic substrate. As a reflection of ongoing weathering of underlying materials, these deposits are relatively young and relatively thin compared to other Quaternary-age deposits.

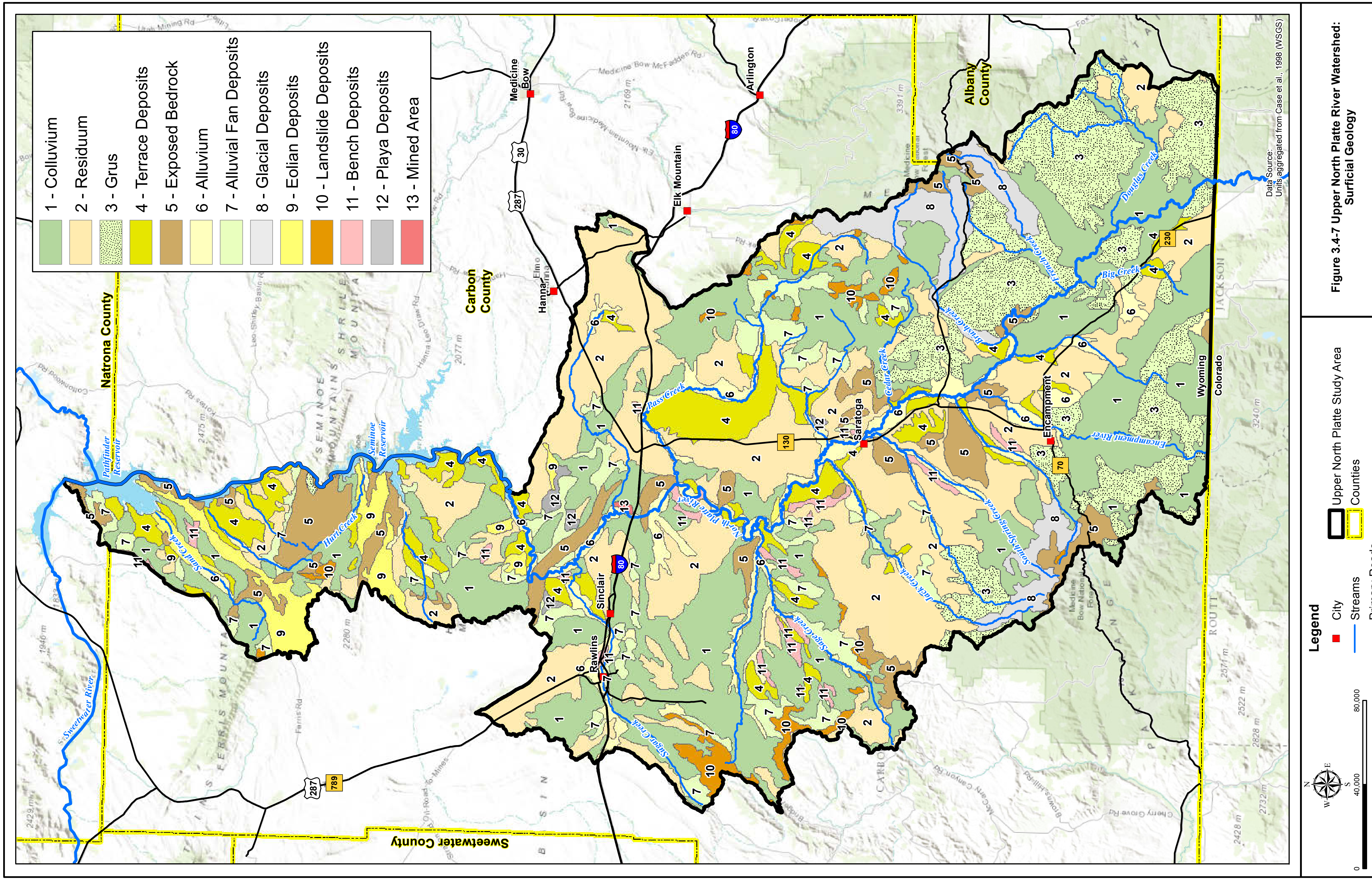


Figure 3.4-7 Upper North Platte River Watershed: Surficial Geology

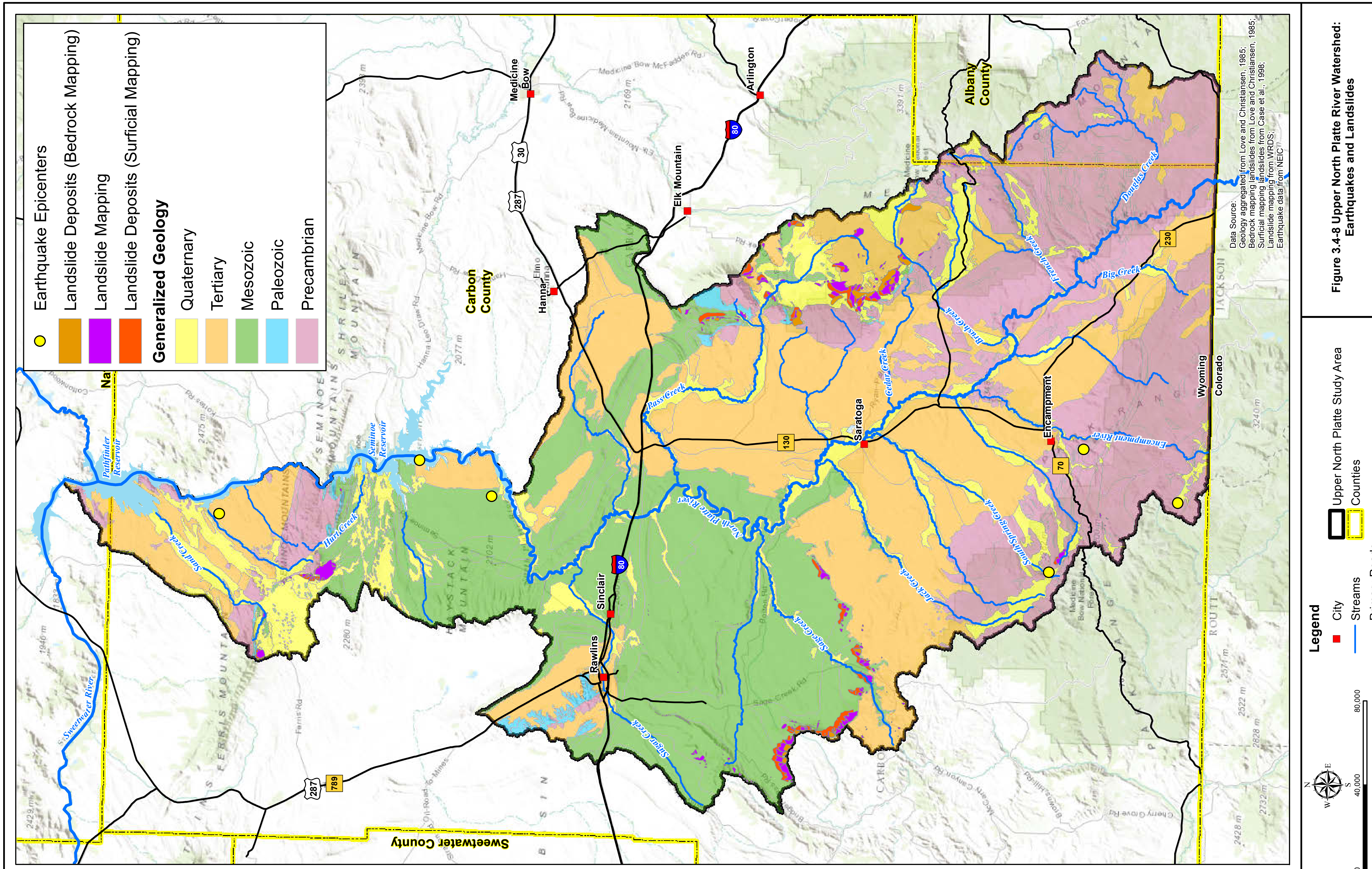


Figure 3.4-8 Upper North Platte River Watershed: Earthquakes and Landslides

Grus is an accumulation of rock fragments derived locally from the decomposition of granitic rocks. Thus, it is found across wide areas of the watershed south of Saratoga where such rocks are exposed at the ground surface.

3.4.3.2 Bedrock Geology

The geologic formations that underlie the study area range in age from Precambrian to Recent. Figure 3.4 9 provides a bedrock geologic map of the study area developed from standard mapping by the USGS and WSGS. Appendix 3F provides descriptions of the mapped units, from the same sources.

A detailed description of the complexities of the study area's geology is beyond the scope of this Level I investigation. A multitude of sources exist which provide site-specific geologic descriptions and mapping. (See Taboga et al., 2014 for copious discussion and bibliography.) For the purposes of this planning investigation, the general geologic maps and unit descriptions are presented in order to identify the formations present which could potentially affect development of watershed improvement projects, reservoir storage, etc.

3.4.3.3 Geologic Structure

The geologic structure of the Upper North Platte watershed is that of sedimentary basins between the uplifts of the Seminoe, Sierra Madre, and Medicine Bow Mountains and the Rawlins Uplift. See Figure 3.4-10 for locations. Figure 3.4-9 includes individual faults associated with these uplifts and other deformations, as mapped at 1:500,000 scale.

With few exceptions, faulting within the study area is the result of activity in the far-distant past. While the fracturing associated with faults can usefully enhance permeability and groundwater production, the faults themselves do not represent a constraint on development activity.

3.4.3.4 Geologic Hazards

Figure 3.4-8 presents landslide and earthquake information for the study area. Landslide mapping is available as the "landslide deposits" mapped with bedrock geology, as the "landslide deposits" mapped with the surficial deposits, and as "landslides" mapped based on surface morphology, independent of geologic materials. The three approaches produce very similar, although not identical results. In any case, landslides are not widespread in the study area. West of Saratoga, they are commonly associated with the contact between the North Park Formation and underlying shale-dominated formations (Frontier Formation, Niobrara Shale, Steele Shale), e.g. slope failures as more-easily eroded shales undercut the overlying sandstones. Elsewhere in the study area (e.g. east of Saratoga, west of Encampment, and north of Rawlins), landslide occurrence is primarily associated with steep slopes underlain by granitic rocks and adjacent sediments.

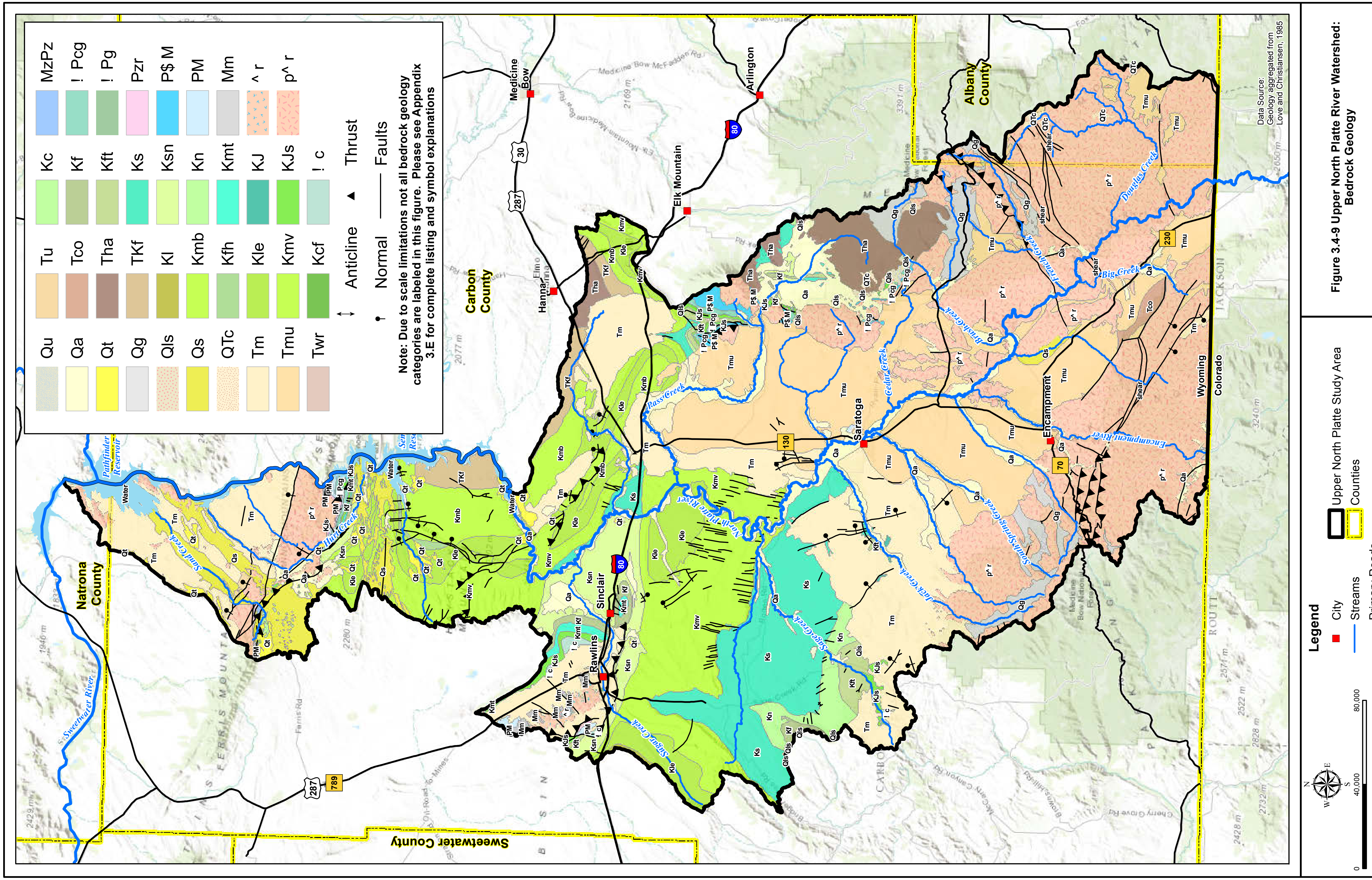


Figure 3.4-9 Upper North Platte River Watershed: Bedrock Geology

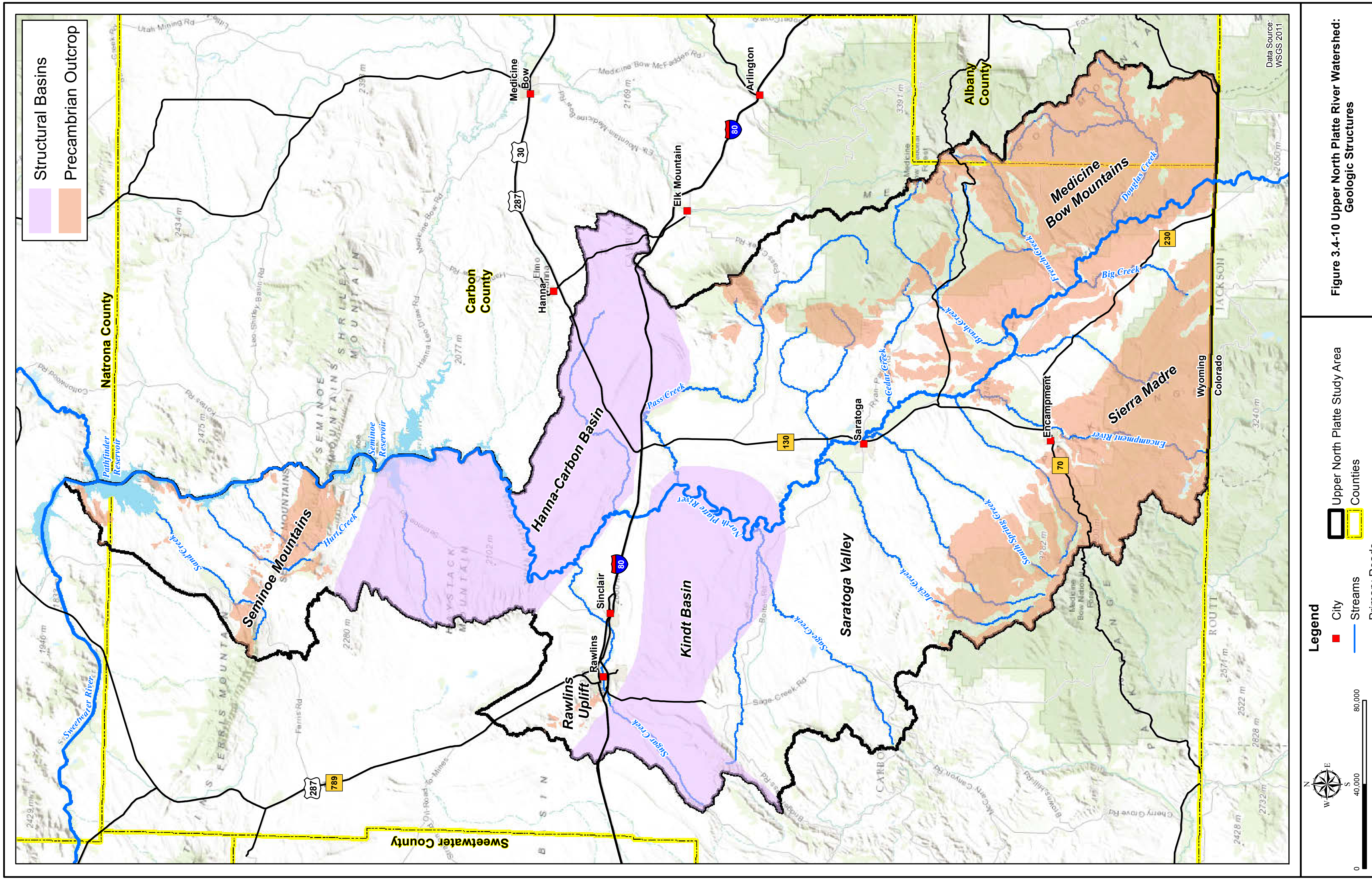


Figure 3.4-10 Upper North Platte River Watershed: Geologic Structures

In any case, landslide activity is the result of local combinations of slope, permeability, pore pressure, and formation strength creating slope failure. Future landslides are most likely to occur in association with areas of historical slope failure. Thus, while this potential hazard is not strictly confined to the areas mapped, those areas merit heightened concern.

There are six (6) natural earthquakes of magnitude 3.0 or greater recorded in the study area in the National Earthquake Information Center database. None of these events have been of magnitude greater than 3.5. Earthquakes in this range of magnitudes are described as, "Felt only by a few persons at rest, especially on upper floors of buildings." A 4.1 magnitude "explosion" event (presumably associated with the adjacent coal mine) just outside the study area puts the small scale of earthquake activity into perspective.

Seismic hazard mapping by the USGS (Peterson et al, 2015) concludes a peak horizontal acceleration of 6 7% of gravity has a 10% chance of exceedance in 50 years for the study area. For the coterminous United States, this value varies between <1 and >100% (2 - 30% for Wyoming), placing the study area at the lower end of the scale.

3.4.4 Soils

Soils are diverse within the study area because of the variable characteristics of the watershed's underlying geology, topography and elevation, climate and precipitation, and vegetation. Consequently, soils in the watershed vary considerably.

Available soils information and data were obtained from the NRCS and compiled for the watershed. Complete soils mapping is not available for the entire watershed and it is important to note that there is currently no completed soil survey in Carbon County. Completion of a soil survey and soils mapping would greatly enhance the capabilities of the SERCD to complete local and regional planning efforts. For the most current soils information, landowners and managers should access soils data via the Web Soil Survey (WSS) at *http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm*, which provides soil maps and data for almost all counties in the United States and is updated regularly by the NRCS.

Figure 3.4-11 displays a general soils map of the study area prepared using data mapped at the 1:250,000 level of detail and obtained from the NRCS. Figure 3.4-12 displays the detailed soils mapping (1:24,000 scale) for the portions of the study area where available.

3.5 Watershed Hydrology

3.5.1 Groundwater

Groundwater resources are one component of the overall hydrologic cycle. "Groundwater" is not a source of water separate from "surface water". Rather, groundwater diversions provide an alternative to surface water diversions in the use of a portion of the area's total available water resource.

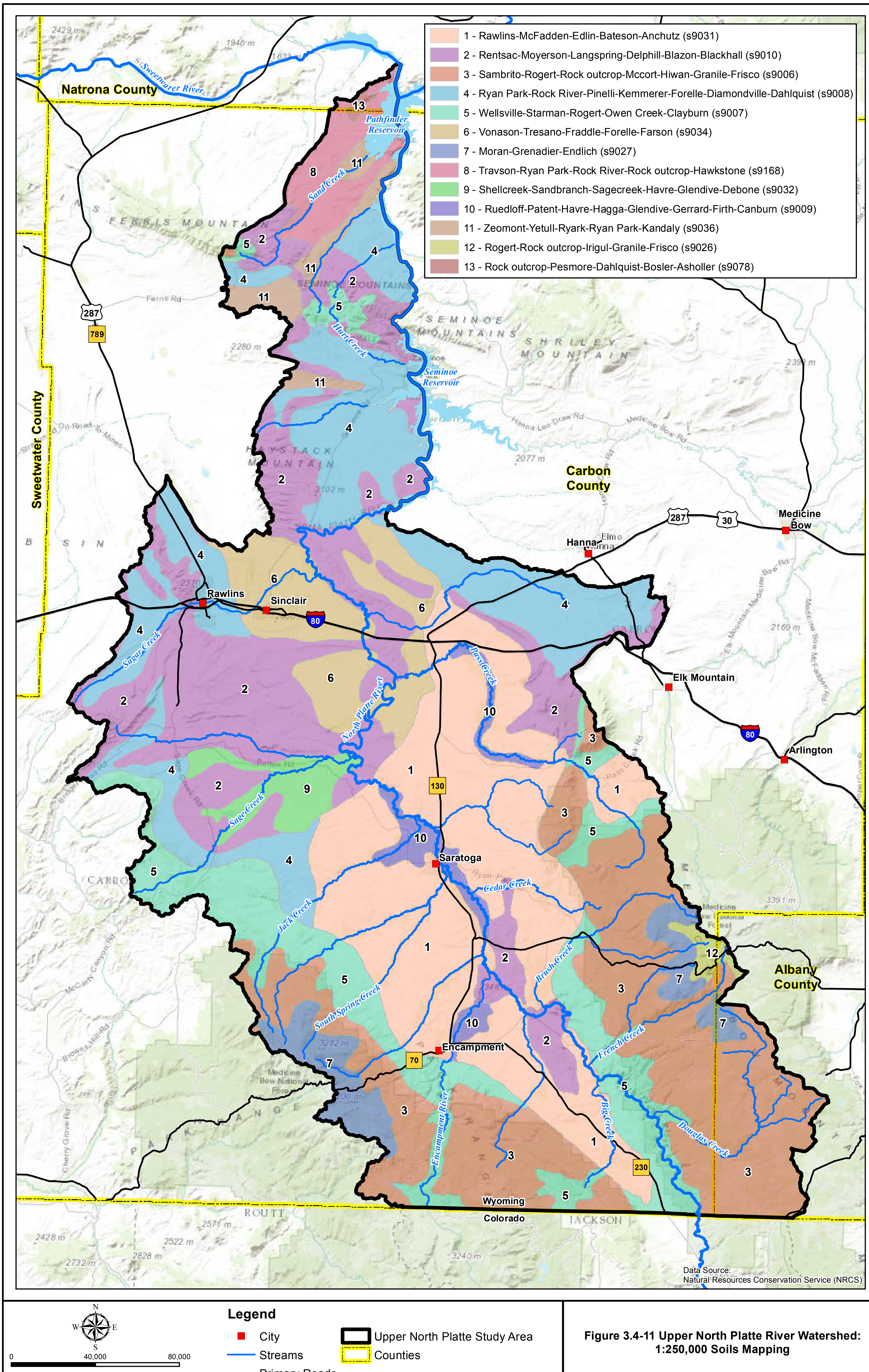


Figure 3.4-11 Upper North Platte River Watershed: 1:250,000 Soils Mapping

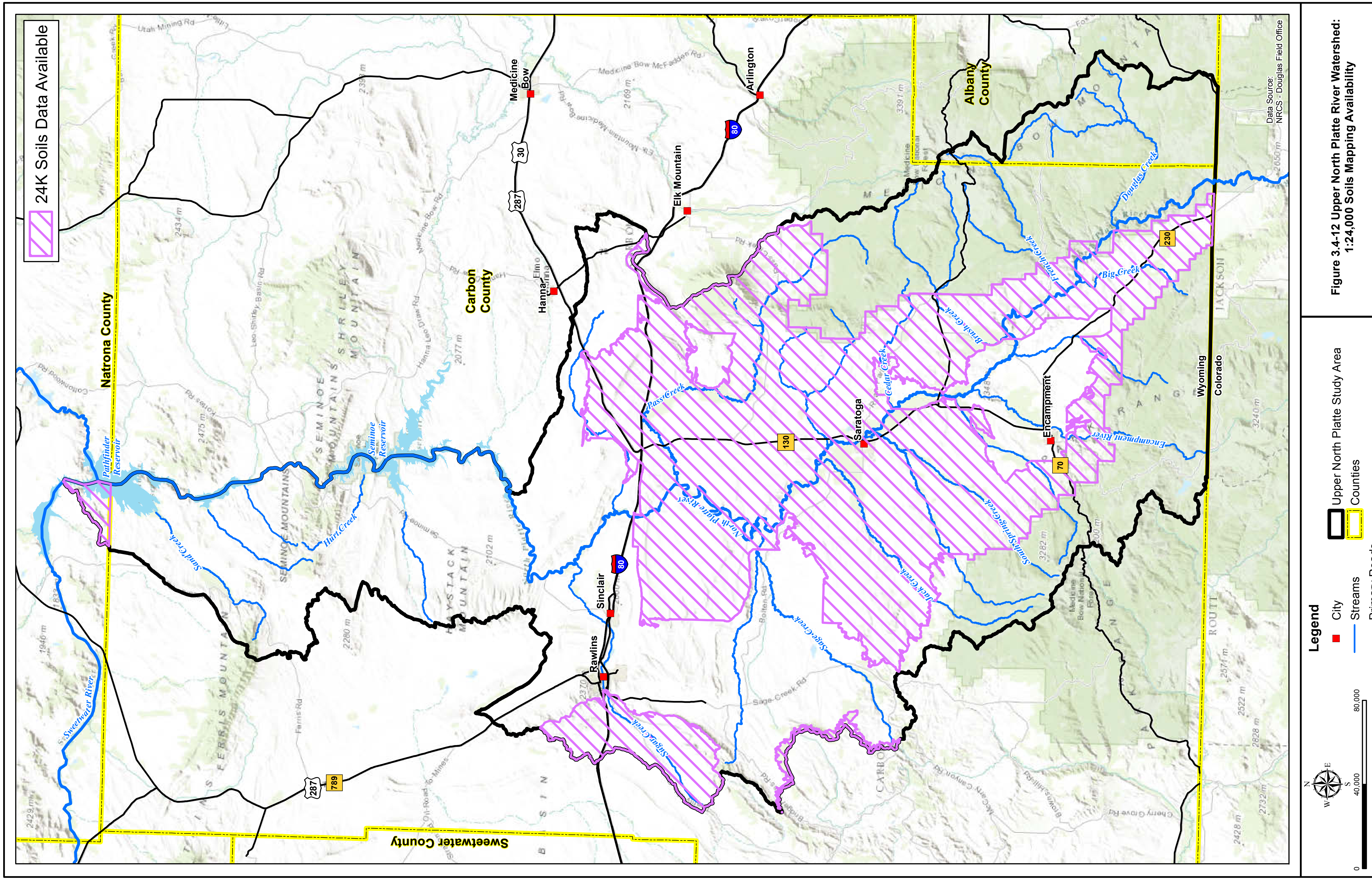


Figure 3.4-12 Upper North Platte River Watershed: 1:24,000 Soils Mapping Availability

Groundwater diversions differ from surface water diversions in timing, location, rate, volume, and quality. Groundwater originates when rainfall, snowmelt, streamflow, and, in some areas, irrigation water, infiltrate into geologic materials. This constitutes groundwater "recharge".

Figure 3.5-1 presents estimates of the rates of groundwater recharge within the study area. (These estimates come from a 1998 statewide groundwater vulnerability assessment, and are quite generalized.) Recharge rates are a function of elevation, i.e. the raw quantity of precipitation increases with elevation, and of the infiltration characteristics of the soil and underlying bedrock. Recharge is concentrated on the flanks of the bounding mountain ranges. The great majority of the study area averages less than 1 inch of groundwater recharge per year.

Over days, years, centuries, or even millennia (where groundwater circulation is long and deep), this recharge travels through the ground and returns to the surface as discharge. Between the points of recharge and discharge, groundwater flow may be straightforward or quite complex. Because groundwater is continually returning to the surface as springs and, more importantly, as diffuse gains to most of Wyoming's perennial streams, streamflow records include large quantities of groundwater. In the absence of storm runoff or snowmelt, most of the flow in Wyoming's streams comes from groundwater at some point upstream.

Like surface water, groundwater flows “downhill”, from areas of high head to areas of lower head. In the case of the Upper North Platte watershed, that means groundwater flow is generally from beneath higher elevations to beneath lower elevations, and the North Platte River serves as the “base” elevation for both the surface and groundwater flow network. Because Wyoming's river basins are generally a reflection of regional geology, even in deep artesian aquifers groundwater flow tends to be toward and along major rivers.

3.5.1.1 Springs

Groundwater is naturally discharged by springs and seeps, by evapotranspiration, and by discharge to streams and other aquifers. Springs and seeps occur when the water table intersects the land surface. This commonly is the result of changes in lithology, faults and fractures, and topography. For example, where a sufficiently permeable geologic unit (e.g., poorly-cemented sandstone or conglomerate) crops out in a swale or on a hillside at an elevation below the prevailing groundwater table in the bedrock unit at that location, a spring may develop. Similarly, a permeable geologic structure (e.g., an open joint, fracture or fault zone) may intersect the ground surface and serve as a conduit for the discharge of groundwater from deeper aquifers. Spring flows vary widely due to the nature of the aquifer/structure discharging, the amount of seasonal recharge from snowmelt and rainfall, depletion of storage during periods of drought, and even evaporation and evapotranspiration at the site of the spring. The flows can be concentrated or diffuse, again depending on the nature of the geologic conditions causing the spring (Susong, et al., 1993).

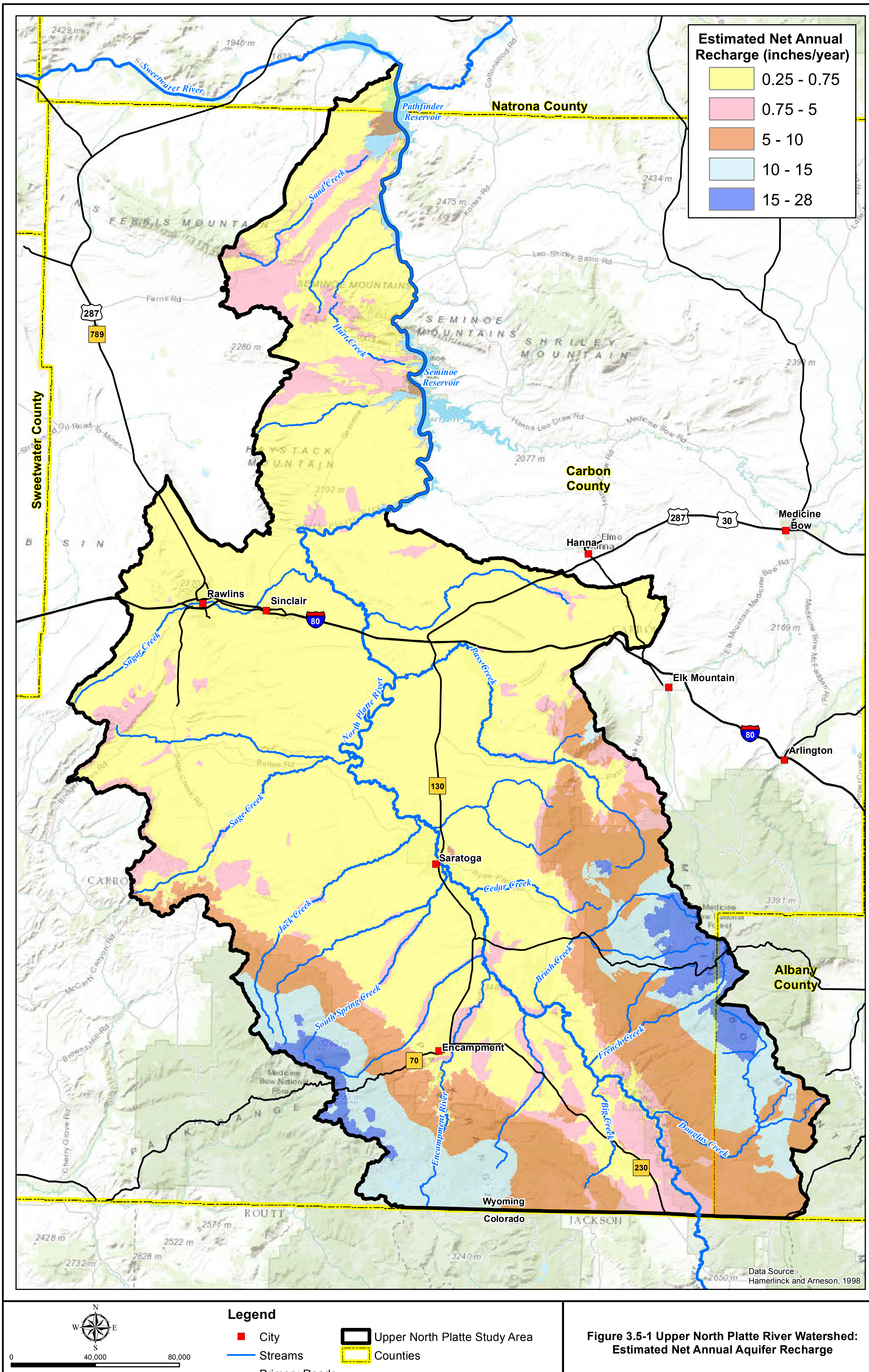


Figure 3.5-1 Upper North Platte River Watershed: Estimated Net Annual Aquifer Recharge

Figure 3.5-2 presents a compilation of springs data for the study area: 1) those digitized from individual USGS 7.5-minute topographic maps by workers at the Wyoming State Geological Survey; and 2) those listed in the water-right permits database of the Wyoming State Engineer's Office. The latter are more likely to be more substantial or important springs, as they have attracted sufficient attention to warrant establishing an explicit water right for a specific beneficial use.

Large springs are necessarily associated with productive aquifers (discussed below), but small springs and seeps occur as a result of sometimes quite local conditions of recharge, topography, and aquifer permeability, in many geologic settings.

Springs have been developed from the Browns Park Formation as the major component of the municipal water supply for the City of Rawlins. A 26-mile pipeline from the upper Sage Creek Basin south of the city is required to bring this spring water to points of use.

3.5.1.2 Alluvial Aquifers

Alluvial deposits are the primary component of the "Quaternary" age deposits depicted on the base maps for this section (e.g. Fig. 3.5-2). Under favorable conditions, alluvial aquifers can produce well yields on the order of 500-1,000 gallons per minute (gpm). But alluvial deposits may be unproductive where silt and clay components are abundant. In some areas, although the alluvium is coarse-grained, it is relatively thin and sits above the groundwater table. Where the alluvial aquifer is associated with an active stream, either interception of groundwater headed for the stream or induced infiltration from the stream may provide most of the available groundwater, and stream depletion rates may approach pumping rates over relatively short time periods. Where closely associated with surface streams, alluvial aquifer quality tends to be good due to the low salinity of water in the stream and the filtering effect of the aquifer.

A large number of stock and domestic wells within the study area are shallow wells completed in the alluvial aquifers associated with the North Platte River and its tributaries. Although locally productive, the alluvial aquifers in the study area tend to be relatively thin and of limited areal extent, providing modest supplies of groundwater along the North Platte and Encampment Rivers and along Jack, Spring, and Cow Creeks in the Saratoga area. Particularly in the Saratoga area, however, the alluvial aquifers along the North Platte River and Spring Creek receive discharge of poor quality from underlying bedrock units, reducing their value for uses requiring drinking-water quality.

3.5.1.3 Bedrock Aquifers

Groundwater exists in bedrock aquifers under unconfined, water table conditions (at atmospheric pressure) or under confined conditions where the aquifer is present at depth and pressures are sufficient to push water higher than the top of the formation, in some cases to the ground surface to create a flowing well.

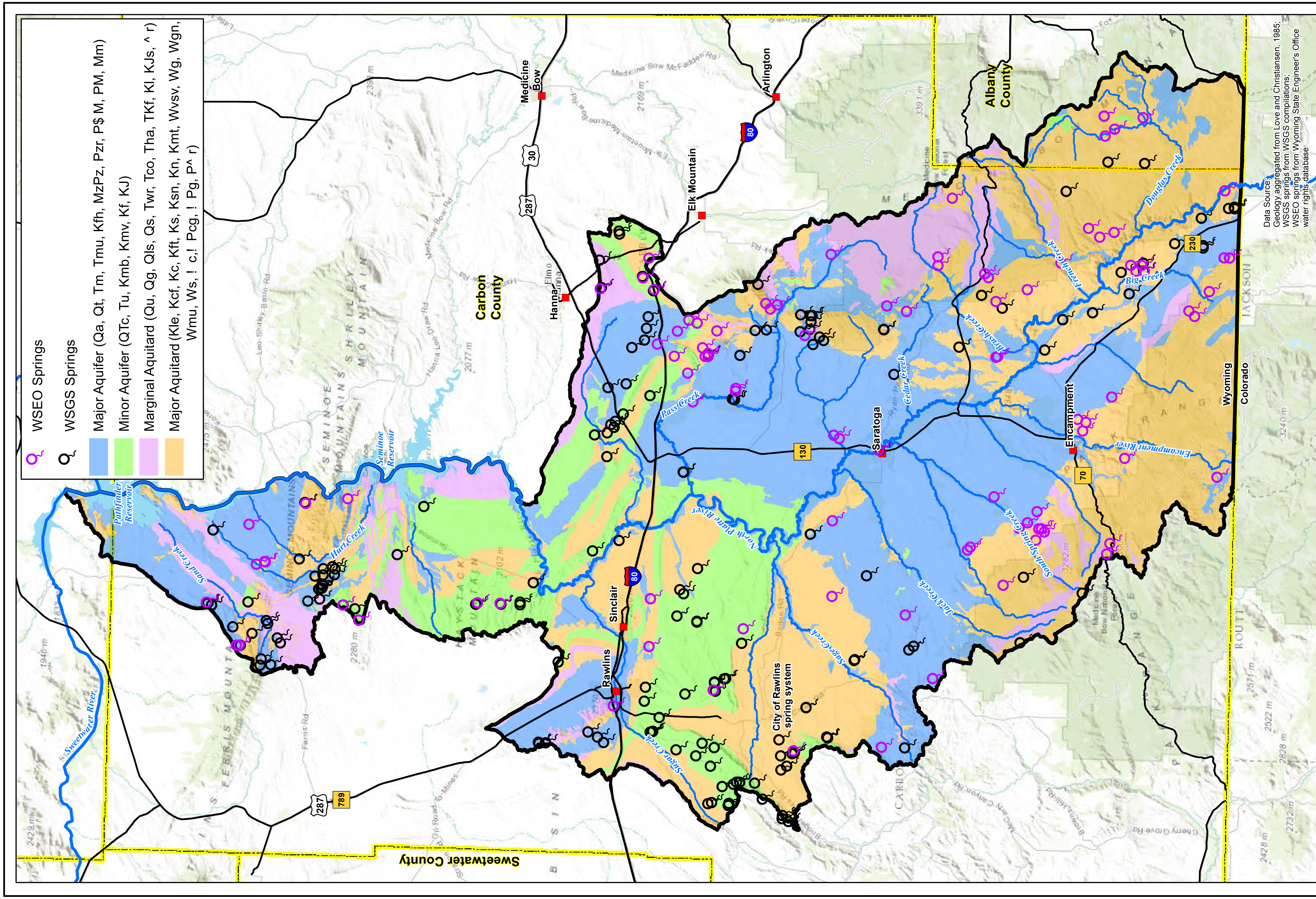


Figure 3.5-2 Upper North Platte River Watershed: WSEO and WSGS Springs

Data Source:
Geology aggregated from Love and Christiansen, 1985;
WSGS springs from WSGS compilations;
WSEO springs from Wyoming State Engineer's Office water rights database

Legend
City
Streams
Primary Roads
Upper North Platte Study Area
Counties

0 40,000 80,000
Feet

Classification of a body of geologic material as an "aquifer" depends on how much water is needed for a specific user or purpose. A hydrogeologic formation capable of adequately supplying the modest water needs of a single rural residence may be entirely inadequate to meet the needs of a large agricultural operation.

To assist in the assessment of groundwater development opportunities, Figure 3.5-3 presents the formations of Figure 3.4-9 classified with respect to general water-production characteristics following the taxonomy of the 2007 Wyoming Framework Water Plan (WWC, 2007). (The individual formations within each group are keyed to the symbols used on Figure 3.4-9).

Major aquifer - deposits capable of producing high-capacity wells where saturated. The most consistently productive aquifer on Figure 3.5-3 is the Miocene-age aquifer (“Tm”) in the northern portion of the study area. Also known as the "Split Rock Formation", it hosts test wells in excess of 1,000 gpm production. The Miocene-age North Park aquifer (central study area) is less consistent than Miocene deposits south and west of Pathfinder Reservoir, but is locally quite productive. For example, it produces the 1,600 gpm spring flow developed for municipal supply by the City of Rawlins and hosts the municipal wellfield for Saratoga and Riverside. Locally less-than-desirable groundwater quality and productivity in the Miocene aquifer of the central study area indicate site-specific evaluation with respect to specific project needs. For example, these deposits are thin or unsaturated in much of the area around Rawlins and provide only marginal development opportunity.

Minor aquifer - deposits less likely to provide high-capacity wells, but commonly provide useful groundwater supplies for local use. The Mesaverde and Medicine Bow formations in the central portion of the study area are examples. These formations consist of interbedded sandstones and shales. The former produce wells of modest production and water quality; the latter are rarely usefully productive.

Marginal aquifer - “Most geologic formations can provide useful groundwater supplies under the right conditions, particularly if the demands are small such as for stock and domestic use. The formations of this group are commonly considered capable of yields on the order of 1-5 gpm, with higher production rates relatively rare. Sandstone beds are the primary source of groundwater, although zones of fractured siltstone or shale can be locally productive, and coal seams in the Hanna and Ferris Formations are locally important sources of groundwater.” (WWC, 2007)

Major aquitard - These deposits are generally poorly productive of groundwater. (The name refers to their retarding effect on groundwater flow.) In the study area, the primary representatives are the Mesozoic-age Cody, Steele, Niobrara, Lewis, Thermopolis, and Mowry Shales, and the crystalline PreCambrian rocks of the upland areas. Under locally favorable conditions, these formations can produce small, useful quantities of water.

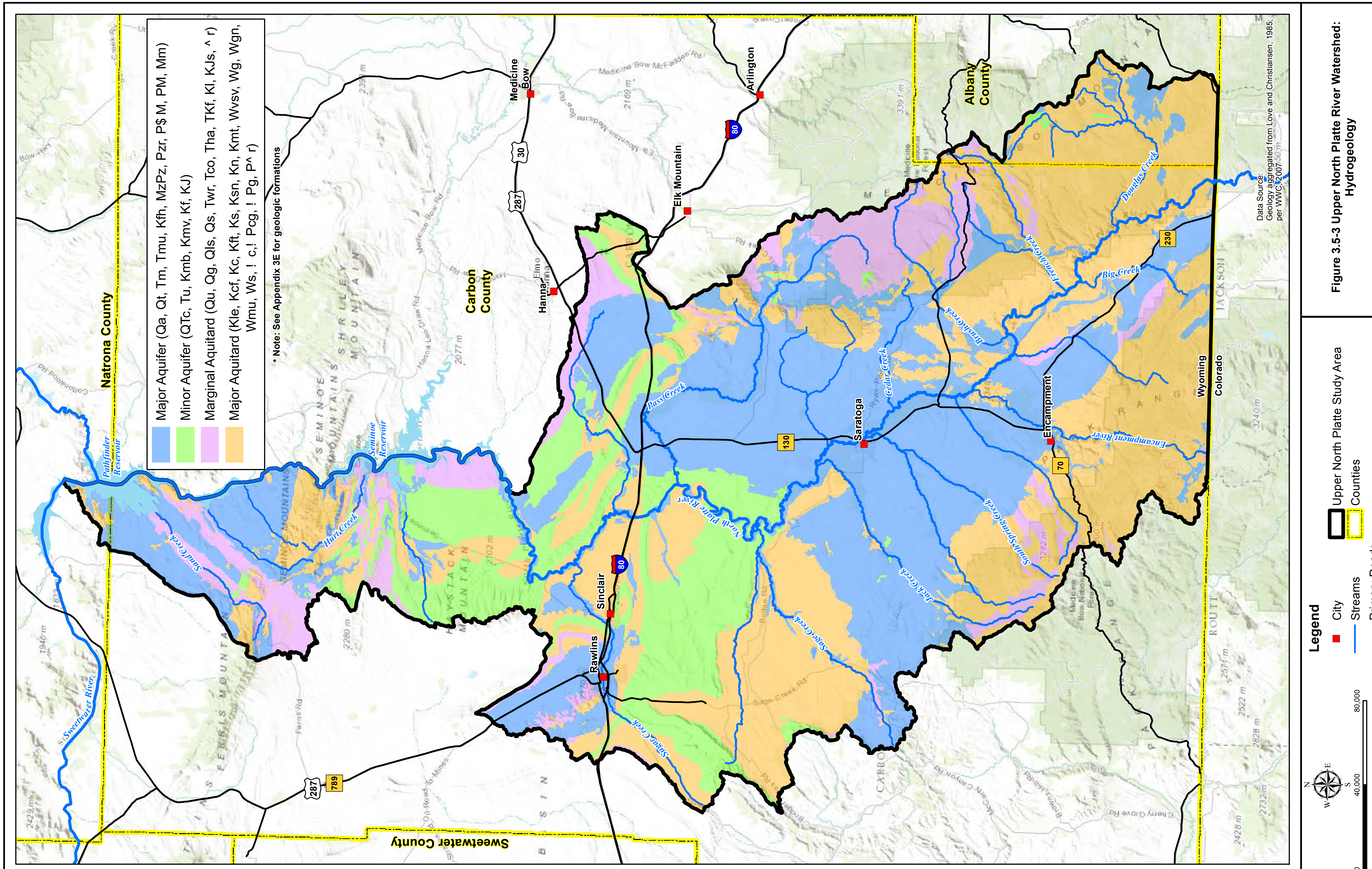


Figure 3.5-3 Upper North Platte River Watershed: Hydrogeology

As shown on Figure 3.5-3, most of the study area is underlain by "aquifers" of some capability. However, local conditions of permeability - commonly enhanced along faults and folds - and groundwater quality are key to successful development. Also, Figures 3.4-9 and 3.5-3 display only the surface outcrop of the designated formations. In most cases, the formations older than those mapped are present at depth. Deep drilling may provide useful access to more productive formations than are present at the surface, although groundwater quality commonly deteriorates somewhat with depth.

3.5.1.4 Groundwater Development

All diversions or extractions of water, both surface and groundwater, require permitting through the Wyoming State Engineer's Office. To a significant extent, the distribution of wells is a reflection of the productivity of the local aquifers, i.e. "groundwater is where you find it" and direct experience has outlined the resource. Figures 3.5-4, 3.5-5, 3.5-6, and 3.5-7 provide this empirical mapping of the groundwater resource, in ascending order of the quantity demanded. (These data are drawn from the groundwater permitting files of the Wyoming State Engineer's Office, updated through March, 2015.) The base for these figures is a grouping of formations by geologic age; individual formations are listed by geologic age in Appendix 3E.

Figures 3.5-4 and 3.5-5 display the least demanding wells. Livestock and domestic wells are typically deemed satisfactory if yields exceed 2 gpm. Domestic wells are of course most common along streams, where people prefer to live. Stock wells are more widely distributed, reflecting grazing management. Between the two groups, these small demands are well distributed across the landscape. Useful groundwater has been found in most areas, with the exception of the Precambrian rocks in the southern portion of the study area, although perennial streams are more common sources of water in those upland areas.

The depth required to obtain small quantities of water is indicated by the depth ranges on Figures 3.5-4 and 3.5-5. Although most of these wells (approximately 60%) are less than 100 ft. deep, in some areas depths of 250 ft. or more has been required, and in some areas conditions vary significantly over short distances. Note also, that these uses may be tolerant of groundwater of less-than-ideal quality. Particularly those in the shale-dominated strata may have relatively high salinity or other, specifically problematic chemical constituents.

Groundwater of adequate quality and quantity to meet municipal demands and at locations that can be feasibly developed is relatively rare in this watershed. Figure 3.5-6 shows the municipal wells in the study area, i.e. those serving Rawlins, Saratoga, and Riverside (backup supply for Encampment). To obtain supplies satisfactory for municipal use, Rawlins has had to drill wells 1700 ft. deep, 10 miles south of the City, into the Nugget Sandstone. In the case of Saratoga, local groundwater was of unsatisfactory quality and the municipal wellfield was developed in the North Park Formation 3 miles east of town. At Riverside, groundwater availability within the community was similarly unsatisfactory; productive thicknesses of the North Park Formation have been developed for groundwater production east of

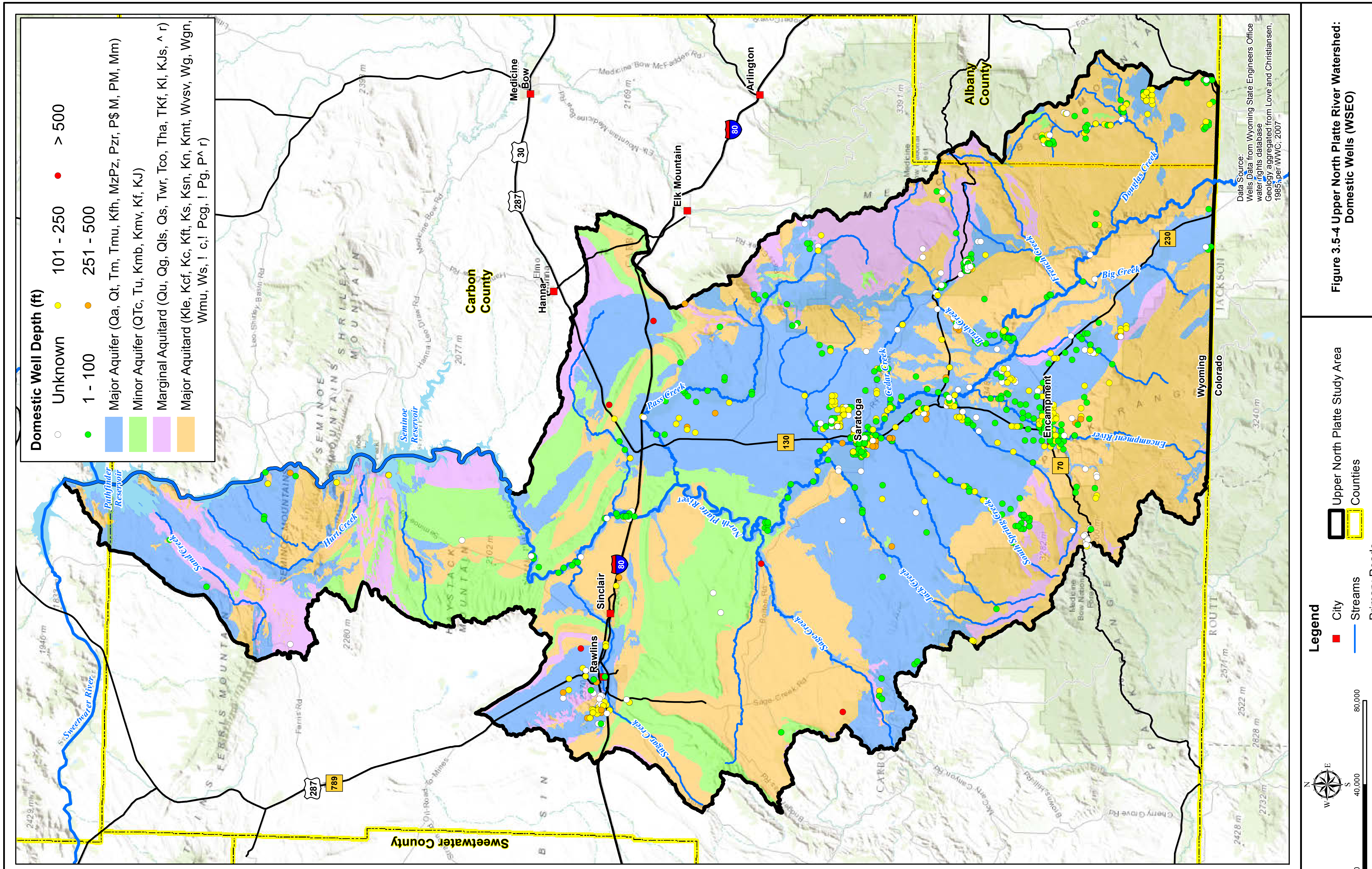


Figure 3.5-4 Upper North Platte River Watershed: Domestic Wells (WSEO)

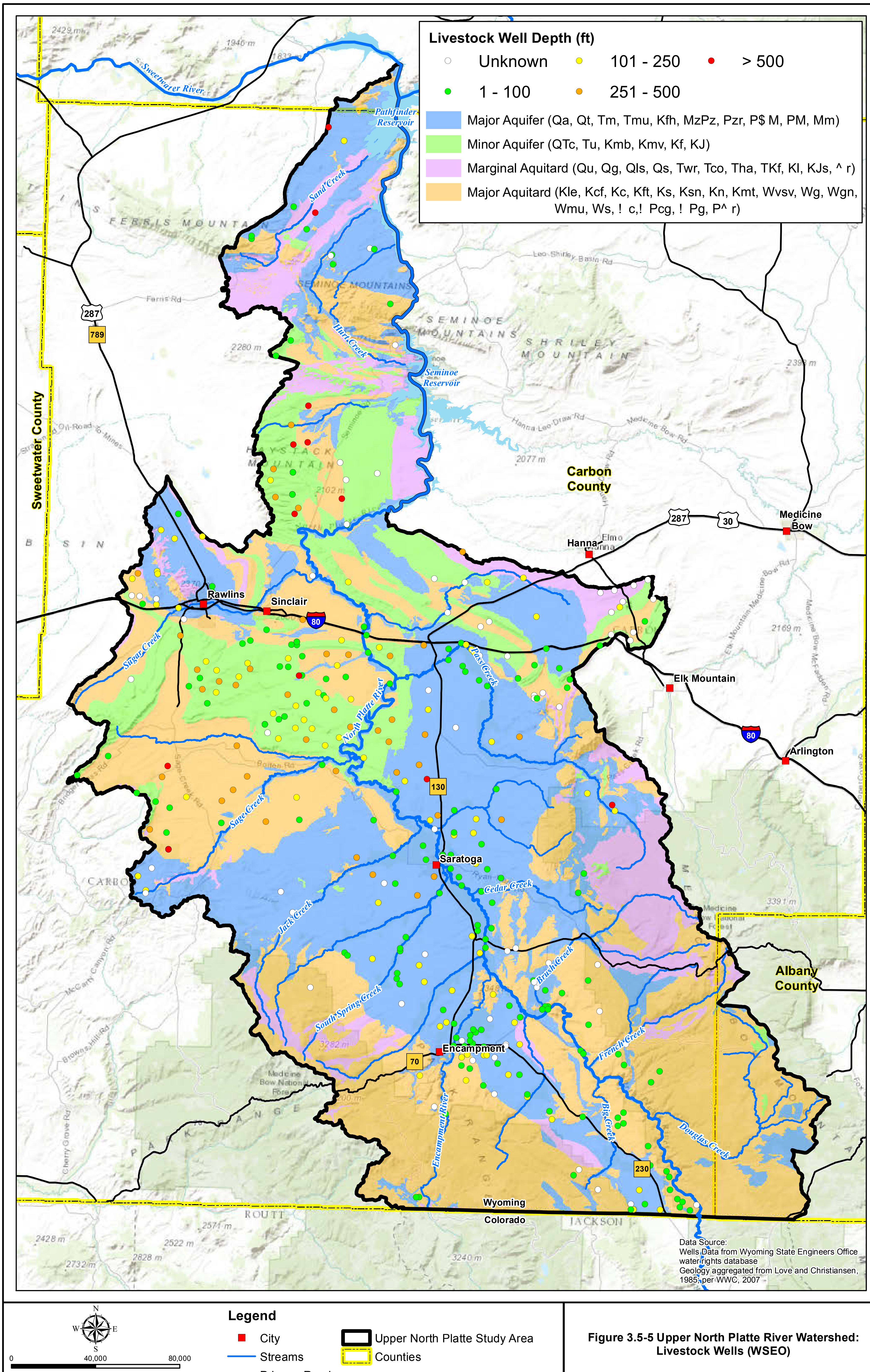


Figure 3.5-5 Upper North Platte River Watershed: Livestock Wells (WSEO)

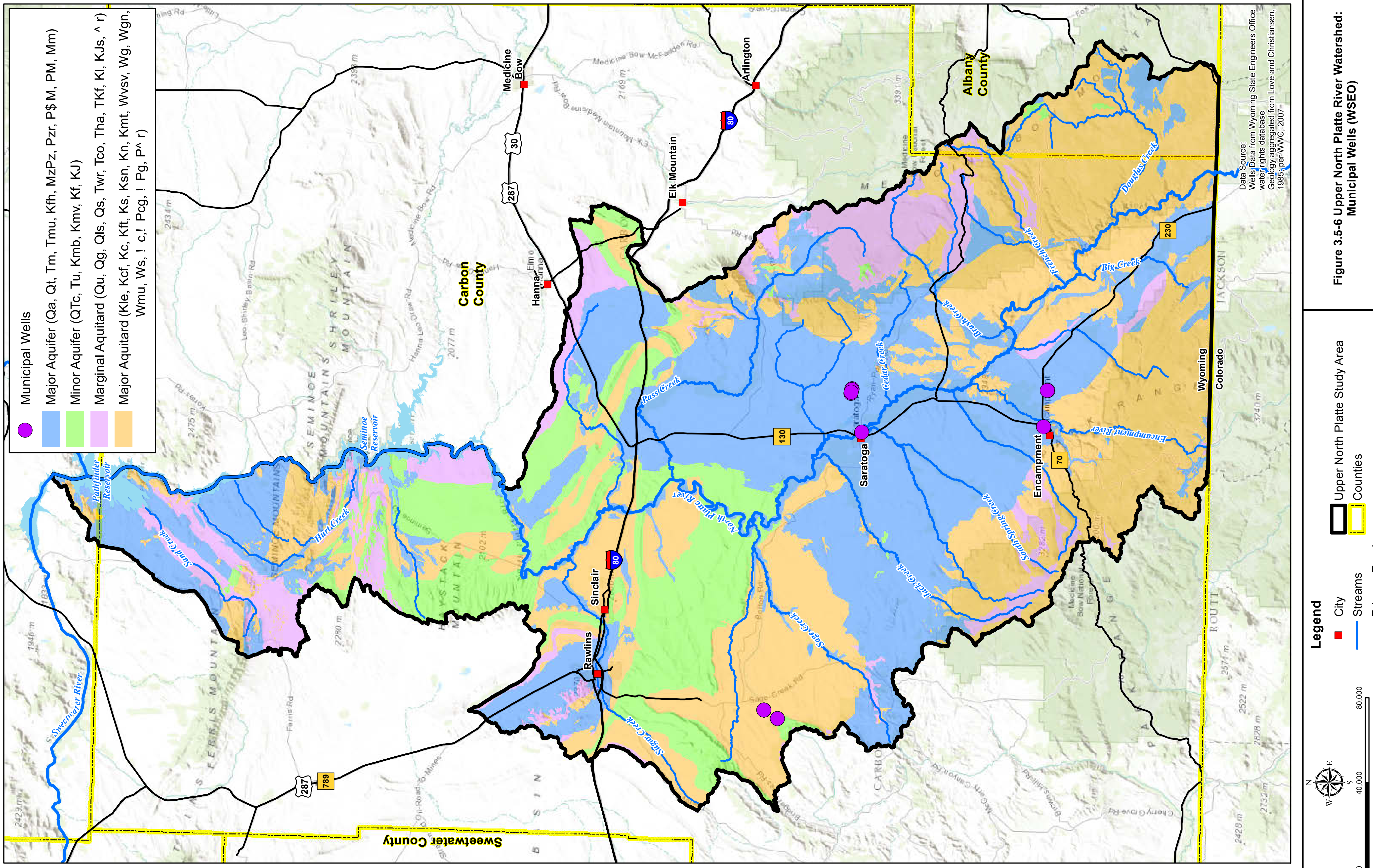


Figure 3.5-6 Upper North Platte River Watershed: Municipal Wells (WSEO)

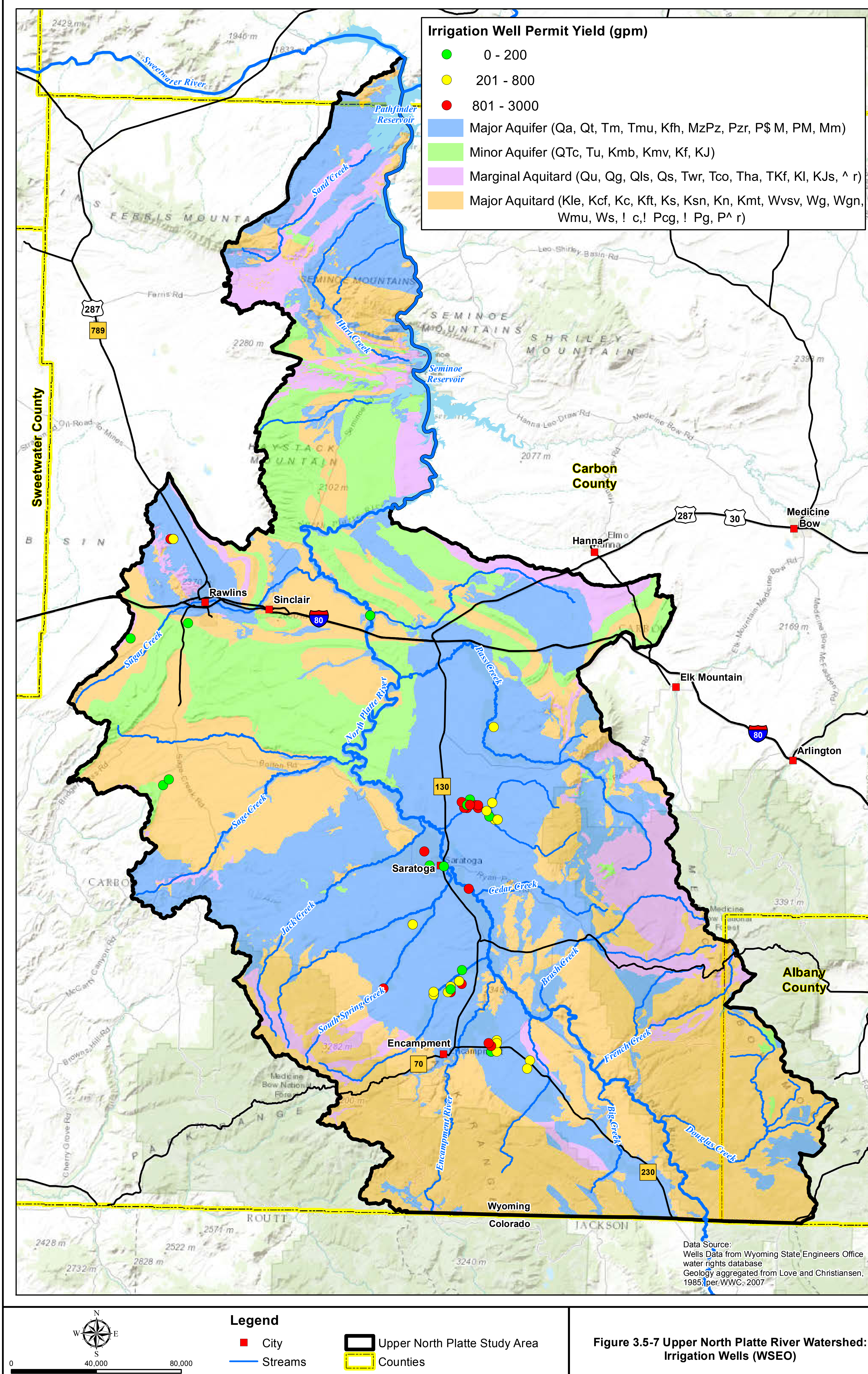


Figure 3.5-7 Upper North Platte River Watershed: Irrigation Wells (WSEO)

town. The "in-town" wells shown in both Saratoga and Riverside are of relatively poor quality. (Two small (<2gpm) wells permitted to Rawlins for municipal use are not mapped on Figure 3.5-6).

Figure 3.5-7 reflects the relative high-quantity demands of most irrigation systems. The three primary clusters of wells on this figure - northeast of Saratoga, north of Encampment, and east of Riverside are all completed in the North Park Formation. The majority of these wells are less than 200 ft. deep. The similarly productive wells serving the U.S. Fish Hatchery just north of Saratoga are also completed in this formation.

Under locally favorable conditions, the North Park Formation is the most important aquifer in the study area. The absence of irrigation wells in the very productive Miocene aquifer southwest of Pathfinder Reservoir is a function of land use rather than aquifer productivity.

3.5.1.5 Groundwater Administration

Surface water use in Wyoming is administered under the priority system, i.e. "First in time is first in right". While this principle also applies to groundwater rights, its practical application is a "work in progress" in Wyoming. Questions of the adequacy of diversions (i.e. wells), interference within an aquifer, lag times between cause and effect, and the presence of large reservoirs of groundwater pose significant challenges to routine administration. One arena in which groundwater administration has been codified is reflected on Figure 3.5-8. The green shading on this figure delineates areas which have been determined to be insufficiently connected with surface streamflow to warrant limitation under the specific provisions of the Modified North Platte Decree and the Platte River Recovery Implementation Program. Thus, future groundwater development in these areas is exempt from the special provisions and limitations of those agreements. (Unshaded areas on the figure have not been affirmatively determined to be "connected" under the agreed-upon criteria, as they may simply not have been examined sufficiently to make that determination.)

The determinations of "not hydrologically connected" of Figure 3.5-8 are specific to the listed administrative program and have no role in the general administration of Wyoming water rights. Areas in which wells are sufficiently connected to streams to warrant routine priority administration are likely much less extensive than depicted here; areas in which groundwater development may ultimately impact surface flows are likely much more extensive than depicted here.

3.5.1.6 Groundwater Quality / Sensitivity

Groundwater quality can present a major constraint on the usefulness of a particular aquifer. The North Park Formation in the vicinity of Saratoga, for example, is locally quite productive, but has dissolved solids concentrations that compromise its value for certain uses. Groundwater quality is a function of the composition of the materials through which aquifer recharge travels and of the residence time in the subsurface. The following discussion is taken from the 2007 Wyoming Framework Water Plan (WWC, 2007):

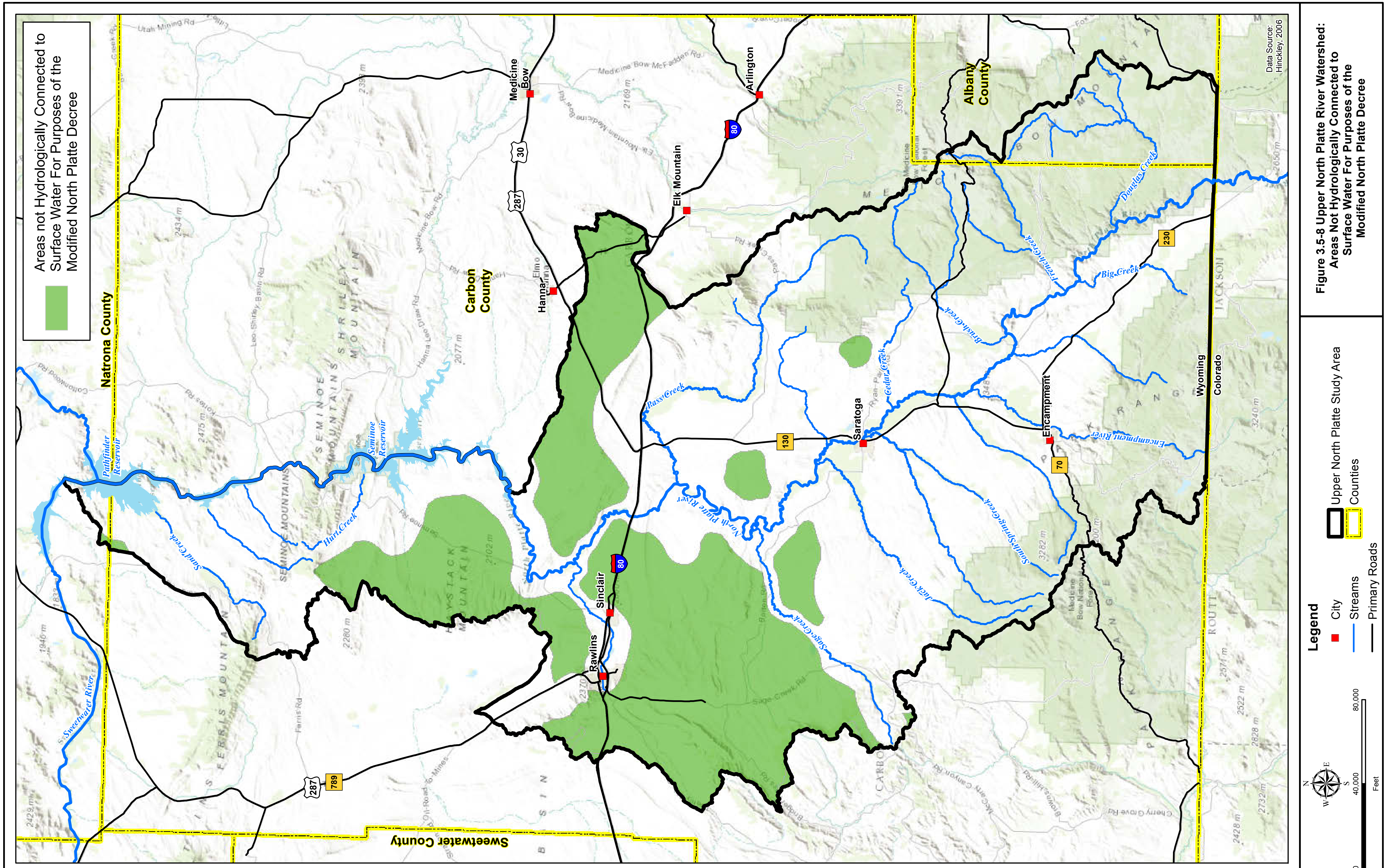


Figure 3.5-8 Upper North Platte River Watershed: Areas Not Hydrologically Connected to Surface Water For Purposes of the Modified North Platte Decree

"The alluvial aquifers primarily receive recharge from an overlying stream (or irrigation applications) and/or the surrounding geologic materials. Where the former dominates, groundwater quality is generally good. The aquifer sands and gravels tend to filter sediment and bacteria from the surface source to produce water that is clean and of low salinity. Where there is substantial inflow to the alluvial aquifer from bedrock, alluvial groundwater quality will reflect that of the surrounding formations. This water will commonly be higher in salinity than the surface water and may render the alluvial aquifer of limited value for many applications.

Bedrock aquifers receive recharge through the infiltration of rainfall, snowmelt, and streamflow, although discharge from groundwater to streams is more common than the other way around. Groundwater developed close to the areas of recharge may be of relatively high quality, regardless of the host formation. As water moves deeper, it generally becomes more mineralized.

In general, groundwater quality tends to be better in the more productive aquifers because of the more active groundwater circulation and less soluble minerals. An exception is the crystalline rocks (Precambrian) in which quality is generally good due to the very low solubilities of the constituent minerals, but productivity is low due to the virtual absence of porosity in the rock.

Where aquifers receive recharge from the surface, they are potentially subject to contamination. In 1998, the University of Wyoming completed a statewide study of groundwater contamination potential that assessed seven factors, including depth to groundwater and recharge rates, to produce 1:100,000 scale county-by-county maps."

Figure 3.5-9 presents this mapping of "Aquifer Sensitivity" for the Upper North Platte Watershed. Rankings are relative and carry no specific units. The most sensitive lands are those where a contaminant at the surface such as a spill, over-application of agricultural chemicals, or septic system effluent can most easily enter the aquifer. The alluvial aquifers are most sensitive. Least sensitive are bedrock aquifers where substantial thicknesses of low-permeability material lie above them.

3.5.2 Surface Water

The USGS has designated watersheds within the United States with numeric identifiers called Hydrologic Unit Codes, or HUCs. According to the USGS, "The United States is divided and sub divided into successively smaller hydrologic units which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system."

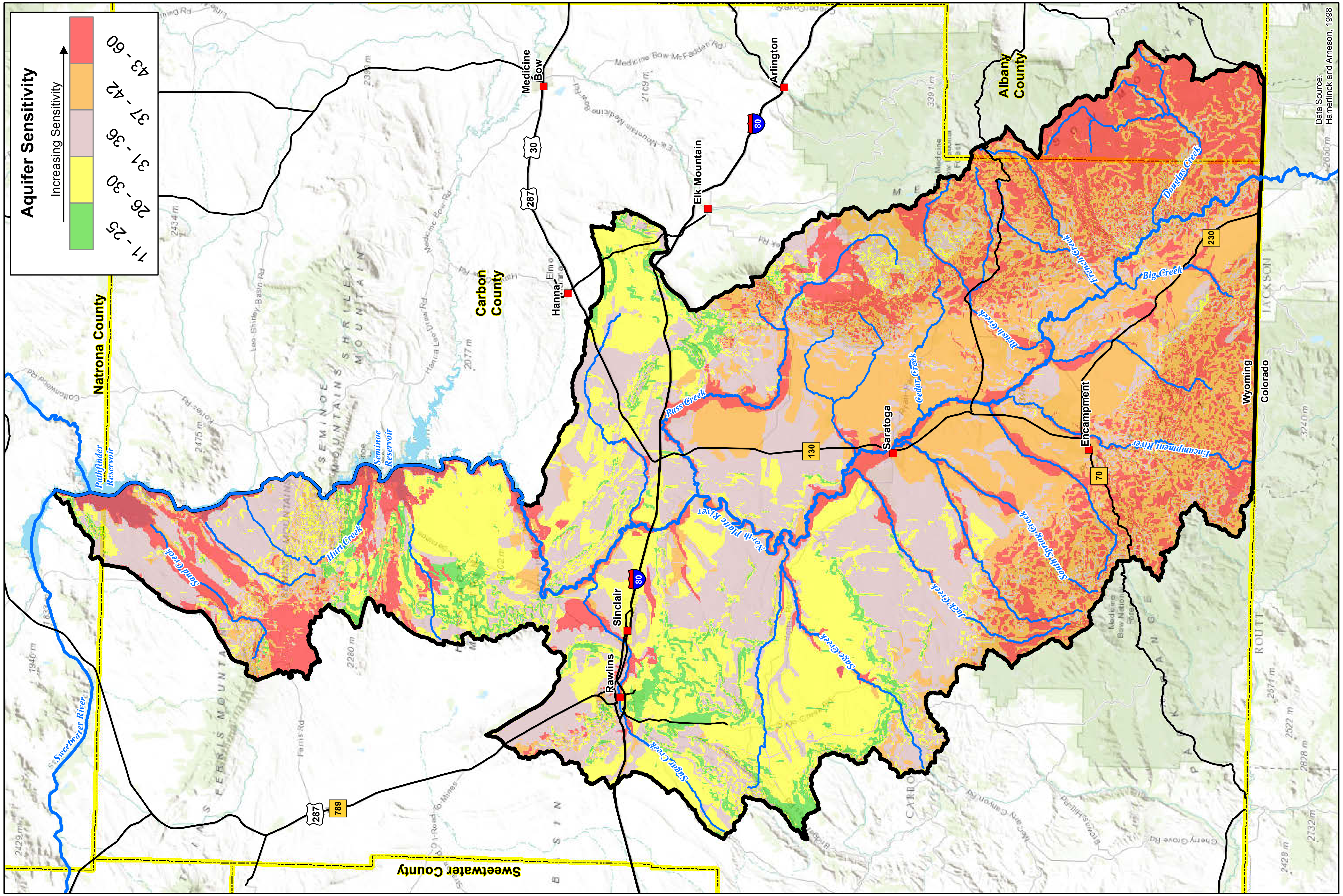


Figure 3.5-9 Upper North Platte River Watershed: Aquifer Sensitivity

Upper North Platte Study Area
Counties

Legend
City
Streams
Primary Roads

0 40,000 80,000 Feet

The first level of classification divides the Nation into 21 major geographic areas, or regions. These geographic areas typically contain the drainage area of a major river, such as the Missouri region. Eighteen of the regions occupy the land area of the conterminous United States. As regions are subdivided, the HUC identifier is extended. At this time, the smallest subdivision is referred to as the Twelfth order HUC due to the fact that the identifier has 12 digits. The following information is provided as an example of the HUC system as it refers to one of the Upper North Platte River tributaries: South Brush Creek.

Region:	10 Missouri River	(Second order HUC)
Subregion:	1018 North Platte River	(Fourth Order HUC)
Accounting Unit:	101800 North Platte River	(Sixth Order HUC)
Cataloging Unit:	10180002 Upper North Platte River	(Eighth Order HUC)
Sub-basin:	1018003204 Brush Creek	(Tenth Order HUC)
Sub-basin:	101800320401 South Brush Creek	(Twelfth Order HUC)

The Upper North Platte River watershed study area was defined primarily by the eighth order HUC 100800062 Upper North Platte River combined with the western half of the eighth order HUC 10180003 Pathfinder – Seminoe Reservoir. The Pathfinder – Seminoe Reservoir HUC was divided to correspond with the SERCD boundary. Table 3.5-1 summarizes the HUC system as it pertains to the study area as indicated in Figure 3.5-10.

Existing Stream Gaging Stations

There are currently seven active USGS stream gaging stations within the watershed (Figure 3.5-10). As indicated in Figure 3.5-11, historically, thirty-one gages have been active with up to twelve active at one time (mid-1960’s). However twenty-four of the gages have been discontinued by the USGS (the last one being discontinued in 1981), leaving the basin with seven active gages. In addition, the Wyoming State Engineers Office maintains gages on streams, irrigation canals/ditches and reservoirs. Table 3.5-2 tabulates the WSEO gages within the study area. Note that some gages appear on both the WSEO and the USGS lists as they are cooperatively managed.

Mean monthly discharges were computed using the available data from the active USGS gages and are presented in Table 3.5-3. The mean annual hydrographs at these gage locations reflect typical snowmelt driven runoff patterns. The bulk of the annual runoff occurs between April and July at all of the gages. The late summer through fall months (August through October) see steep declines in streamflow as the streams return to baseflow conditions through the winter. Figure 3.5-12 displays the mean annual hydrograph at the seven active gages sited within the study area.

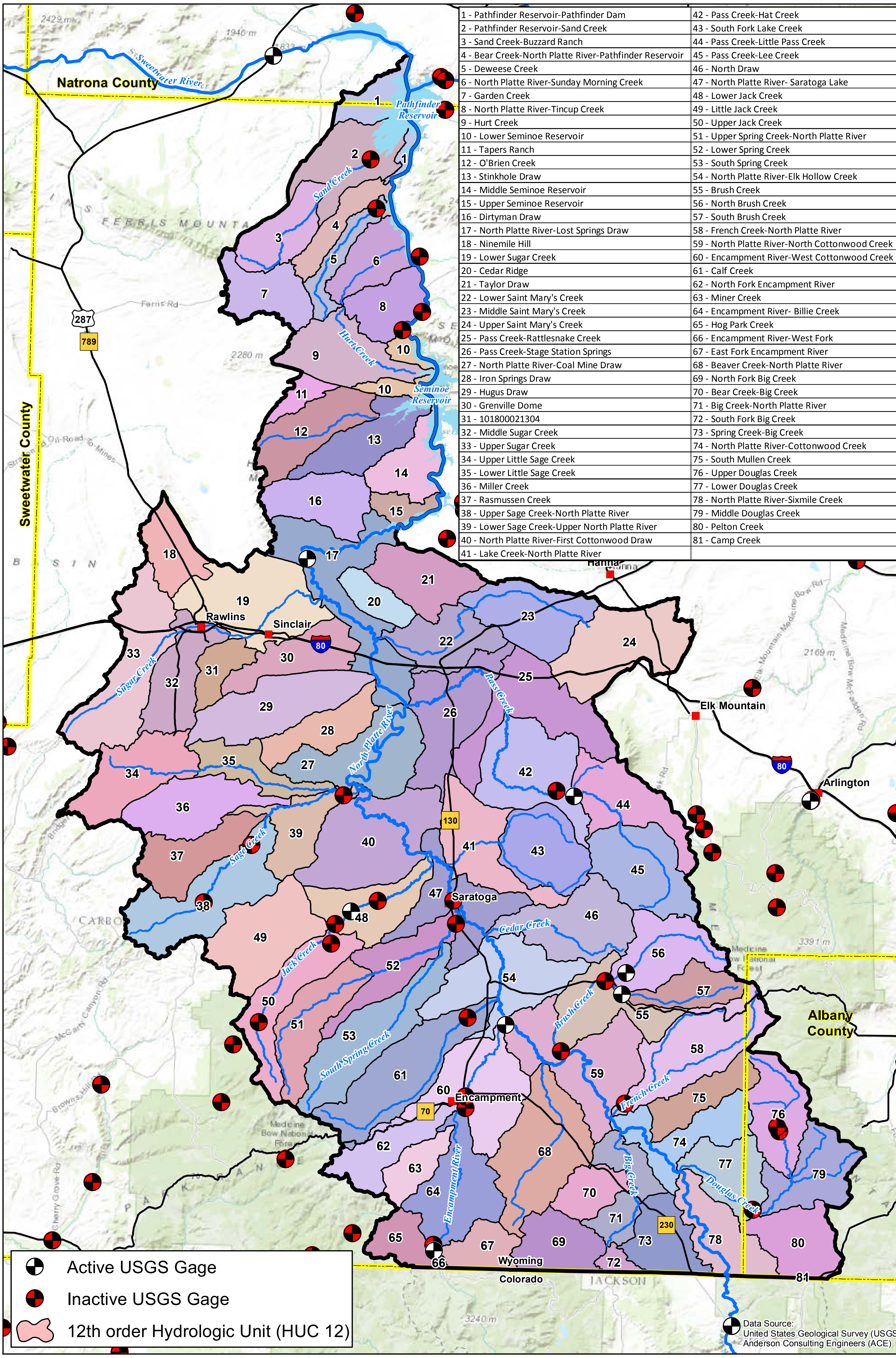
The stream reaches and tributaries in the study area range from perennial to ephemeral. Ephemeral streams are defined as those streams/reaches that flow only in response to direct precipitation events, and where any groundwater inflows are insufficient to sustain streamflow due to losses from

Table 3.5-1 Upper North Platte River Watershed Study: Hydrologic Units.

HUC 2 Number / Name	HUC 4 Number / Name	HUC 6 Number / Name	HUC 8 Number / Name	HUC 10		HUC 12	
				Number	Name	Number	Name
Region: Missouri River	Region: Missouri River	Accounting Region 101800: North Platte	Cataloging Unit 1018002: Upper North Platte	1018000201	North Platte River-Douglas Creek	101800020101	North Platte River-Sixmile Creek
						101800020102	Camp Creek
						101800020104	Upper Douglas Creek
						101800020105	Middle Douglas Creek
						101800020106	Pelton Creek
						101800020107	Lower Douglas Creek
						101800020201	North Platte River-Cottonwood Creek
						101800020202	South Mullen Creek
						101800020203	French Creek-North Platte River
						101800020204	North Platte River-North Cottonwood Creek
						101800020205	Beaver Creek-North Platte River
				1018000203	Big Creek	101800020301	South Fork Big Creek
						101800020302	North Fork Big Creek
						101800020303	Big Creek-North Platte River
						101800020304	Spring Creek-Big Creek
						101800020305	Bear Creek-Big Creek
				1018000204	Brush Creek	101800020401	South Brush Creek
						101800020402	North Brush Creek
						101800020403	Brush Creek
				1018000205	Encampment River	101800020502	Encampment River-West Fork
						101800020503	East Fork Encampment River
						101800020504	Encampment River- Billie Creek
						101800020505	Hog Park Creek
						101800020506	Miner Creek
						101800020507	North Fork Encampment River
						101800020508	Encampment River-West Cottonwood Creek
				1018000206	North Platte River-Cow Creek	101800020601	North Platte River-Elk Hollow Creek
						101800020602	Calf Creek
						101800020603	North Draw
						101800020604	North Platte River- Saratoga Lake
						101800020605	South Fork Lake Creek
						101800020606	Lake Creek-North Platte River
						101800020607	North Platte River-First Cottonwood Draw
				1018000207	Spring Creek	101800020701	Upper Spring Creek-North Platte River
						101800020702	Lower Spring Creek
						101800020703	South Spring Creek
				1018000208	Jack Creek	101800020801	Upper Jack Creek
						101800020802	Little Jack Creek
						101800020803	Lower Jack Creek
				1018000209	Sage Creek	101800020901	Upper Sage Creek-North Platte River
						101800020902	Rasmussen Creek
						101800020903	Lower Sage Creek-Upper North Platte River
						101800020904	Miller Creek
						101800020905	Upper Little Sage Creek
						101800020906	Lower Little Sage Creek
				1018000210	North Platte River-Iron Springs Draw	101800021001	North Platte River-Coal Mine Draw
						101800021002	North Platte River-Lost Springs Draw
						101800021003	Iron Springs Draw
						101800021004	Hugus Draw
						101800021005	Grenville Dome
						101800021006	Dirtyman Draw
						101800021007	Cedar Ridge
						101800021008	Taylor Draw
				1018000211	Pass Creek	101800021101	Pass Creek-Lee Creek
						101800021102	Pass Creek-Little Pass Creek
						101800021103	Pass Creek-Hat Creek
						101800021104	Pass Creek-Rattlesnake Creek
						101800021105	Pass Creek-Stage Station Springs
				1018000212	Saint Mary's Creek	101800021201	Upper Saint Mary's Creek
						101800021202	Middle Saint Mary's Creek
						101800021203	Lower Saint Mary's Creek
				1018000213	Sugar Creek	101800021301	Upper Sugar Creek
						101800021302	Middle Sugar Creek
						101800021303	Lower Sugar Creek
						101800021304	1.018E+11
						101800021305	Ninemile Hill
			Cataloging Unit 1018003: Pathfinder-Seminoe R	1018000301	Seminoe Reservoir	101800030101	Upper Seminoe Reservoir
						101800030102	Middle Seminoe Reservoir
						101800030103	Lower Seminoe Reservoir
						101800030104	O'Brien Creek
						101800030105	Stinkhole Draw
						101800030106	Tapers Ranch
						101800030108	Hurt Creek
				1018000303	Pathfinder Reservoir	101800030301	North Platte River-Tincup Creek
						101800030303	North Platte River-Sunday Morning Creek
						101800030304	Bear Creek-North Platte River-Pathfinder Reservoir
						101800030305	Deweese Creek
						101800030306	Pathfinder Reservoir-Pathfinder Dam
						101800030307	Sand Creek-Buzzard Ranch
						101800030308	Garden Creek
						101800030309	Pathfinder Reservoir-Sand Creek

evaporation, transpiration, and seepage. The hydrologic behavior of intermittent streams/reaches is transitional between perennial and ephemeral stream hydrology. Ephemeral streams tend to be extremely 'flashy', displaying very rapid rise to peak followed by a rapid recession in streamflow. Annual runoff is typically low.

Using regional methods described by the USGS (Miller, 2003), peak flow characteristics were calculated for each of the 81 subwatersheds (HUC12) within the study area. The methodology used to compute these discharges is based upon regressional analyses of gaged data against various basin characteristics.



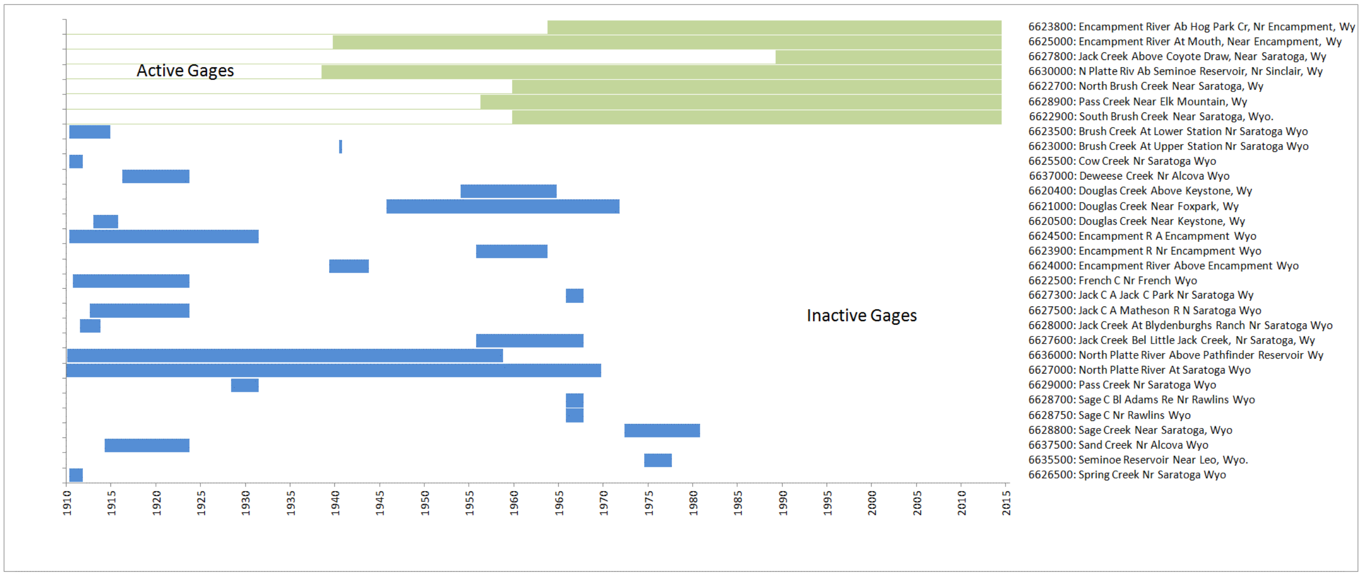
Legend

- City
- Streams
- Primary Roads
- Upper North Platte Study Area
- Counties

0 40,000 80,000 Feet

Figure 3.5-10 Upper North Platte River Watershed: Hydrologic Units and USGS Stream Gages

Figure 3.5-11 Period of Record for Study Area Stream Gages.



Site Number	Site Name	Site Status	Beginning	End	Drainage Area (sq. miles)	Gauge Elevation (ft, NGVD29)
6620400	DOUGLAS CREEK ABOVE KEYSTONE, WY	Inactive	1/5/1955	9/30/1965	22.1	9280
6620500	DOUGLAS CREEK NEAR KEYSTONE, WY	Inactive	1/7/1914	10/3/1916	25.6	9050
6621000	DOUGLAS CREEK NEAR FOXPARK, WY	Inactive	10/1/1946	10/6/1972	120	8200
6622500	FRENCH C NR FRENCH WYO	Inactive	10/1/1911	9/30/1924	59.6	7500
6622700	NORTH BRUSH CREEK NEAR SARATOGA, WY	Active	10/1/1960	5/15/2015	37.4	8020
6622900	SOUTH BRUSH CREEK NEAR SARATOGA, WYO.	Active	10/1/1960	5/15/2015	22.8	8100
6623000	BRUSH CREEK AT UPPER STATION NR SARATOGA WYO	Inactive	7/1/1941	9/30/1941	77	7820
6623500	BRUSH CREEK AT LOWER STATION NR SARATOGA WYO	Inactive	5/1/1911	11/30/1915	107	
6623800	ENCAMPMENT RIVER AB HOG PARK CR, NR ENCAMPMENT, WY	Active	10/1/1964	5/15/2015	72.7	8270
6623900	ENCAMPMENT R NR ENCAMPMENT WYO	Inactive	10/1/1956	9/30/1964	105	8200
6624000	ENCAMPMENT RIVER ABOVE ENCAMPMENT WYO	Inactive	5/1/1940	9/30/1944	207	
6624500	ENCAMPMENT R A ENCAMPMENT WYO	Inactive	5/1/1911	6/30/1932	211	7141
6625000	ENCAMPMENT RIVER AT MOUTH, NEAR ENCAMPMENT, WY	Active	10/1/1940	5/15/2015	265	6970
6625500	COW CREEK NR SARATOGA WYO	Inactive	5/1/1911	10/31/1912	58.9	
6626500	SPRING CREEK NR SARATOGA WYO	Inactive	5/1/1911	10/31/1912	114	
6627000	NORTH PLATTE RIVER AT SARATOGA WYO	Inactive	7/1/1903	9/30/1970	2840	6772
6627300	JACK C A JACK C PARK NR SARATOGA WY	Inactive	10/1/1966	9/30/1968	12.2	
6627500	JACK C A MATHESON R N SARATOGA WYO	Inactive	8/1/1913	9/30/1924	41.2	7200
6627600	JACK CREEK BEL LITTLE JACK CREEK, NR SARATOGA, WY	Inactive	10/1/1956	9/30/1968	98.2	7100
6627800	JACK CREEK ABOVE COYOTE DRAW, NEAR SARATOGA, WY	Active	4/1/1990	5/15/2015	109	7050
6628000	JACK CREEK AT BLYDENBURGHS RANCH NR SARATOGA WYO	Inactive	7/1/1912	10/31/1914	113	
6628700	SAGE C BL ADAMS RE NR RAWLINS WYO	Inactive	10/1/1966	9/30/1968	24.3	
6628750	SAGE C NR RAWLINS WYO	Inactive	10/1/1966	9/30/1968	52	
6628800	SAGE CREEK NEAR SARATOGA, WYO	Inactive	5/1/1973	9/30/1981	263	6650
6628900	PASS CREEK NEAR ELK MOUNTAIN, WY	Active	4/1/1957	5/15/2015	91.5	7230
6629000	PASS CREEK NR SARATOGA WYO	Inactive	6/1/1929	6/30/1932	106	
6630000	N PLATTE RIV AB SEMINOE RESERVOIR, NR SINCLAIR, WY	Active	7/1/1939	5/15/2015	4061	6400
6635500	SEMINOE RESERVOIR NEAR LEO, WYO.	Inactive	7/17/1975	8/25/1978	6641	6190
6636000	NORTH PLATTE RIVER ABOVE PATHFINDER RESERVOIR WY	Inactive	1/1/1911	9/30/1959	6652	5929
6637000	DEWEESE CREEK NR ALCOVA WYO	Inactive	4/1/1917	9/30/1924	104	
6637500	SAND CREEK NR ALCOVA WYO	Inactive	4/1/1915	9/30/1924	51	

These estimates are intended to be used for regional planning efforts only. The methodology varies depending upon which of six regions within the state the watershed falls within. The three regions involved in this study and the regressional factors employed for each are as follows:

- Rocky Mountain Region: basin area, longitude of basin outlet, and mean basin elevation
- Eastern Basins and Plains Regions: basin area and mean basin soils hydrologic index
- High Desert Region: basin area, latitude of basin outlet

Project-specific estimates would be required before design of future watershed projects (ex. reservoir storage). Appendix 3G presents the results of this effort.

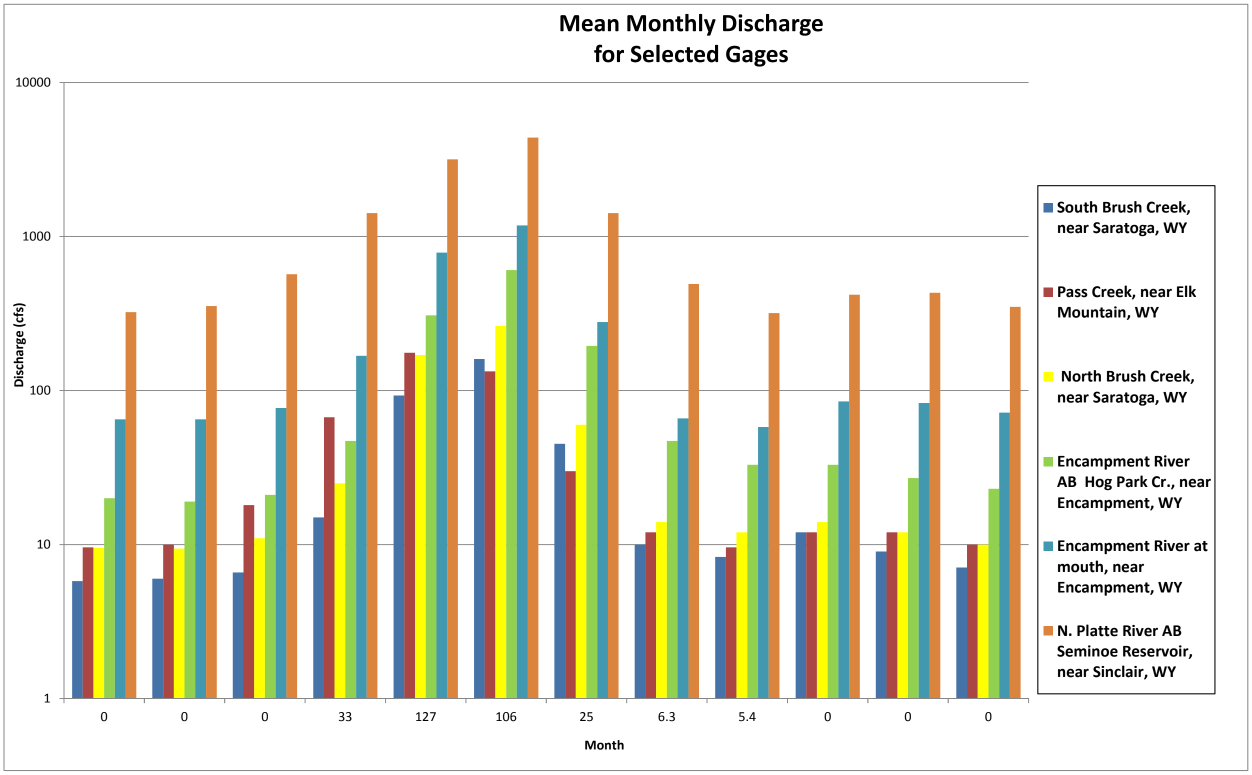
Table 3.5-2 Wyoming State Engineers Office Gages in the Project Study Area.

Station ID	Location	Parameter	Start of Record	End of Record
(0117ACFD)	A.C. Forrester Ditch	Discharge	2010/05/20	2015/10/01
(0117BRCK)	Barrett Creek	Discharge	2009/07/06	2015/10/01
(0118BVCK)	Beaver Creek	Discharge	1904/01/01	2015/10/05
(0117BCHC)	Brush Creek @ Harris Cabin	Discharge	2009/07/06	2015/10/01
(0117BCSD)	Brush Creek Supply Ditch	Discharge	2010/05/20	2015/10/01
(0117CDCK)	Cedar Creek	Discharge	2009/07/06	2015/10/01
(0107CCEN)	Cow Creek nr Encampment	Discharge	2009/07/14	2015/10/01
(0107CR)	Cow Creek Reservoir	Total Storage	2009/11/13	2015/12/01
(0117DCRR)	Douglas Creek below Rob Roy Reservoir	Discharge	1904/12/01	2015/12/01
(06623800)	Encampment R ab Hog Park Creek	Discharge	2010/04/16	2015/12/01
(06625000)	Encampment R at mouth nr Encmpt	Discharge	2009/07/06	2015/12/01
(0106HAID)	Haines Ditch	Discharge	2010/05/20	2015/10/16
(0117HL4D)	Highline #4 Ditch	Discharge	2009/07/14	2015/09/21
(0107HPE)	Hog Park Effluent (Outflow)	Discharge	2009/07/06	2015/12/01
(0107HPI)	Hog Park Influent (Inflow)	Discharge	2009/07/06	2015/12/01
(0117HDSA)	Hugus Ditch	Discharge	2010/05/20	2015/10/16
(06627800)	Jack Creek above Coyote Draw	Discharge	2009/07/06	2015/10/07
(0106KR)	Kindt Reservoir	Total Storage	2009/06/16	2015/06/04
0106KR-DS)	Kindt Reservoir down stream gage	Discharge	2009/06/16	2015/06/23
(06622700)	North Brush Creek near Saratoga	Discharge	2009/07/06	2015/12/01
(06620000)	North Platte R nr Northgate, CO	Discharge	2009/07/06	2015/12/01
(0117NPSA)	North Platte River @ Saratoga, WY	Discharge	2009/07/06	2015/12/01
(0106NSR)	North Spring Creek Reservoir	Total Storage	2008/10/29	2015/12/01
(0106NSR-DS)	North Spring Creek Reservoir down stream gage	Discharge	2009/07/14	2015/12/01
(06628900)	Pass Creek near Elk Mountain	Discharge	2010/04/16	2015/08/25
(0106SCR)	Sage Creek Reservoir	Total Storage	2009/07/06	2015/12/01
(06622900)	South Brush Creek	Discharge	2009/07/06	2015/10/07
(0117SBCS)	South Brush Creek Supply	Discharge	2010/05/20	2015/10/01
(0106SSCK)	South Spring Creek	Discharge	1904/01/01	2015/10/02
(0106SSR)	South Spring Creek Reservoir	Total Storage	2009/07/06	2015/12/01
106SSR-DS)	South Spring Creek Reservoir down stream gage	Discharge	2009/07/14	2015/12/01
(0107WAGD)	Wagoner Ditch	Discharge	1904/01/01	2015/10/01
(0117WNTD)	Wiant Ditch	Discharge	2009/07/13	2015/10/01
(0107WOLD)	Wolford Ditch	Discharge	2010/05/25	2012/05/11

Table 3.5-3 Mean Monthly Discharges for Active Stream Gages.

Month	Mean Stream Discharge						
	North Brush Creek, near Saratoga, WY	South Brush Creek, near Saratoga, WY	Encampment River AB Hog Park Cr., near Encampment, WY	Encampment River at mouth, near Encampment, WY	Jack Creek above Coyote Draw, near Saratoga, WY	Pass Creek, near Elk Mountain, WY	N. Platte River AB Seminoe Reservoir, near Sinclair, WY
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
USGS Gage	06622700	06622900	06623800	06625000	06627800	06628900	06630000
Period of Record	10/1/1960 to Current	10/1/1960 to Current	10/1/1964 to Current	10/1/1940 to Current	4/1/1990 to Current	4/1/1957 to Current	7/1/1939 to Current
Jan	9.5	5.8	20	65	0	9.6	323
Feb	9.4	6	19	65	0	10	354
Mar	11	6.6	21	77	0	18	569
Apr	25	15	47	168	33	67	1,420
May	170	93	308	788	127	176	3,170
Jun	263	160	606	1,180	106	133	4,390
Jul	60	45	195	278	25	30	1,420
Aug	14	10	47	66	6.3	12	491
Sep	12	8.3	33	58	5.4	9.6	318
Oct	14	12	33	85	0	12	419
Nov	12	9	27	83	0	12	431
Dec	10	7.1	23	72	0	10	349
Annual	50.8	31.5	114.9	248.8	25.2	41.6	1137.8

Figure 3.5-12 Mean Monthly Discharge at Selected USGS Stream Gages.



Mean annual discharge was computed for each of the 81 subwatersheds (HUC12) within the study area using regional methods described by Lowham (1988). The methodology used to compute these discharges relies upon statistical relationships between basin area, mean annual precipitation and measured stream discharge. Results of this analysis are presented in Figure 3.5-13.

3.6 Stream Geomorphology

3.6.1 General

The field of fluvial geomorphology is the study of how land is formed under processes associated with running water. The balance between processes such as erosion, deposition, and sediment transport determines the character and condition of a stream. The objective of the geomorphic evaluation of the study area is to determine the nature of this balance, and where the balance has been upset.

The condition of a stream can be assessed with respect to its basic form (width, depth, slope, etc.), as well as its state of equilibrium, or geomorphic stability (Thorne, et al, 1996; Johnson, et al., 1999). Stable, or equilibrium, channels are generally defined as those that have achieved a balance between flow energy and sediment delivery, such that sediment is transported at the rate at which it is delivered, and the form and pattern of the channel is maintained (Thorne, et al., 1996). Dynamically stable

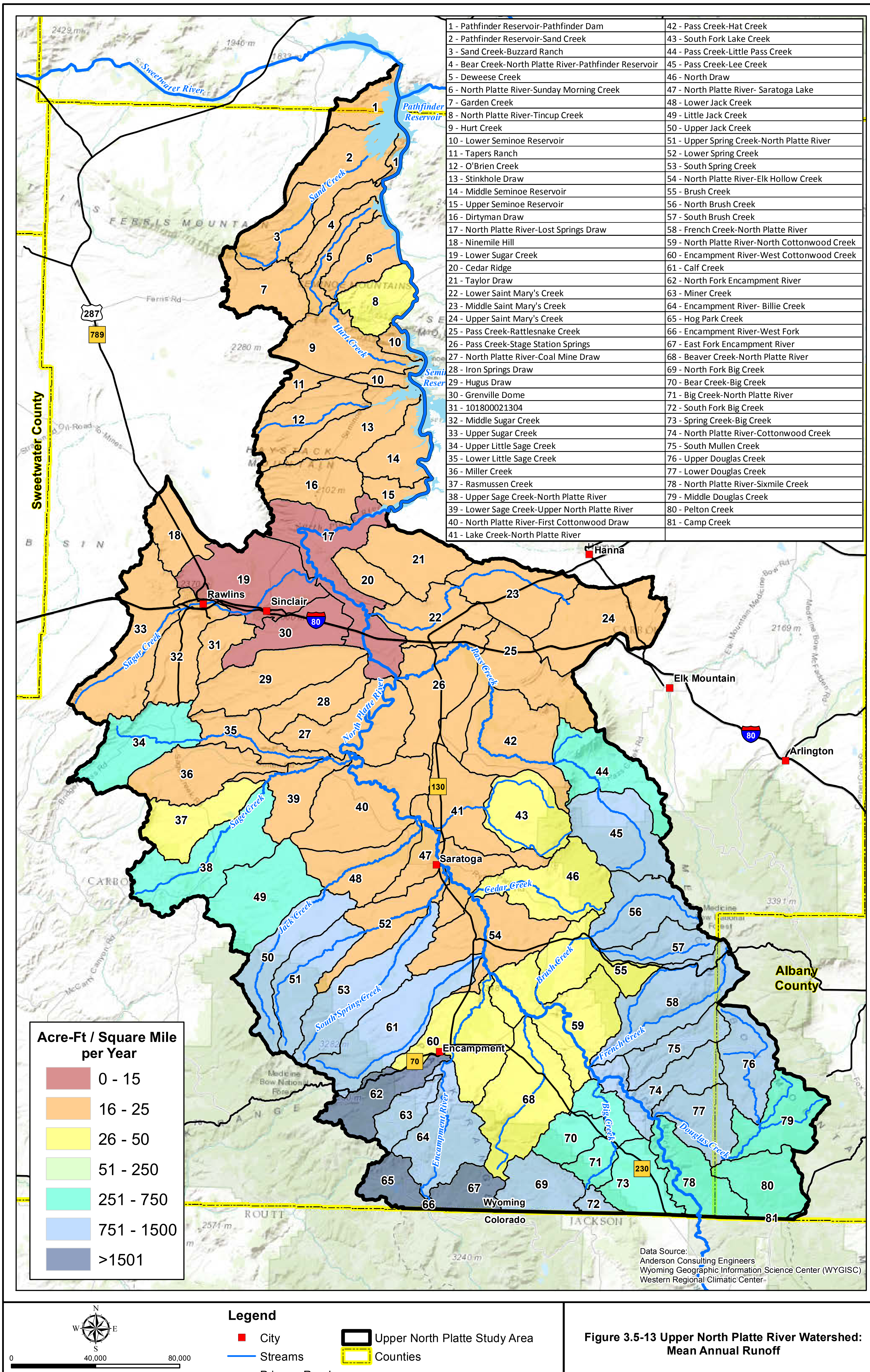


Figure 3.5-13 Upper North Platte River Watershed: Mean Annual Runoff

channels are adjustable in nature, and "stability" does not preclude lateral migration and associated dynamics such as bank erosion and sediment deposition.

In geomorphically stable conditions, minor changes in either sediment supply or transport energy result in gradual adjustment of channel form to accommodate those changes (Lane, 1955). Channels destabilize when changes in those factors are extreme enough that rapid and dramatic alterations in pattern or form occur. Common indicators of channel instability include active downcutting and accelerated bank erosion, major changes in channel width/depth ratios, and increased flooding due to sediment deposition. Geomorphic function is achieved when a channel is in equilibrium, while undergoing processes such as lateral migration, sediment reworking, and occasional overbank flooding that effectively create and sustain quality habitat elements, such as bars, pool/riffles, step/pools, and healthy, regenerating riparian corridors.

A commonly used term today for this type of stability is dynamic equilibrium. A stream in dynamic equilibrium has adjusted its width, depth and slope such that the channel is neither aggrading nor degrading. However, change may be occurring in the stream bank, erosion may result, and bank stabilization may be necessary, even on the banks of a stream in dynamic equilibrium.

The equilibrium concept of streams discussed above can also be described by various qualitative relationships. One of the most widely used relationships is the one proposed by Lane (1955) which states that:

$$Q_s \cdot D_{50} \propto Q_w \cdot S$$

Where Qw is the water discharge, S is the slope, Qs is the bed material load, and D50 is the median size of the bed material. This relationship, commonly referred to as Lane's Balance, is illustrated in Figure 3.6-1.

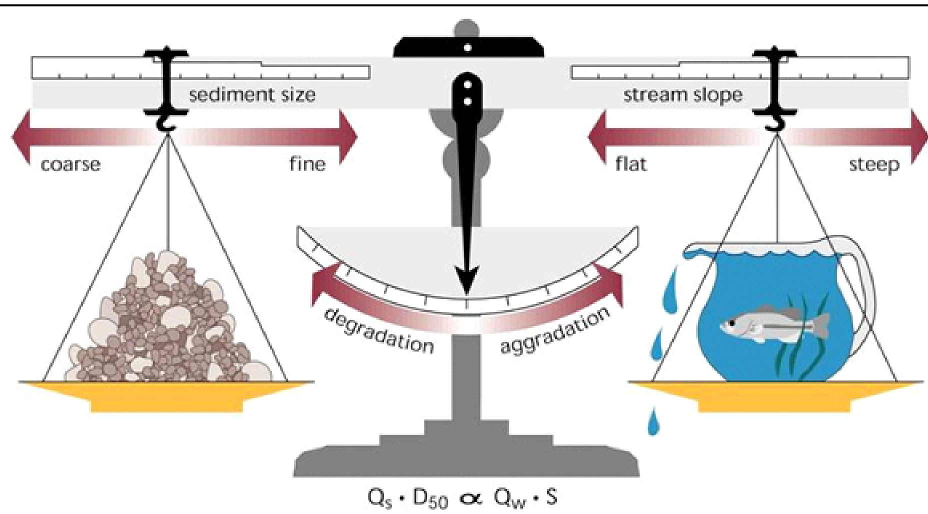


Figure 3.6-1 Lane's Balance.

This graphic indicates that a change in any of the four variables will cause a change in the others such that equilibrium is restored. When a channel is in equilibrium, it will have adjusted these four variables such that the sediment being transported into the reach is transported out, without significant deposition of sediment in the bed (aggradation), or excessive bed scour (degradation). It should be noted that by this definition of stability, a channel is free to migrate laterally by eroding one of its banks and accreting the one opposite at a similar rate.

In summary, a stable river, from a geomorphic perspective, is one that has adjusted its width, depth, and slope such that there is no significant aggradation or degradation of the stream bed or significant planform changes (meandering to braided, etc.) By this definition, a stable river is not in a static condition, but rather is in a state of dynamic equilibrium where it is free to adjust laterally through bank erosion and bar building (Watson, et al, 1999).

Impairments to geomorphic function reflect a significant loss of the functional potential of the green channel segment. These impairments are typically described in general, qualitative terms, and any rehabilitation of impaired channel segments requires a more thorough, site-specific assessment of impacts, impairments, and feasible remedies.

3.6.2 Rosgen Classification System

The literature presents descriptions of numerous systems for classifying and evaluating stream systems. Of these, perhaps the most widely used today is the Rosgen classification system (Rosgen, 1996). This system, based upon the stream's existing channel morphology, was utilized in this study. Parameters such as the sinuosity, slope, width/depth ratio, and size of channel materials are evaluated and used to classify the stream into one of the various "types" included in the system.

There are four levels of classification in the Rosgen system, each being more detailed than the previous level. Figure 3.6-2 displays the hierarchy of the assessment levels and the general nature of effort associated with each. Much of the Level I geomorphic characterization is qualitative and utilizes aerial photography and topographic maps. Streams are divided into eight (8) broad types on the basis of their channel and floodplain geometry. Rosgen's classification system stream types can be thought of in their relative location within the watershed, from their headwaters through lowlands. The major stream types reflect their location in the watershed. For example, “A” type streams are located in headwaters; “C” & “E” stream types are located in meandering lowlands, etc.

The Level II effort provides a more detailed description of the stream using measurements at selected locations. Stream types are further subdivided into 94 subtypes based upon degree of entrenchment, width-to-depth ratio, water surface slope, streambed materials, and sinuosity (Figure 3.6-3). Consequently, the Level II characterization is more quantitative than the Level I effort. Levels III and IV require more extensive data collection and quantification of stream characteristics. The Upper North Platte River Study included Level I evaluation of the mainstem streams and their principal tributaries.

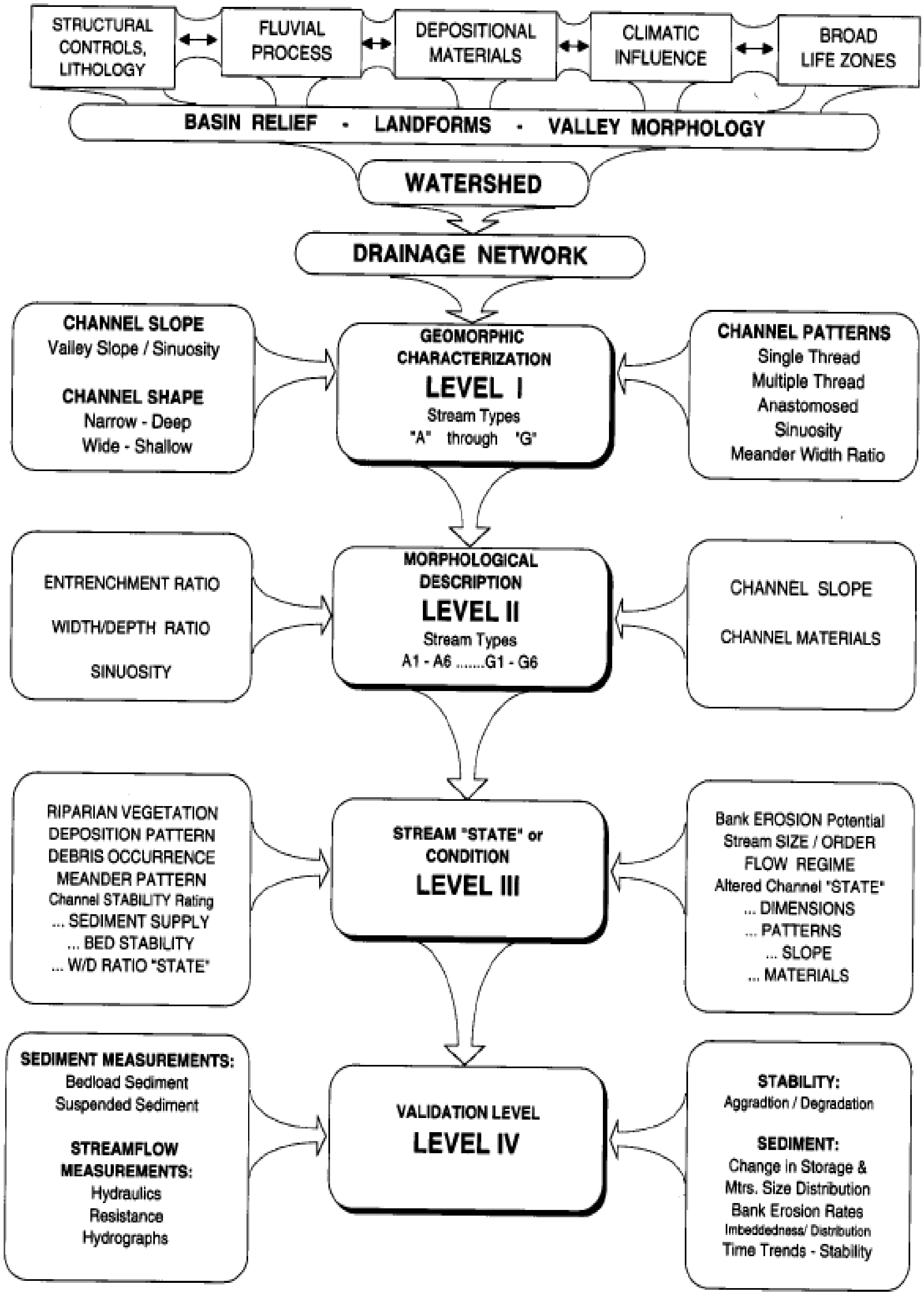


Figure 3.6-2 Hierarchy of the Rosgen Stream Classification System.

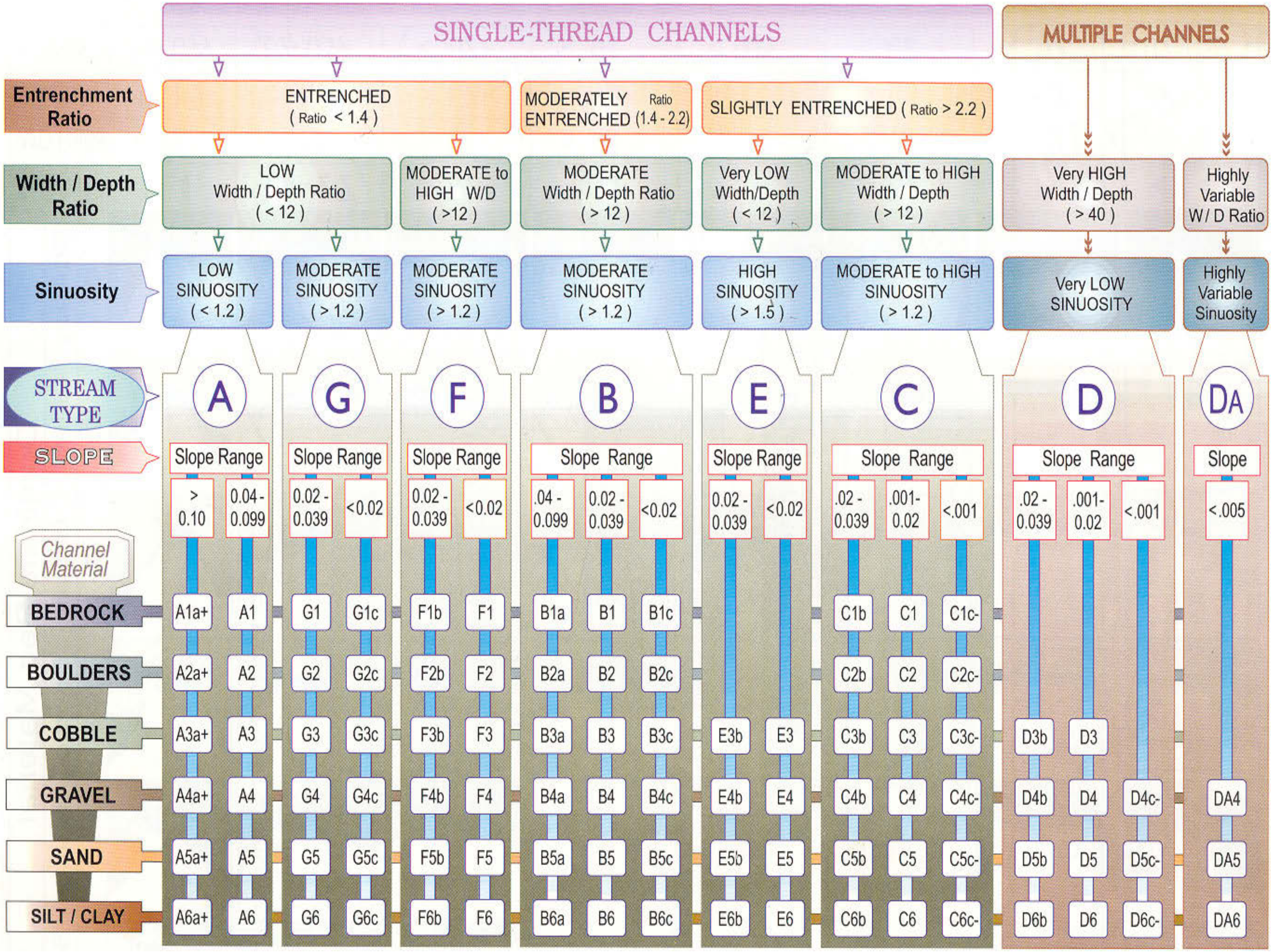


Figure 3.6-3 Rosgen Classification Matrix (Rosgen, 1996).

3.6.2.1 Level I Methods

The purpose of the Level I geomorphic classification is to provide an inventory of the study area's overall stream morphology, character, and condition. It is intended to serve as an initial assessment for use in more detailed assessments and to determine the location and approximate percentage of stream types within the basin. The results of the Level I classification can be integrated directly into the project Geographic Information System (GIS) providing a graphical "snapshot" of the basin. Based upon this initial effort, potential stream reference reaches can be identified for further study in Level II classification efforts. The end product of the Level I classification is the determination of the major stream types, A through G.

Figure 3.6-4 shows the major stream types within the Rosgen Classification System along with their relative locations within a typical watershed. Brief descriptions of the various stream types encountered in the watershed are presented in the following paragraphs.

A-Type Channels are relatively steep channels that form in headwater areas as well as within bedrock canyons. These channels are entrenched and confined by steep valley margins such that little to no floodplain area borders them. As the boundaries of A-type channels are typically highly resistant to erosion, these stream types are generally quite resilient with respect to human impacts. The most common cause of geomorphic change within A-type channels is due to large-scale sediment transport events, (landslides, debris flows, debris jam failure) that may result in blockage or deflection of channel flow.

B-Type Channels tend to form downstream of headwater channels, in areas of moderate slope where the watershed transitions from headwater environments to valley bottoms (Figure 3.6-5). B-Type channels are characterized by moderate slopes, moderate entrenchment, and stable channel boundaries. Due to the relatively steep channel slopes and stable channel boundaries, B-channels are moderately resistant to human impacts, although, their reduced slopes relative to headwater areas can make them prone to sediment deposition and subsequent adjustment following a large sediment transport event such as an upstream landslide, debris flow, or flood.

Figure 3.6-5 Example Type B Channel: North Brush Creek from WY HWY 130.

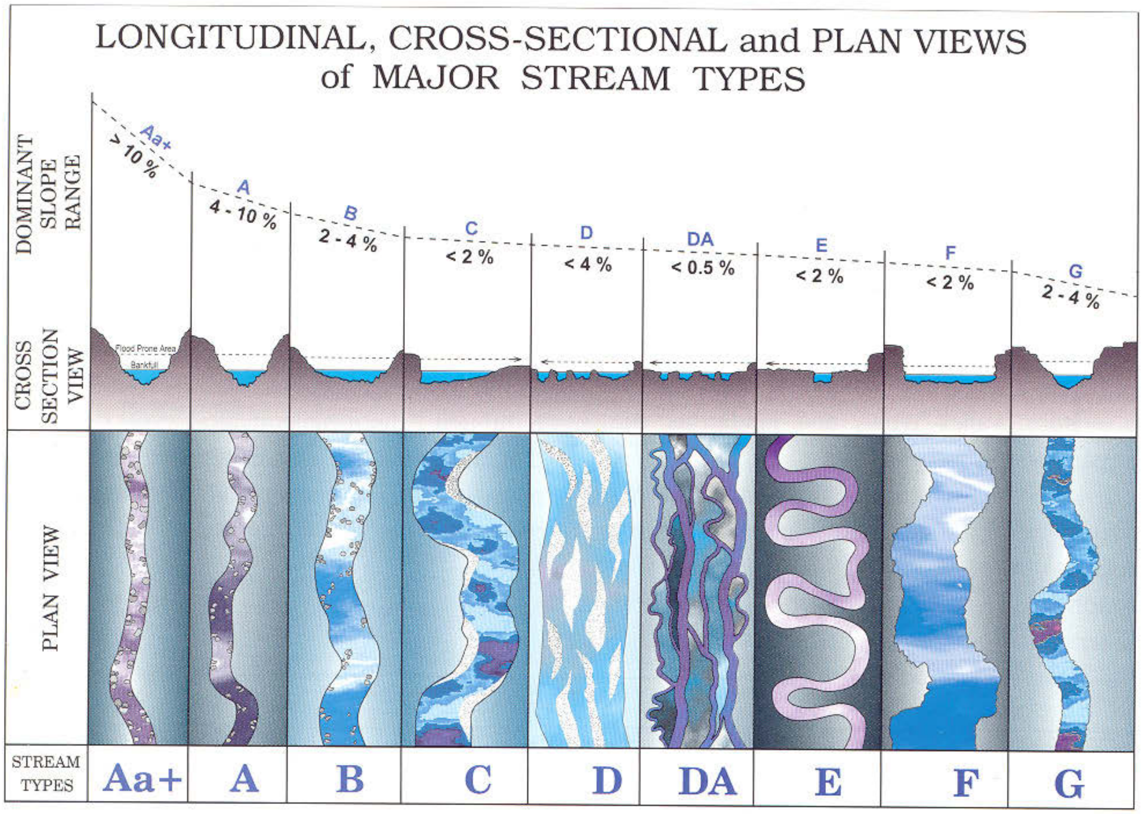


Figure 3.6-4 Major Stream Types within the Rosgen Classification System (Rosgen, 1996).

C-Type Channels are typically characterized by relatively low slopes, meandering planforms (i.e., the shape one would see if viewing from above, as on a map or aerial photo), and pool/riffle sequences (Figure 3.6-6). The channels tend to occur in broad alluvial valleys, and they are typically associated with broad floodplain areas; they are not entrenched and still have 'access' to their floodplains. C channels tend to be relatively sinuous, as they follow a meandering course within a single channel thread. In stream systems in which the boundaries of C-type channels are composed of alluvial sediments, channels tend to be dynamic in nature, and susceptible to rapid adjustment in response to disturbance.

Figure 3.6-6 Example Type C Channel: Jack Creek at Jack Creek Rd Crossing.

E-Type Channels are somewhat similar to C channels, as they form as single threads with defined, accessible floodplain areas. However, E channels are different in that they tend to have fine-grained channel margins, which provide cohesion and support dense bankline vegetation. The fine-grained, vegetation-reinforced banklines allow for the development of steep banks, very sinuous planforms, and relatively deep, U-shaped channel cross sections. E type channels commonly form in low gradient areas with fine-grained source areas, mountain meadows, and in beaver-dominated environments. E-channels tend to have very stable planforms, and efficient sediment transport capacities due to low width/depth ratios (Figure 3.6-7).

Figure 3.6-7 Example Type E Channel: Deweese Creek near Pathfinder Reservoir.

F-Type Channels typically have relatively low slopes (<2%), similar to C and E channel types. The primary difference between C/E channels and F channels is with respect to entrenchment. F channels are entrenched, which means that the floodplain is quite narrow relative to the channel width. The entrenchment of alluvial F-type channels typically is an indicator of an historic downcutting event. F-type channels may form in resistant boundary materials (e.g., U-shaped bedrock canyons), and relatively erodible alluvial materials (e.g., arroyos). When the boundary materials are erodible, the steep valley walls are prone to instability, and channel widening commonly occurs within the entrenched channel cross section (Figure 3.6-8).

Figure 3.6-8 Example Type F Channel: Sugar Creek near Sinclair WY.

G-Type Channels are narrow, steep entrenched gullies. G-Type channels typically have high bank erosion rates and a high sediment supply. Channel degradation and sideslope rejuvenation processes are typical.

The Level I classification effort was conducted primarily using existing information incorporated into the project GIS. Several analytical tools were developed and integrated into the GIS which allowed the evaluation of various geomorphic parameters (sinuosity, slope, stream station determination). The data collated and incorporated in the Project GIS include digital aerial photography, USGS topographic maps, Landsat color infrared imagery, a digital elevation model (DEM), and digitized hydrography information. The most current data available were used in the geomorphic evaluation. Because the DEM was limited to a 10-meter grid, elevations and subsequent slope calculations are approximate. Stream alignments were digitized using 2011 aerial photography and represent the best available estimate of current channel alignment.

The streams evaluated were divided into reaches based upon definable geographic factors (e.g. confluences with tributaries, major road crossings, etc) or where their geomorphic character displayed changes. Each reach was evaluated in light of the characteristics required at the Level I classification. These parameters, as indicated in Figure 3.6-3, were channel slope, channel shape, channel patterns, and valley morphology. Note that in the Level I classification, these parameters are not typically quantified and the relative magnitude (i.e., "moderate", "slightly", etc.) is utilized to classify the stream.

3.6.2.2 Geomorphic Characterization

Level I Classification

Results of the Level I classification effort are presented in Table 3.6-1 and graphically in Figure 3.6-9. This figure displays a map of the study are depicting the various stream types as well as the reach designations used in the classification effort.

The North Platte River enters the project study area from Colorado in a confined steep-walled canyon reach where it was classified as a B-Type stream. At the confluence with Brush Creek, the valley broadens significantly and the river transitions to a C-Type stream. The lateral confinement is reduced, the slope lessens and the boundary materials become less coarse. As a result of these downstream changes in boundary conditions, the lower subreaches tend to display meandering channel dynamics; that is, pool/riffle development and increased lateral channel migration. The North Platte and other tributaries transition from B-type channels, which are located in transition zones at the foot of the mountains, to C-type channels, which are gravel bed meandering streams that dominate the lower basin.

Primary tributaries originate in the steeper slopes of the Sierra Madre and the Medicine Bow Mountains. Within the mountainous areas, the channels are steep and bounded by very coarse, resistant materials that include hillslope colluvium and bedrock. Rocks here are harder igneous and metamorphic Precambrian rocks. As a result, the channels are laterally stable, and geomorphically resilient with respect to human impacts. Channel change in these upper subreaches typically results from punctuated hillslope processes rather than gradual channel migration. The channels are A-type or B-type channels which reflects their steep slope and stable boundaries.

A lesser number of channels were classified as either Type F or Type G stream channels in at least portions of their extent. Type F and Type G stream classifications both denote channels which have "disconnected" from their floodplains. These channels are typically erosive, actively downcutting, or

Table 3.6-1 Rosgen Level I Stream Classifications.

Stream	Reach Number	Station (Distance from Mouth)		Reach Length (mi)	Sinuosity	Slope	Rosgen
		Station Start (mi)	Station End (mi)				
Beaver Creek	1	0.0	9.0	9.00	1.63	0.005	C
	2	9.0	15.2	6.23	1.23	0.012	E
	3	15.2	22.4	7.17	1.07	0.050	A
Big Creek	1	0.0	8.6	8.56	1.20	0.006	B
	2	8.6	17.5	8.99	1.47	0.007	C
Brush Creek	1	0.0	6.5	6.47	1.21	0.012	C
	2	6.5	11.3	4.88	1.17	0.014	B
Cedar Creek	1	0.0	6.5	6.49	1.52	0.009	E
	2	6.5	14.7	8.17	1.47	0.009	C
	3	14.7	20.2	5.50	1.10	0.037	B
Corral Creek	1	0.0	12.7	12.71	1.16	0.013	F
Cow Creek	1	0.0	8.9	8.90	1.65	0.006	B
	2	8.9	18.7	9.75	1.19	0.017	B
	3	18.7	26.7	8.08	1.07	0.040	A
Deweese Creek	1	0.0	7.1	7.13	1.29	0.013	F
	2	7.1	16.3	9.15	1.40	0.036	E
Douglas Creek	1	0.0	10.1	10.06	1.12	0.015	B
	2	10.1	24.6	14.55	1.18	0.015	B
	3	24.6	31.4	6.83	1.20	0.017	A
Encampment River	1	0.0	11.5	11.51	1.25	0.004	C
	2	11.5	21.0	9.46	1.18	0.007	B
	3	21.0	30.0	9.07	1.10	0.158	A
French Creek	1	0.0	5.1	5.14	1.16	0.019	B
Hurt Creek	1	0.0	3.7	3.69	1.09	0.012	B
	2	3.7	8.5	4.79	1.30	0.020	B
	3	8.5	12.6	4.09	1.11	0.049	B
Jack Creek	1	0.0	19.2	19.25	2.19	0.003	E
	2	19.2	35.7	16.46	1.57	0.008	C
	3	35.7	47.6	11.89	1.28	0.021	B
Little Sage Creek	1	0.0	8.3	8.30	1.38	0.003	E
	2	8.3	19.4	11.13	1.63	0.002	E
	3	19.4	30.8	11.34	1.23	0.010	B
North Brush Creek	1	0.0	7.2	7.16	1.11	0.031	B
	2	7.2	15.5	8.34	1.24	0.034	B
North French Creek	1	0.0	5.4	5.39	1.10	0.033	B
	2	5.4	12.4	7.06	1.14	0.039	A
North Platte River	1	0.0	48.3	48.32	1.31	0.001	C
	2	48.3	93.5	45.21	1.29	0.002	C
	3	93.5	126.6	33.07	1.17	0.004	B
North Spring Creek	1	0.0	18.8	18.84	2.06	0.004	E
	2	18.8	26.6	7.79	1.26	0.026	B
	3	26.6	34.6	7.94	1.09	0.033	A
Pass Creek	1	0.0	31.2	31.21	2.42	0.001	E
	2	31.2	62.2	31.03	2.18	0.003	E
	3	62.2	77.0	14.80	1.51	0.010	C
	4	77.0	83.1	6.08	1.08	0.045	A
Sage Creek	1	0.0	18.1	18.11	1.89	0.002	F
	2	18.1	29.7	11.62	1.91	0.003	B
	3	29.7	46.1	16.39	1.46	0.009	C
Saint Marys Creek	1	0.0	17.4	17.38	1.43	0.003	E
	2	17.4	33.2	15.87	1.39	0.002	E
Sand Creek	1	0.0	8.2	8.17	1.30	0.005	F
	2	8.2	14.6	6.41	1.35	0.007	F
	3	14.6	23.3	8.75	1.31	0.033	F
South Brush Creek	1	0.0	6.4	6.36	1.10	0.031	B
	2	6.4	13.3	6.96	1.08	0.052	A
South French Creek	1	0.0	7.7	7.72	1.12	0.022	B
	2	7.7	15.6	7.87	1.09	0.050	A
South Spring Creek	1	0.0	12.7	12.67	1.69	0.006	E
	2	12.7	19.9	7.20	1.18	0.021	B
	3	19.9	25.8	5.88	1.05	0.073	A
Spring Creek	1	0.0	8.4	8.40	2.13	0.002	E
Sugar Creek	1	0.0	18.9	18.88	1.27	0.003	C
	2	18.9	36.3	17.39	1.22	0.005	C

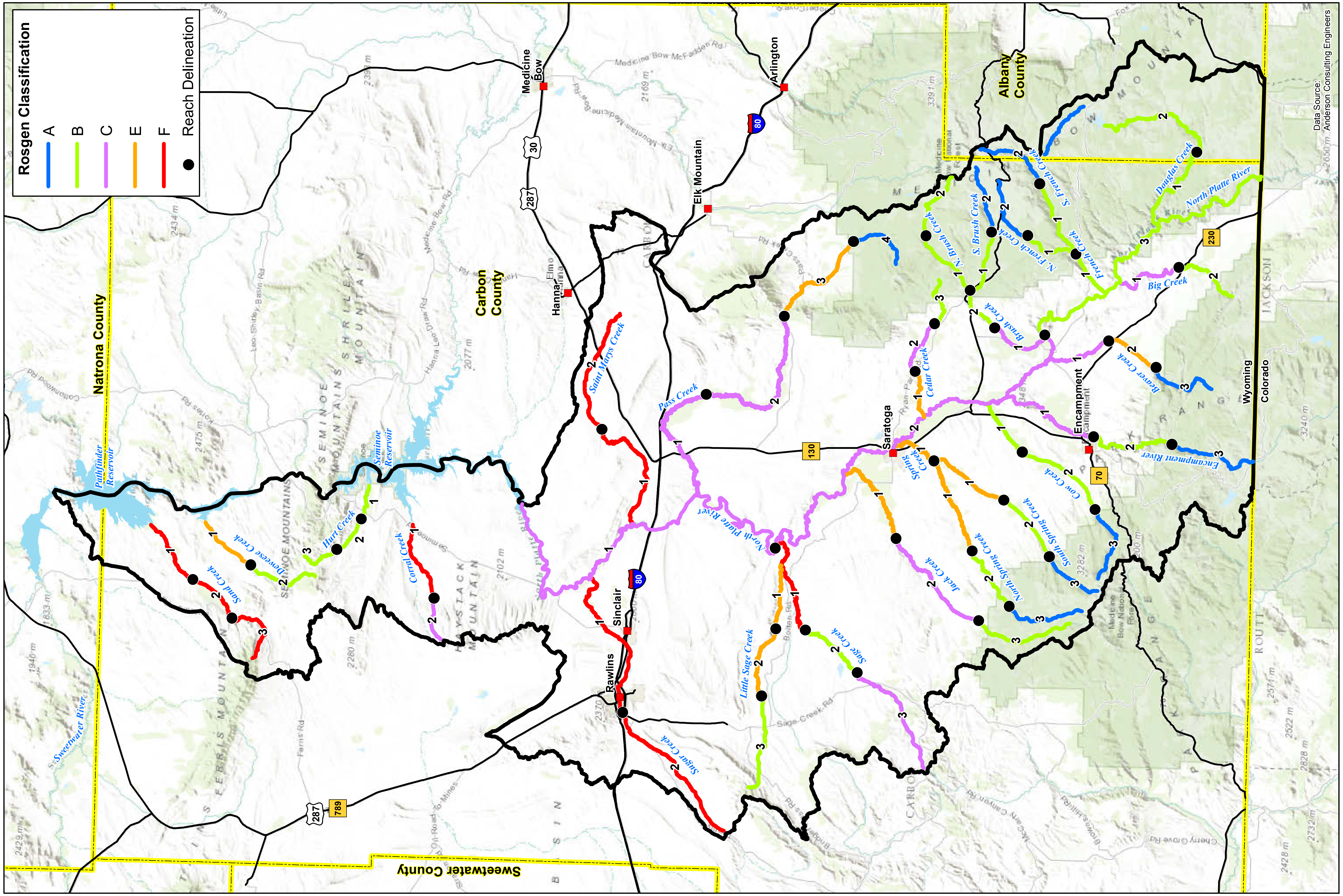


Figure 3.6-9 Upper North Platte River Watershed: Rosgen Level I Classification

widening. Based upon the GIS classification effort followed by field verification, it was concluded that the majority of stream channels within the study area are entrenched to some degree. Entrenchment occurs for a variety of reasons including presence of erosive soils coupled with land use practices including road construction, energy development, grazing, etc. Observations of channel conditions within the study revealed entrenchment ranging from slight to severe.

Some of the first-order tributaries in the lower portions of the basin can be classified as G-Type channels, or gullies. These channels are highly erosive, generate high sediment volumes, and can result in the loss of productive lands and destabilize upland conditions. Observation of many of these channels indicates that while the major stream channels appear to have achieved a level of stability, the upper reaches of the watershed are still suffering a level of destabilization. These channels could be forming in response to one or more of numerous stimuli including but not necessarily limited to: channel realignment (straightening), road and culvert construction, range management practices, or base-level lowering associated with main channel incision.

Additional Considerations

The character of streams in the study area have been affected in many areas by man and his activities. The North Platte River and many of its tributaries were used during the late 1800's and early 1900's as a means of conveying logs used as railroad ties during the period of railroad construction; the process was called 'tie driving' (Figure 3.6-10). Millions of railroad ties were floated down study area streams between 1868 and 1940 (Young, et al, 1994). Figure 3.6-11 displays the streams within the project area used for this purpose. Researchers determined that stream reaches subjected to tie drives contained less coarse woody debris and had lower densities of large riparian trees than streams which did not have tie drives. They also determined that tie-driven streams had lower channel complexity in terms of riffles and pools than did unaffected streams (Young, et al, 1994).

Elsewhere in the basin, channels have been realigned or straightened in efforts to reduce flooding or to modify agricultural lands. Figure 3.6-12 displays a photo of a portion of Sage Creek where stream realignment is clearly evident. This activity can have long lasting effects on overall channel stability. Numerous additional stream courses have been modified or realigned, including for example, the North Platte River and the Encampment River.

Figure 3.6-10 A tie jam on Douglas Creek. Photograph courtesy of the American Heritage Center, University of Wyoming.

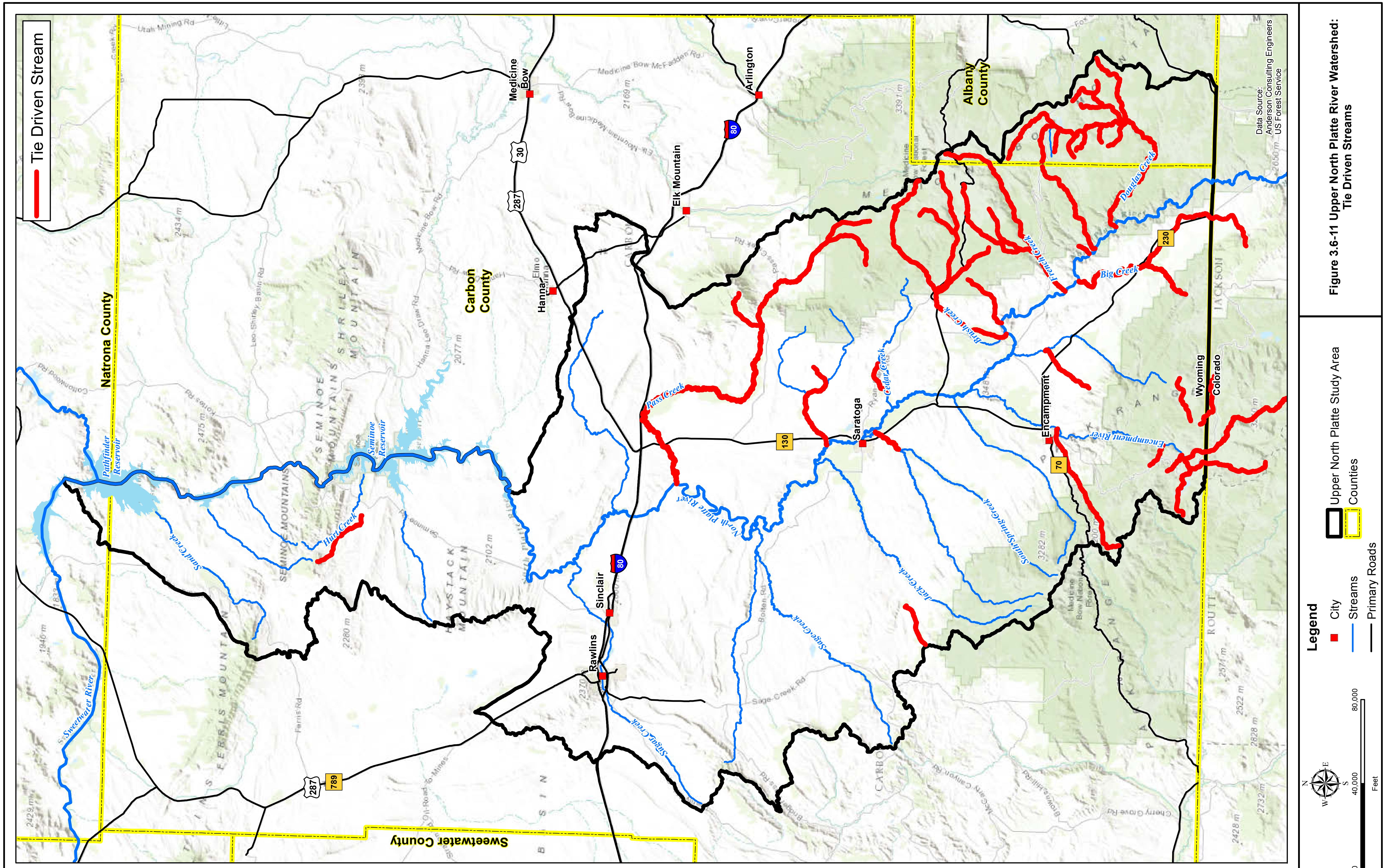


Figure 3.6-11 Upper North Platte River Watershed: Tie Driven Streams

Figure 3.6-12 Sage Creek tream realignment.

Additional Studies

During the completion of this Level I watershed investigation, a more detailed geomorphic investigation of the North Platte River was being completed by private consultants on behalf of the Town of Saratoga. The objective of the study was to evaluate the nature, extent, and consequences of river impairment and the loss of physical and ecological functions within the evaluation reach of the North Platte River through Saratoga. The Town of Saratoga River Study included the following discussion of the geomorphic character of the North Platte River:

> *"The landform of the North Platte River is associated with an unconfined alluvial valley; The river is bounded by high pediment surfaces of gravel that overlay sandstone and limestone. A relatively high sand supply is added to the river due to lateral accretion against these high pediment terraces. Holocene or river terraces are also present that are associated with stratified deposits of coarse cobble to fine sand river alluvium. The North Platte River is a meandering, single-thread, cobble-bed channel with floodplain connectivity on slopes less than 0.022 feet/feet and a width/depth ratio greater than 12.0, which corresponds to a C3 stream type. The bedrock outcrops as evident within the bed of the North Platte River through Saratoga may be responsible for a previous channel pattern change as observed in the aerial photograph shown in Figure 10. The upstream pattern of abandoned meander scrolls, multiple-thread channels, and associated avulsion channels and oxbows are much different than the pattern of the downstream reach; Downstream of town, the previous river pattern is similar to the above Saratoga reach as depicted in figure 10* (Figure 3.6-13 in this report).

Figure 3.6-13 North Platte River through Saratoga, Wyoming.

The North Platte River through the town of Saratoga was determined to be a C3 stream type with a cobble-bed channel, with an average slope of 0.00218 feet/feet and an unusually high width/depth ratio range from 63 to 106, with an average of 80. Typical bed features of C3 stream types include riffles, runs, pools, and glides. (Wildland Hydrology, Stantec 2014a).

"The North Platte River through Saratoga has a long history of disturbance affecting the dimensions, pattern, profile, and overall stability and biological functions of the river. Log and railroad tie drives occurred from the 1860s to the early 1930s where thousands of logs and ties per year were floated down the North Platte River to mills and tie landings as far as Ft. Steele. Structures to direct flows away from the streambanks were installed along the river; some bank structures are still evident as observed upstream during the assessment.

The North Platte River also has many bridges that have caused backwater conditions at higher flows resulting in excess deposition, flood risk, lateral erosion, and land loss. Cross-channel *“pushup” dams for irrigation diversions have also increased the width/depth ratio of the river channel leading to increased sediment deposition, high maintenance, and diminished aquatic habitat. The Pick Ditch diversion at the lower end of the project reach has caused excess deposition, streambank erosion, and backwater resulting in headward sediment deposition and high maintenance with the dam and diversion canal. Flow diversions for agricultural purposes during base flows have also adversely impacted the river temperature and holding cover for fish. Imported water due to the Cheyenne project has increased streamflows to the North Platte River that may help offset local depletions. An evaluation of the existing flow-duration curves from the streamgage station will help ascertain potential impacts. Additionally, riparian vegetation communities of cottonwood and willow were converted to grass/forb communities throughout various locations of the North Platte River, leading to accelerated streambank erosion, land loss, and increased sediment supply. In 1950, channel dredging attempted to remove in-channel bars and islands as evident in the photograph in Figure 3 [not included in this report] from around 1948; aerial photographs in 1958 showed the bars starting to rebuild at the same reach eight years following dredging. The aerial photographs at this reach also indicated a very high channel width between the Bridge Street and First Street bridges. The extensive bars were reformed due to the river’s high width/depth ratio and the bridge influence; such dredging is a temporary solution at best, and diminishes fish habitat and river stability.*

The channel pattern of the North Platte River adjusted between 1994 and 2009 as a by-pass channel was cut through the existing island to divert streamflows to the right channel (NE side) of Veterans Island. This by-pass diversion may have been constructed to reduce the streamflow convergence against the mainstem, downstream left bank where rock rip-rap had been placed. The channel pattern is much straighter through the developed portions of Saratoga than that observed above and below the town. This may indicate channelization and straightening activities in the past.

The North Platte River through Saratoga has also had a history of major floods and associated impacts, which are not uncommon for communities historically established along river corridors and floodplains. According to the Wyoming Department of Water Resources at the streamgage in downtown Saratoga, since the major flood of 1917, the largest flood of record was in 2011, when on June 9th, flows of16,922 cubic feet per second (cfs) (flood stage 10.42 ft) occurred as shown in Figure 6 [not included in this report]. Recently, on May 28, 2014, a major high magnitude flood of 14,611 cfs (flood stage 10.14 ft) occurred.

Last, the North Platte River has many constraints, including the natural hot springs that occur along the river corridor in Saratoga, which brought Indian tribes to the region to experience the “place of magic waters”. The hot springs have had historic value since the late 1800s for their healing values as described by the state Geologist of Wyoming (Bartlett, 1926), where “hopeless rheumatics have been cured in two to six weeks…victims of liquor and tobacco have been entirely cured…sufferers from stomach and intestinal disease have been sent away happy at the first freedom of pain, completely cured.” Subsequent economic developments and recreation *have bolstered the local economy due to the presence of these high mineral, low sulphur hot springs. Impacts to these hot springs occurred several years ago when in-channel excavation introduced surface river water to the ground water, temporarily reducing the water temperature of the hot springs. This was mitigated by "resealing" the disturbance with concrete."*

3.6.3 Proper Functioning Condition

At the time of this report Proper Functioning Condition (PFC) data was not made available from the Rawlins BLM field office. The only PFC data available was data related to the Wyoming Landscape Conservation Initiative (WLCI), and was originally collected in 2010. This WLCI data was obtained from the United States Geological Survey (USGS). The USGS compiled PFC data from various BLM field offices within the WLCI study area, which comprises most of southwestern Wyoming and includes the Upper North Platte River study area.

The BLM utilizes a procedure for assessing the health of a stream called Proper Functioning Condition assessment or PFC. PFC is described by the BLM as:

"A qualitative method for assessing the condition of riparian-wetland areas. The term PFC is used to describe both the assessment process, and a defined, on the-ground condition of a riparian-wetland area. The PFC assessment refers to a consistent approach for considering hydrology, vegetation, and erosion/deposition (soils) attributes and processes to assess the condition of riparian-wetland areas. A checklist is used for the PFC assessment, which synthesizes information that is foundational to determining the overall health of a riparian-wetland system" (BLM, 1998).

The PFC assessment terminates with the definition of one of three classes for a given stream segment as described below.

Proper Functioning Condition: A stream is said to be functioning properly when adequate vegetation, landform, or debris is present to:

- dissipate energies associated with wind action, wave action, and overland flow from adjacent sites, thereby reducing erosion and improving water quality;
- filter sediment and aid floodplain development;
- improve flood water retention and groundwater recharge;
- develop root masses that stabilize islands and shoreline features against cutting action;
- restrict water percolation;
- develop diverse ponding characteristics to provide the habitat and water depth, duration, and temperature necessary for fish production, water bird breeding, and other uses; and
- support greater biodiversity.

Functional At Risk: Riparian/wetland areas are classified as *functioning-at-risk* when they are in functioning condition but an existing soil, water, or vegetation attribute makes them susceptible to degradation. These areas are further distinguished based on whether or not they demonstrate an *upward*, *not apparent*, or *downward* trend.

Nonfunctioning: Riparian/wetland areas are classified as *nonfunctioning* when they clearly are not providing adequate riparian vegetation, physical structure, or large woody debris to dissipate stream energy associated with high flows.

The data collected from the USGS for use with the Wyoming Landscape Conservation Initiative (WLCI) indicates that as of 2010, approximately 681 miles of stream within the study area has been assessed for Proper Functioning Condition (PFC). Of the 681 miles of assessed streams, 36 miles are classified as Nonfunctioning, 365 miles are classified as Functional At Risk, and 280 miles are classified as being in Proper Functioning Condition. Figure 3.6-14 displays the PFC data in a graphical format.

3.6.4 Impairments

Based upon this basin-wide overall review, study area history and existing or on-going studies, Impairments to stream channels within the study area appear to fall into the following broad and interrelated categories:

Riparian Vegetation Degradation: Impaired riparian condition and habitat, and
Riparian Degradation: Generally bank erosion and physical disturbance of stream banks.
Imbalance of Sediment Supply: Imbalance between stream capacity and sediment supply can lead to channel degradation or aggradation

3.7 Water Quality

3.7.1 Stream Classifications

The Water Quality Division of the WDEQ has classified water bodies in the state into two parts: primary bodies and secondary bodies. The primary bodies are listed in what is referred to as "Table A" and represent those water bodies either named on the USGS 1:500,000 scale hydrologic map or those specifically classified by the WDEQ. The secondary bodies are taken from the WGFD's "Streams and Lakes Inventory" and are based on the presence or absence of fish species. Where there are differences in classification, "Table A" takes precedence. The water bodies are then classified based upon their use. Table 3.7-1 summarizes the stream classifications and their use designations.

The Upper North Platte Watershed study area has 1,085 miles of streams and 5 reservoirs/lakes classified by the WDEQ's "Table A" as displayed in Figure 3.7-1. The definitions of the stream classes applicable to the watershed are quoted from the Water Quality Rules and Regulations, Chapter 1, Wyoming Surface Water Quality Standards (WDEQ, 2013) as follows:

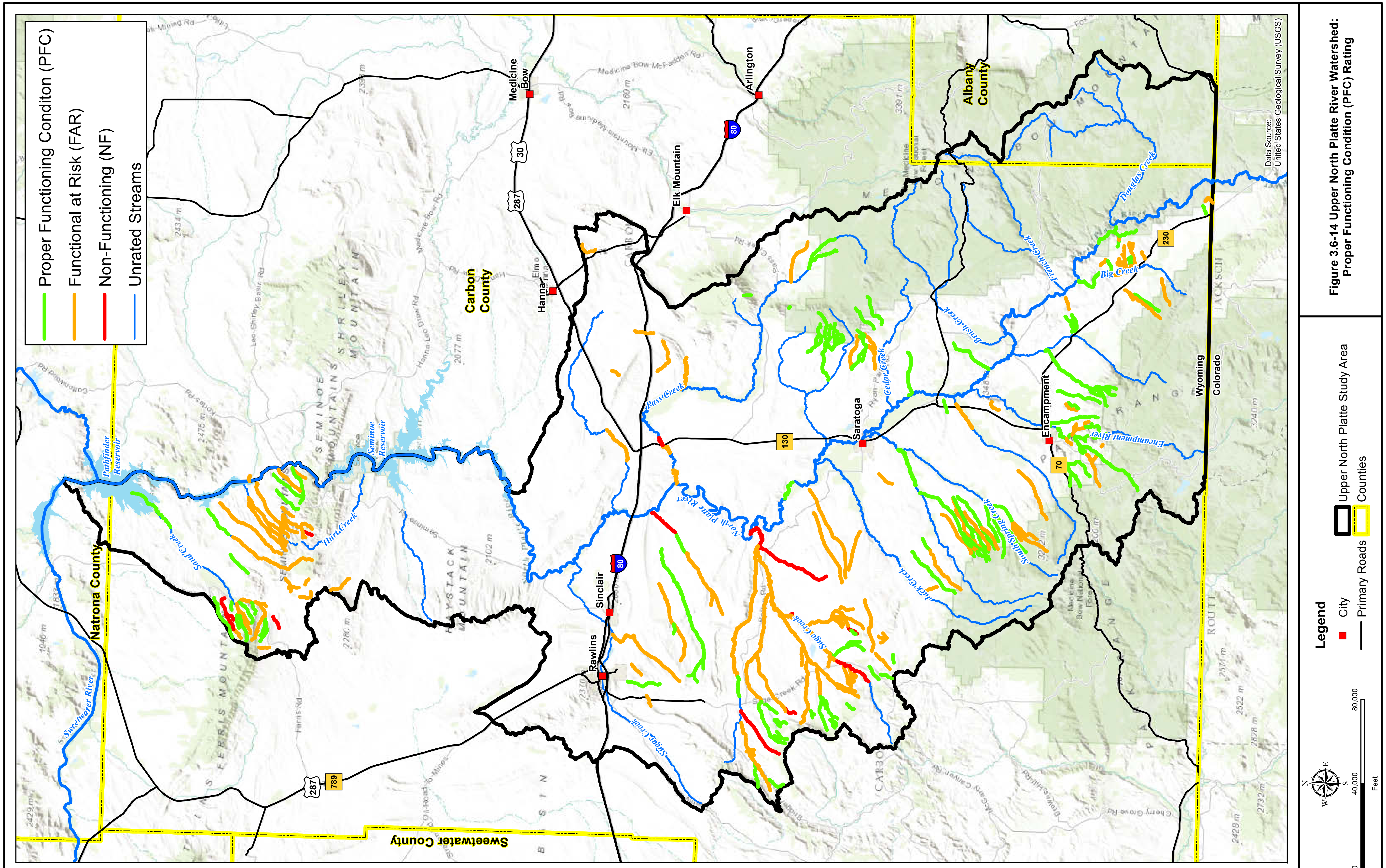


Figure 3.6-14 Upper North Platte River Watershed: Proper Functioning Condition (PFC) Rating
Proper Functioning Conditon (PFC)
Functional at Risk (FAR)
Non-Functioning (NF)
Unrated Streams
Legend
City
Primary Roads
Upper North Platte Study Area
Counties
0
40,000
80,000
Feet
Data Source: United States Geological Survey (USGS)
Carbon County
Albany County
Natrona County
Sweetwater County
Medicine Bow
Arlington
Elk Mountain
Hanna
Elmo
Sinclair
Rawlins
Saratoga
Encampment
Wyoming
Colorado
North Platte River
Pass Creek
Cedar Creek
Brush Creek
French Creek
Douglas Creek
Big Creek
Encampment River
South Spring Creek
Jack Creek
Sage Creek
Hurt Creek
Sand Creek
Sweetwater River
Pathfinder Reservoir
Seminoe Reservoir

Class 1 waters are those surface waters in which no further water quality degradation by point source discharges other than from dams will be allowed. Nonpoint sources of pollution shall be controlled through implementation of appropriate best management practices. Pursuant to Section 7 of these regulations, the water quality and physical and biological integrity which existed on the water at the time of designation will be maintained and protected. In designating Class 1 waters, the Environmental Quality Council (council) shall consider water quality, aesthetic, scenic, recreational, ecological, agricultural, botanical, zoological, municipal, industrial, historical, geological, cultural, archaeological, fish and wildlife, the presence of significant quantities of developable water and other values of present and future benefit to the people.

Class 2AB waters are those known to support game fish populations or spawning and nursery areas at least seasonally and all their perennial tributaries and adjacent wetlands and where a game fishery and drinking water use is otherwise attainable. Class 2AB waters include all permanent and seasonal game fisheries and can be either "cold water" or "warm water" depending upon the predominance of cold water or warm water species present. All Class 2AB waters are designated as cold water game fisheries unless identified as a warm water game fishery by a "ww" notation in the "Wyoming Surface Water Classification List". Unless it is shown otherwise, these waters are presumed to have sufficient water quality and quantity to support drinking water supplies and are protected for that use. Class 2AB waters are also protected for nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value uses.

C*lass 2C waters are those known to support or have the potential to support only nongame fish populations or spawning and nursery areas at least seasonally including their perennial tributaries and adjacent wetlands. Class 2C waters include all permanent and seasonal nongame fisheries and are considered "warm water". Uses designated on Class 2C waters include nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value.*

Class 3B waters are tributary waters including adjacent wetlands that are not known to support fish populations or drinking water supplies and where those uses are not attainable. Class 3B waters are intermittent and ephemeral streams with sufficient hydrology to normally support and sustain communities of aquatic life including invertebrates, amphibians, or other flora and fauna which inhabit waters of the state at some stage of their life cycles. In general, 3B waters are characterized by frequent linear wetland occurrences or impoundments within or adjacent to the stream channel over its entire length. Such characteristics will be a primary indicator used in identifying Class 3B waters."

Table 3.7-1 WYDEQ Surface Water Classification and Use Designations.

		Surface Water Classification												
		1	2AB	2A	2B	2C	2D	3A	3B	3C	3D	4A	4B	4C
Designated Use	Drinking Water	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No
	Cold Water game fish	Yes	Yes	No	Yes	No	If Present	No	No	No	No	No	No	No
	Warm Water game fish	Yes	Yes	No	Yes	No	If Present	No	No	No	No	No	No	No
	Nongame Fish	Yes	Yes	No	Yes	Yes	If Present	No	No	No	No	No	No	No
	Fish Consumption	Yes	Yes	No	Yes	Yes	Yes	No	No	No	No	No	No	No
	Aquatic life other than fish	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
	Recreation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Wildlife	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Agriculture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Scenic Value	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

3.7.2 WYPDES Permitted Discharges

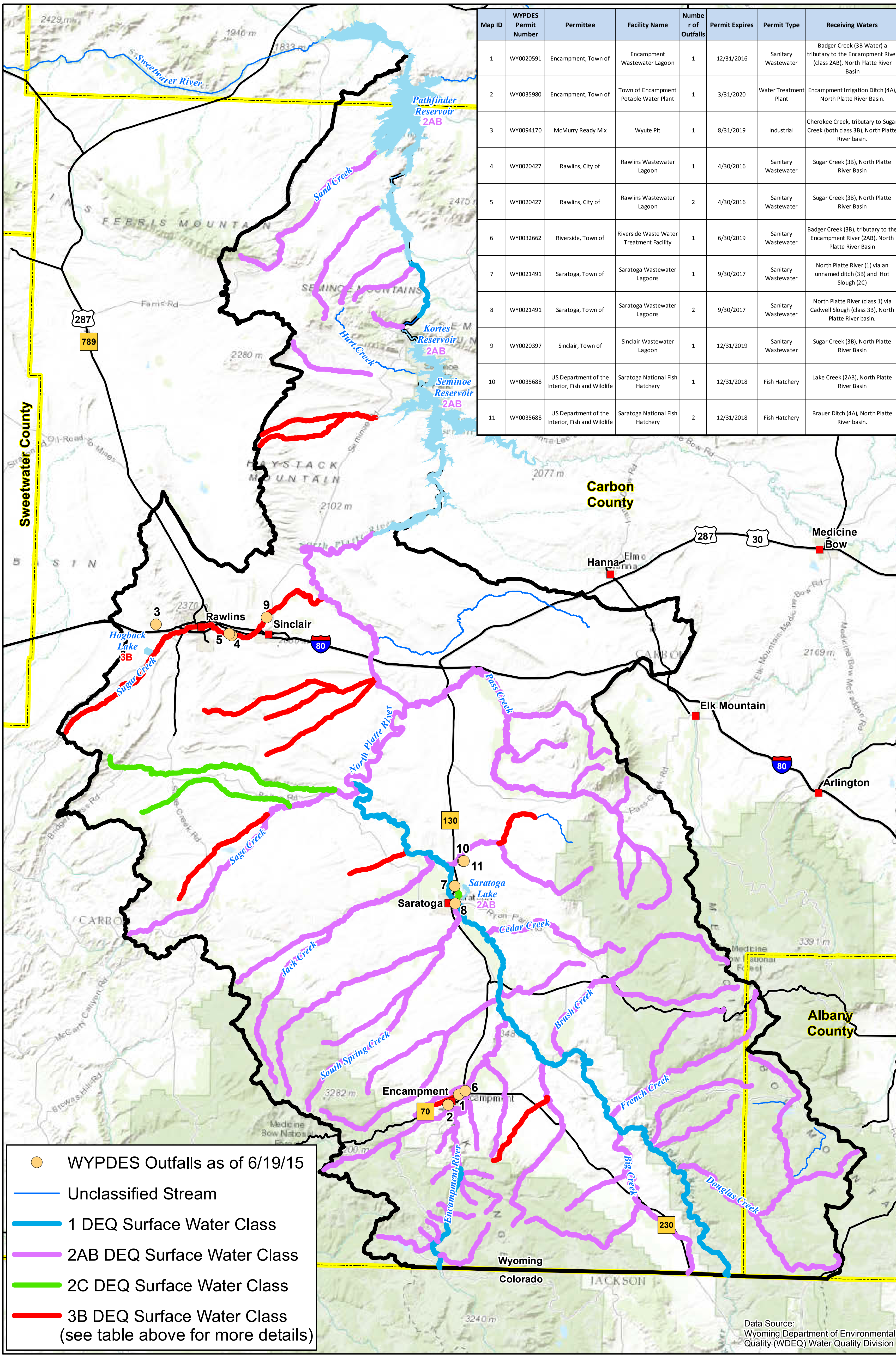
A database of permitted discharges under the National Pollution Discharge Elimination System (NPDES) was obtained from the Wyoming Department of Environmental Quality. As of the time this report was prepared, there were a total of 14 active (WYPDES) permitted discharges present within the study area. These 14 discharges are filed under only 8 separate permits, certain permits have multiple outfalls and different receiving waters. Table 3.7-2 summarizes pertinent information regarding the permits. The locations of these discharges are shown on Figure 3.7-1.

3.7.3 Waters Requiring TMDLs

A Total Maximum Daily Load (TMDL) is the amount of pollutant which a stream can accept and still meet its designated uses. TMDLs must be established for each pollutant which is a source of stream impairment. They must be measurable and must consider both point and nonpoint source pollutant loads, natural background conditions, and a margin of safety.

The term "303(d) list" is short for the list of impaired and threatened waters (stream/river segments, lakes) that the Clean Water Act requires all states to submit for EPA approval every two years on even-numbered years. At the time this report was prepared, there were no water bodies within the study area on the 303(d) list.

Map ID	WYPDES Permit Number	Permittee	Facility Name	Number of Outfalls	Permit Expires	Permit Type	Receiving Waters
1	WY0020591	Encampment, Town of	Encampment Wastewater Lagoon	1	12/31/2016	Sanitary Wastewater	Badger Creek (3B Water) a tributary to the Encampment River (class 2AB), North Platte River Basin
2	WY0035980	Encampment, Town of	Town of Encampment Potable Water Plant	1	3/31/2020	Water Treatment Plant	Encampment Irrigation Ditch (4A), North Platte River Basin.
3	WY0094170	McMurry Ready Mix	Wyute Pit	1	8/31/2019	Industrial	Cherokee Creek, tributary to Sugar Creek (both class 3B), North Platte River basin.
4	WY0020427	Rawlins, City of	Rawlins Wastewater Lagoon	1	4/30/2016	Sanitary Wastewater	Sugar Creek (3B), North Platte River Basin
5	WY0020427	Rawlins, City of	Rawlins Wastewater Lagoon	2	4/30/2016	Sanitary Wastewater	Sugar Creek (3B), North Platte River Basin
6	WY0032662	Riverside, Town of	Riverside Waste Water Treatment Facility	1	6/30/2019	Sanitary Wastewater	Badger Creek (3B), tributary to the Encampment River (2AB), North Platte River Basin
7	WY0021491	Saratoga, Town of	Saratoga Wastewater Lagoons	1	9/30/2017	Sanitary Wastewater	North Platte River (1) via an unnamed ditch (3B) and Hot Slough (2C)
8	WY0021491	Saratoga, Town of	Saratoga Wastewater Lagoons	2	9/30/2017	Sanitary Wastewater	North Platte River (class 1) via Cadwell Slough (class 3B), North Platte River basin.
9	WY0020397	Sinclair, Town of	Sinclair Wastewater Lagoon	1	12/31/2019	Sanitary Wastewater	Sugar Creek (3B), North Platte River Basin
10	WY0035688	US Department of the Interior, Fish and Wildlife	Saratoga National Fish Hatchery	1	12/31/2018	Fish Hatchery	Lake Creek (2AB), North Platte River Basin
11	WY0035688	US Department of the Interior, Fish and Wildlife	Saratoga National Fish Hatchery	2	12/31/2018	Fish Hatchery	Brauer Ditch (4A), North Platte River basin.



Legend
City
Streams
Primary Roads
Upper North Platte Study Area
Counties
0 40,000 80,000
Feet

Figure 3.7-1 Upper North Platte River Watershed: WYPDES Outfalls as of 6/19/15 and DEQ Surface Water Classifications

Table 3.7-2 Summary of Active WYPDES Permitted Discharge Locations.

Map ID	WYPDES Permit Number	Permittee	Facility Name	Number of Outfalls	Permit Expires	Permit Type	Receiving Waters
1	WY0020591	Encampment, Town of	Encampment Wastewater Lagoon	1	12/31/2016	Sanitary Wastewater	Badger Creek (3B Water) a tributary to the Encampment River (class 2AB), North Platte River Basin
2	WY0035980	Encampment, Town of	Town of Encampment Potable Water Plant	1	3/31/2020	Water Treatment Plant	Encampment Irrigation Ditch (4A), North Platte River Basin.
3	WY0094170	McMurry Ready Mix	Wyute Pit	1	8/31/2019	Industrial	Cherokee Creek, tributary to Sugar Creek (both class 3B), North Platte River basin.
4	WY0020427	Rawlins, City of	Rawlins Wastewater Lagoon	1	4/30/2016	Sanitary Wastewater	Sugar Creek (3B), North Platte River Basin
5	WY0020427	Rawlins, City of	Rawlins Wastewater Lagoon	2	4/30/2016	Sanitary Wastewater	Sugar Creek (3B), North Platte River Basin
6	WY0032662	Riverside, Town of	Riverside Waste Water Treatment Facility	1	6/30/2019	Sanitary Wastewater	Badger Creek (3B), tributary to the Encampment River (2AB), North Platte River Basin
7	WY0021491	Saratoga, Town of	Saratoga Wastewater Lagoons	1	9/30/2017	Sanitary Wastewater	North Platte River (1) via an unnamed ditch (3B) and Hot Slough (2C)
8	WY0021491	Saratoga, Town of	Saratoga Wastewater Lagoons	2	9/30/2017	Sanitary Wastewater	North Platte River (class 1) via Cadwell Slough (class 3B), North Platte River basin.
9	WY0020397	Sinclair, Town of	Sinclair Wastewater Lagoon	1	12/31/2019	Sanitary Wastewater	Sugar Creek (3B), North Platte River Basin
10	WY0035688	US Department of the Interior, Fish and Wildlife	Saratoga National Fish Hatchery	1	12/31/2018	Fish Hatchery	Lake Creek (2AB), North Platte River Basin
11	WY0035688	US Department of the Interior, Fish and Wildlife	Saratoga National Fish Hatchery	2	12/31/2018	Fish Hatchery	Brauer Ditch (4A), North Platte River basin.

3.8 Irrigation System Inventories

For the purposes of this study, specific irrigation structure inventories and evaluations were conducted at the request of irrigators/stakeholders at locations identified by them.

Specific tasks completed during this effort included the following:

- interviewing ditch representatives and users;
- field inventory of ditch structures;
- inventory of physical ditch conditions;
- assessment of hydraulic efficiency of existing ditch structures;
- photographic documentation of structures and an assessment of their condition;
- location of the structures using GPS technology; and
- incorporation of data into the project GIS.

Possible improvements include rehabilitation or replacement of existing infrastructure, bank stabilization (particularly near structures), and installation of new structures. Many of the ditch system components inspected are significantly deteriorated and have exceeded their design life. Several ditches were built prior to statehood and have been nursed along over the years through the efforts of private landowners. Due to the fact that only problematic structures were visited, results of the irrigation structure inventories are incorporated directly into the watershed management plan (Chapter 4).

3.9 Water Storage and Retention

A number of potential benefits of additional storage have been identified during the course of this study and are recommended for more detailed evaluation should a storage project(s) advance to the next level of study. The potential benefits of additional storage would vary as a function of the size and cost of the facility, but could include the following:

- Provision of a source of late season irrigation water,
- Enhancement/establishment of late-season stream flows to benefit aquatic and wildlife species, riparian habitat, and livestock,
- Provision of additional direct wildlife/livestock watering opportunities and potential to serve gravity-fed watering systems,
- Reduction of flooding impacts to the aquatic and riparian habitats downstream and potentially downstream municipalities,
- Improvement of stream bank/channel conditions,
- Establishment of a lake fishery,
- Provision of seasonal recreational opportunities (consistent with meeting other needs and achieving other benefits).

3.9.1 Surface Water Availability and Shortages

Development of additional storage within the project study area would be limited based upon the constraints of the Modified North Platte Decree and the Platte River Recovery and Implementation Program. Issues associated with development of storage facilities are discussed in Chapter 4: Watershed Management Plan.

3.9.1.1 North Platte River Basin Spreadsheet Model

The Upper North Platte River study area lies within the geographic boundaries of the North Platte River Basin Framework Plan, currently being completed on behalf of the WWDC by Wenck Associates (Trihydro, 2006). In conjunction with that project, a basin planning spreadsheet model of the North Platte system is being developed in a manner similar that of other river basin planning studies completed on behalf of the WWDC. At the time this report was prepared, construction of the model was in progress but it was not yet completed and available for use. Consequently, estimation of water physically available and within the constraints of Wyoming water law could not be completed. However, the following brief overview of the spreadsheet model and its usage is included.

The spreadsheet model was originally developed on behalf of the WWDC during the completion of the Bear River Basin and the Upper Green River Basin Studies in 2001). The model consists of an Excel spreadsheet programmed to incorporate multiple diversions, gaging stations, and other water resources data within the basin being studied. One of the primary purposes of the model is to provide a planning tool for river basin water users and the State of Wyoming for use in determining those river reaches in which flows may be available to Wyoming water users for future development. For river basin studies already completed, Individual models have been generated to reflect each of three hydrologic conditions: dry, normal, and wet year water supply.

The spreadsheets each represent one calendar year of streamflow data, on a monthly time step. Each spreadsheet relies on a calibration model that reflects available historical data from a 30 to 40 year period to estimate the hydrologic conditions. Streamflow, consumptive use, diversions, and irrigation return flows are the basic input data to the model. 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, reservoir operations, compact allocations, or the management of the basin water supply based on these legal constraints. It is assumed that the historic discharge data reflect effects of any limitations that may have been placed upon water users by water rights or compact restrictions as well as reservoir operations.

To mathematically represent a river system, subbasins are first divided into reaches based primarily upon the location of USGS gaging stations. Each reach was then sub-divided by identifying a series of individual nodes representing locations where diversions occur, basin imports are added, tributaries converge, or other significant water resource features are located.

At each node, a water budget computation is completed to determine the amount of water that flows out of the node. Total flow into the node and diversions or other losses from the node are calculated. The difference between total inflow and diversions/losses is the amount of flow available to the next node downstream. Mass balance, or water budget calculations, are repeated for all nodes in a reach, with the outflow of the last node being the inflow to the beginning node in the next reach. Figure 3.9-1 displays a graphical representation of the water balance approach. For each reach, ungaged stream gains (e.g., ungaged tributaries, groundwater inflow, and return flows from unspecified diversions) and losses (e.g., seepage, evaporation, and unspecified diversions) are taken as the difference between average historical gage flows (or outflows) and model-predicted outflow from the reach. Stream gains are input at the top of a reach to be available for diversion throughout the reach and losses are subtracted at the bottom of each reach.

3.9.1.2 Model Limitations

There are several limitations to the model, which must be considered when reviewing the model and results generated by its use. These limitations and their implications with respect to a determination of water availability are discussed below:

- Use of a monthly time step in the river simulation may result in the exclusion of peak flows on ‘flashier’ systems. These peaks would be incorporated within the monthly average streamflows within the model; however, in instances where peaks exceed demand, the monthly time step could result in underestimation of available flows.

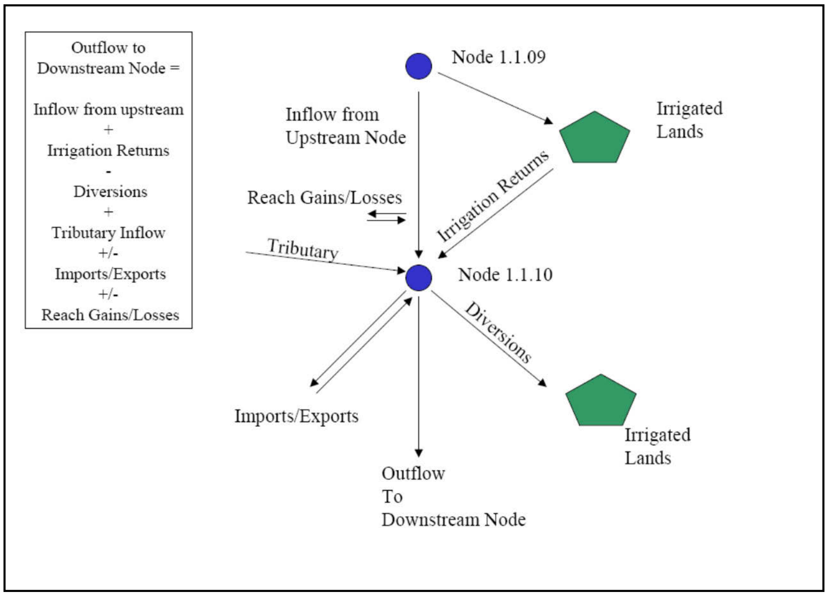


Figure 3.9-1 Diagram of Model Water Budget Computations.

- The spreadsheet model does not explicitly account for diversions from the river in accordance with Wyoming water law and is not operated on these legal principals. Simply stated, this means that the model cannot forego a diversion to an upstream junior water appropriator to satisfy a downstream senior water right.
- The basin planning model was originally developed under the assumption that if this situation occurred historically, the diversion data would reflect this occurrence and the junior appropriator would incur a shortage.
- Models completed to date do not incorporate reservoir operational rules for release or storage of water. Consequently, evaluation of changes in practices that accompany reservoirs is problematic. For each simulation condition (normal-, dry- and wet-year conditions), reservoir releases do not deviate from historic releases.
- The model uses data generated outside of the program in several instances. Consequently, evaluation of different water usage scenarios involving this data is cumbersome. For example, the model does not directly facilitate evaluation of effects of improvements to farm irrigation practices resulting in increased irrigation efficiency without recalculation of input data outside of the model environment.
- Comparison of historic data with full supply diversion estimates indicates that irrigators typically operate under supply-limited conditions. The model simulates diversion data related to a multitude of uses (irrigation, municipal, industrial, etc.). Given the magnitude of the irrigation diversions, however, special attention is devoted to the water requirements associated with irrigated lands. To fully understand this potential limitation, it is important to know that the spreadsheet model can be run in three different modes.

- *Calibration (Historical):* This mode simulates the historical diversions where data are available. This mode is typically used for model calibration because historic diversion data are utilized.
- *Full Supply for Existing Irrigated Lands:* This mode reflects full supply diversions, based on computed diversion requirements for existing irrigated lands (lands presently irrigated and mapped during the planning process).
- *Full Supply for Existing Irrigated Lands and Futures Projects:* This mode simulates full supply, based on computed diversion requirements, for existing irrigated lands and Tribal futures projects.

3.9.1.3 Available Flows Analysis

To determine how much of the physical supply is actually available for storage at any given model node, "available water" was defined as that portion of the physically available streamflow that could be stored without causing a shortage to existing water users in any downstream river reach on the modeled river. *In other words, the water available at any node is determined as the minimum of the physically available flow at that point or the minimum available flow at any node downstream in the system.* As noted previously, this evaluation is made on a water budget basis (inherent to the Basin Plan model) and does not directly incorporate individual water rights.

As previously discussed, a model of the North Platte River is currently under construction in conjunction with ongoing river basin planning efforts being completed on behalf of the WWDC. At the time this report was completed, the model was not completed and available for use.

IV. WATERSHED MANAGEMENT AND REHABILITATION PLAN

IV. WATERSHED MANAGEMENT AND REHABILITATION PLAN

4.1 Overview

The objective of this Level I study is to generate a watershed management and rehabilitation plan that is technically sound, practical in nature, and economically feasible. In conjunction with the development of the study's GIS, the inventory focused on assessment of the watershed and the identification and evaluation of improvements to address those issues described in Chapter 3.0. Potential improvements were developed and categorized into the following:

- **Irrigation System Conservation and Rehabilitation.** The inventory and evaluation of the existing infrastructure was completed and improvements identified for the rehabilitation of existing structures and the potential conservation of existing irrigation diversions.
- **Livestock/Wildlife Upland Watering Opportunities**. Based upon an evaluation of existing water sources and the condition of upland grazing resources, potential upland water source development projects were identified.
- **Grazing Management Opportunities**. Based upon a review of the pertinent ESDs and the ambient vegetation and soil conditions, grazing management strategies are presented.
- **Surface Water Storage Opportunities**. Results of previous investigations pertaining to development of water storage and opportunities identified during the project inventory phase of this investigation are incorporated.
- **Stream Channel Condition and Stability**. Stream channels within the watershed were characterized with respect to their condition and stability. Impaired channels were identified for further evaluation and alternative improvements developed.
- **Other Watershed Management Opportunities**. For each of the categories described above, a series of recommended projects are prescribed in the following portions of this chapter.

These plans have been prepared to provide an overview of potential improvements that can partially or fully address the key issue identified within the watershed.

In the remainder of this chapter, the conceptual plans developed within each watershed component are described and evaluated with respect to providing benefits to improving the existing water supply through conservation. For the purposes of tracking individual components of the watershed management plan, each component was designated two unique project or "improvement" identifiers.
The Component Number denotes the type of project and the portion of the watershed management plan it falls within. Prefixes used for each improvement describe the category of the watershed management plan it falls under. The prefixes are as follows:

- Project Components "IRR": Irrigation system rehabilitation components (Section 4.3)
- Project Components "L/W": Livestock/wildlife upland watering opportunities (Section 4.4)
- Project Components "G": Grazing management opportunities (Section 4.5)

- Project Components "STO": Surface water storage opportunities (Section 4.6)
- Project Components "STR": Stream channel stability components (Section 4.7)
- Project Components "O": Other watershed management opportunities (Section 4.8).

This method of assigning project identifiers allows us to track the project sponsor as well as the type of project being discussed, and will assist the SERCD with the WWDC Small Water Project Program application process. ***Reference to project sponsor names, individuals and properties are omitted from this report at the request of the SERCD.***

4.2 Benefits of Watershed Management Planning

The Wyoming Water Development Commission's (WWDC) Level I Watershed Study is a fundamental landscape analysis confined to a hydrologically connected drainage area or watershed and is focused on two primary components. The first is an identification of the physical attributes of that analysis area. This is accomplished by conducting a comprehensive inventory of the natural resources and subsequently using that inventory to articulate a description of the current natural resource conditions. The second is a long range plan outlining management and/or rehabilitation opportunities and activities that address ecological enhancement and watershed function.

Such activities, in the conservation community, are commonly referred to as bi iiiiiiest management practices (BMPs) or conservation practices. These BMPs and conservation practices are eligible for grant funding assistance through the WWDC's Small Water Project Program (SWPP). The WWDC's SWPP funds are mainly used for installing BMPs and conservation practices such as stock ponds, water wells, buried water delivery pipelines, stock tanks, spring developments, solar platforms and pumps, wetland enhancement and restoration, windmills, and irrigation diversion and conveyance improvements.

There can be one or more benefits resulting from the implementation of BMPs and conservation practices. Such benefits can be either quantitative or qualitative or both. Benefits can be local or global and specific or surrogate, depending on multiple factors unique and specific to the BMP or conservation practice, ecological site, watershed, or major land resource area. BMPs and conservation practices also provide opportunities to relieve grazing pressure on riparian areas and create the potential to induce improvements to soil health, plant community diversity, and improved forage production. They allow for grazing deferment in the event that rest is required due to invasive species control efforts, which can also stimulate water release.

Benefits to ecosystem functionality and landscape health can be and is a response to soil health, water infiltration/percolation and a functioning water cycle. Expected project benefits can be related to watershed function including collection and storage of water along with ecological enhancements such as plant and animal habitat and stream corridor or riverine stability as well as societal values including economic stability and open space maintenance. Multiple benefits can result from improvement opportunities for water resources, which are critical to meet the daily water demands of the resident population of man and beast, develop, increase or extend irrigation water availability, and improve fishery habitat and potential recreational benefits.

4.2.1 Natural Resources Conservation Service Conservation Effects Assessment Program

In 2003, in the interest of government accountability, Congress and the Office of Management and Budget requested information from the U.S. Department of Agriculture (USDA) about the effectiveness of its conservation programs. In response, the Conservation Effects Assessment Project (CEAP) was initiated by NRCS to provide quantitative information about the environmental impacts of its conservation practices on agricultural lands within the contiguous 48 United States. The CEAP is a joint effort of the NRCS, Agricultural Research Service (ARS), National Institute for Food and Agriculture, other federal agencies, and university scientists to quantify the environmental effects of NRCS conservation practices and programs and develop the science base for managing the agricultural landscape for environmental quality. Initially focused on croplands, the CEAP effort has been expanded to include wildlife, wetlands, pastures, and rangelands.

Project findings have been used to guide USDA conservation policy and program development that will assist conservationists, farmers, and ranchers with informed conservation decisions" [Spaeth et al., 2013]. The end product of the CEAP is a literature review and concise collation of information from hundreds of published scientific papers, journals, and additional references. Consequently, the CEAP documents provides a valuable source of information pertaining to various BMPs incorporated in this plan and is referenced throughout the remainder of this section.

4.2.2 Watershed Function

Identifying improvement opportunities for hydrologic and watershed function, including water quantity, yield and use, is an essential element of the Level I Watershed Study. Hydrologically, there are three fundamental watershed functions: (1) collection of the water from rainfall, snowmelt, and storage that becomes runoff, (2) storage of various amounts and durations, and (3) discharge of water as runoff [Black, 1997]. Watershed characteristics such as geologic structure, soils, landform, topography, vegetation, and climate influence the capture or collection of precipitation, infiltration and storage of surface and ground water, and the runoff or discharge of water.

4.2.2.1 Water Quantity

Implementation of BMPs and conservation practices can affect water resource quantity through improvement of plant communities, vegetative diversity, and ecological site health achieved from water development and the creation of reliable water sources in areas devoid of such allows for the establishment of grazing systems and changes in grazing distribution.

Hydrological responses to grazing are strongly contingent on the vegetative community composition, with communities that provide greater cover and obstruction to overland flow, such as midgrass-dominated communities having greater hydrological function, including infiltration rate, than shortgrass-dominated communities [Wood and Blackburn 1981b; Thurow 1991; Natural Resources Conservation Service, 2011]. Poor water distribution has been the primary cause of poor livestock distribution [Holecheck, 1997]. Livestock distribution and grazing behavior can be modified by adjusting the location of supplemental feed and water, implementation of patch burns, and herding in addition to the traditional practice of fencing [Williams 1954; Ganskopp 2001; Fuhlendorf and Engle 2004; Bailey 2005]. Natural Resources Conservation Service [2011] reviewed many studies and found that water distribution, steep slopes, and high elevations unequivocally influenced livestock distribution. Also sufficient evidence existed to recommend that NRCS increase the role of herding and supplement placement along with water development and fences for managing livestock distribution [Natural Resources Conservation Service, 2011].

Soil vegetative cover is widely recognized as a critical factor in maintaining soil surface hydrologic condition and reducing soil erosion [Gifford, 1985; Natural Resources Conservation Service, 2011]. Stocking rates, regardless of grazing system, that reduce soil surface vegetative cover below a site-specific threshold increases detachment and mobilization of soil particles due to raindrop impact, decreases soil organic matter and soil aggregate stability, increases soil surface crusting and reduces soil surface porosity, and thus decreasing infiltration and increasing soil erosion and sediment transport [Blackburn, 1984]. Sufficient vegetative cover, critical soil cover, or residual biomass must remain during and following grazing to protect soil surface condition (e.g., porosity, aggregate stability, and organic matter) and hydrologic properties (e.g., infiltration), however, these site-specific vegetation cover requirements vary depending on cover type (e.g., vegetation, litter, or rock), soil type, rainfall intensities, and water quality goals [Gifford 1985]. The erosive energy of water and the long-term reduction of organic matter additions to soil detrimentally affect numerous soil properties, including the increase of bulk density, disruption of biotic crusts, reduced aggregate stability, and organic matter content, which collectively reduce infiltration rate and increase sediment yield and runoff [Natural Resources Conservation Service, 2011].

The rehabilitation efforts described in the following sections can increase water infiltration/percolation, stimulate spring flows and increase flow volume and duration. An example of restoring watershed function and water quantity was in a 74,000 acre watershed in West Texas near San Angelo where West Rocky Creek, a dry, intermittent stream for decades, started flowing again [Moseley, 1983; Wiedenfeld, 1986]. In the early part of the 20th century, West Rocky Creek was a yearlong flowing stream until the late 1910s, when it became an intermittent stream and by 1935, the springs feeding the creek had been dried up by mesquite and other invading woody plants [Moseley, 1983; Wiedenfeld, 1986].

During the 1950s and 1960s, ranchers and landowners on five ranches, covering about half the watershed, began conservation work including root-plowing, reseeding, tree-dozing, aerial spraying, and chaining of mainly mesquite and juniper brush, which limited water availability for native grasses such as sideoats grama, buffalograss, curly mesquite, and tobosa [Moseley, 1983]. About 30,000 acres or 70 percent of the mesquite was removed from the watershed, and the original prairie was restored [Moseley, 1983; Wiedenfeld, 1986]. In the mid to late 1960s, one of the 5 ranchers noticed that a spring, which was dry since 1935, had started flowing again and by replacing the water-hungry brush with a good grass cover, more rainfall soaked into the aquifer, recharging the dormant springs which began flowing on all 5 ranches by 1970 [Moseley, 1983]. Ongoing grazing management on each ranch enhanced the cover of grasses in the watershed with soils producing an estimated 2,000 to 2,500 pounds of forage per acre which helps retard brush succession; the ranchers periodically must do maintenance brush control to keep the desired vegetation balance [Moseley, 1983].

In southeast Arizona, long-term data on soils, vegetation, hydrology, and climate have been collected for over five decades on the Walnut Gulch Experimental Watershed, which is operated by the USDA's Agricultural Research Service (ARS). The Walnut Gulch Experimental Watershed is one of the most intensively instrumented semiarid experimental watersheds in the world, with a 10 to 100-year record of abiotic and biotic measurements and photographs [Moran et al, 2008]. Researchers studied the interaction between rainfall intensity and soils and vegetation by comparing the frequency of runoff producing summer events between a shrub-dominated watershed and a grass-dominated watershed and found that it takes higher rainfall intensities to produce runoff on the grassed watershed [U.S. Department of Agriculture, 2013]. Results also indicate that the grassland plant community is producing more plant material than the shrubland, with close to the same amount of precipitation input, making the grassland ecosystem more water use efficient [U.S. Department of Agriculture, 2013]. The researchers found that runoff quantities at the watershed scale are controlled more by infiltration of water into alluvial channels and spatial distribution of thunderstorm rainfall [U.S. Department of Agriculture, 2013].

4.2.3 Ecological Enhancement

An ecological enhancement is any activity that improves an ecosystem such as stabilizing erosive soils, increasing soil quality, planting or maintaining native grasses, shrubs, or trees, removing and controlling invasive species, and improving or maintaining riparian/wetland areas. Ecological sites are complex and varied within the study area as described in Section 3.4.5.5 and Figure 3.3-12. And so are the potential benefits achieved from project activities and implementations that influence the condition of those ecological sites and characteristics.

Conjunctive to soil function is plant community diversity, health and productivity and subsequent forage diversity, production and wildlife habitat. Benefits accrued to water quality are significant as improvements to the chemical, physical, and biological constituents of a water body produce both local site enhancements and those transferred downstream. Wetland enhancement and restoration provides benefits to ecological stabilization as well as contributions to water quality and quantity. Ecologically, watersheds function by providing diverse sites and pathways along which vital chemical reactions occur and furnishing habitat for the flora and fauna that constitute the biological elements of ecosystems [Black, 1997].

4.2.3.1 Plant and Animal Habitat

Locations of conservation practices and rangeland infrastructure can have a large, indirect impact on overall vegetation change with the spatial design of infrastructure including the locations of fences, watering points, and feeders that are used to modify patterns of animal movement and forage utilization, taking into account livestock behavior and the template of topography and plant communities to which livestock respond [Laca, 2009; Natural Resources Conservation Service, 2011]. The use of rangelands for sustainable livestock production has the potential to ensure the maintenance of wildlife habitat which will ensure that wildlife habitat will persist into the future [Natural Resources Conservation Service, 2011]. Livestock grazing can have negative or positive impacts on game bird habitat, depending on timing and intensity of grazing and the habitat being influenced [Beck and Mitchell, 2000]. Wildlife responses to conservation practices are usually species and even species-habitat specific, meaning not only that each species may respond differently to any specific practice but also that a single species may respond differently to the same practice in different vegetation associations or conditions [Natural Resources Conservation Service, 2011].

Free-stranding water has been considered to be a resource that limits distribution and abundance of many species of wildlife in arid regions of the United States, and water developments have been used since the 1940s to improve wildlife habitat [Simpson et al, 2011]. Simpson et al [2011] compiled and evaluated available literature for evidence of effects of water sources on wildlife populations. Positive effects of water developments on wildlife have been documented, and species thought previously not to use free-standing water developments do so when it is available [Simpson et al, 2011]. Additionally, researchers studied effects of wildlife water developments in southwestern Arizona and found that water developments were used by a diverse array of wildlife, including mule deer, game birds, a number of nongame species [Rosenstock et al, 2004].

4.2.3.2 Stream Corridors and Riparian/Wetland Areas

Reducing impact to riparian plant communities through the development of upland water resources can result in stream corridor benefits. Riparian plant community diversity and regeneration of desirable important woody species can help restore local water tables, trap sediments, increase wildlife habitat and migration corridors, and stabilize stream banks which can affect localized land loss. In addition, aquatic population benefits can accrue and recreation potential can be realized.

Livestock distribution practices such as water developments, supplement placement, and herding are effective means of managing the intensity and season of livestock grazing in riparian areas [Natural Resources Conservation Service, 2011]. Season of grazing also determines livestock grazing effects on riparian plant communities, particularly woody plants, and can be managed to conserve riparian habitats and their associated services [Natural Resources Conservation Service, 2011]. Sufficient evidence in peer-reviewed studies existed that Natural Resources Conservation Service [2011] suggested riparian grazing management that maintains or enhances key riparian vegetation attributes (i.e., species composition, root mass and root density, cover, and biomass) will enhance stream channel and riparian soil stability, which will in turn support ecosystem services, such as flood and pollutant attenuation and high-quality riparian habitat. Peer-reviewed literature generally supports the effectiveness of water developments, supplement placement and herding for reducing riparian vegetation utilization, or time spent in riparian areas [Natural Resources Conservation Service, 2011].

4.2.4 Societal Value

Natural resource stewardship not only has economic value in terms of forage, livestock, and wildlife production relationships, but also can have non-economic value placed on those conservation practices by society. Those values can even influence the perception of those implementing conservation practices and can be as much an influence in the decision process to implement conservation as is an economic value. Additionally, it is possible for a BMP or conservation practice that provides an ecological service to accrue more value to society in general than to a local landowner. Ecosystem services are defined as those things or experiences produced by natural systems on which humans place value [Natural Resources Conservation Service, 2011]. Ecosystem services benefit society in numerous and diverse ways while each of the conservation practices can potentially produce different kinds, qualities, and amounts of these goods and services, depending on location, natural potentials, current states, and other factors.

Non-economic values can and should be considered in determining watershed enhancement programs, particularly when considering public investment in conservation. Natural Resources Conservation Service [2011] found little to no research exists showing the direct noneconomic effects of BMPs and conservation practices on individuals, households, or social systems but acknowledged it was likely that producers do realize psychological benefits from conservation because stewardship typically ranks high among the management goals of livestock producers [Huntsinger and Fortmann, 1990; Sayre, 2004]. Moreover, livestock producers who believe strongly in a responsibility to society are more likely to engage in environmentally desirable management practices, such as invasive weed control and riparian protection [Kreuter et al, 2006].

In 2012, in cooperation with the Wyoming Stock Growers Association (WGSA), University of Wyoming, and University of California-Davis, research scientists with the USDA's ARS Rangeland Resources Research Unit in Cheyenne, Wyoming investigating effects of rangeland management decision-making asked WGSA producer members about their goals, ranching operations, and management practices via a mail survey and received a total of 307 rancher responses to the survey [Kacheris et al, 2013; Mealor, 2013]. Livestock production and forage production were the top management goals, with ecosystem characteristics that support these goals (e.g., soil health, water quality) tied for second [Kacheris et al, 2013; Mealor, 2013].

In addition to other social values and ecological enhancements, open spaces have long been held with high value to Wyoming and other western region states. From a ranching industry perspective, tourism interest, outdoor recreationist activity, or a real estate value, open space is significant. Preservation of our custom and culture has been and continues to be a focal point of consideration. Open spaces are critical for upland/riparian conductivity, wildlife migrations and habitat, and recreational opportunity. Open space is valued for preservation of cultural resources and for the reduction or prevention of land conversion to a condition that can be stewarded to an improved ecological condition.

4.3 Irrigation System Improvements (Watershed Management Plan Components IRR)

As presented in Chapter 3, the irrigation system inventory effort associated with this project consisted of evaluation of structures and ditch conditions at the request of interested landowners and stakeholders. No ditch systems were inventoried in their entirety. Instead, and at the request of those individuals who came forward with requests to participate in the study, individual irrigation system components were inventoried. The recommendations included herein are not all-inclusive; there will be additional irrigation structures located throughout the watershed in need of rehabilitation or replacement. By virtue of their location within the geographic boundaries of this study, those potential projects involving those structures would still be considered eligible for application funding through the WWDC Small Water Project Program (SWPP).

The improvements that comprise this component of the watershed management plan include:

- Rehabilitation/replacement of existing structures
- Mitigation of seepage losses
- Enhanced delivery of water
- Reduction in annual operation and maintenance costs
- Improvement in ditch management and efficiency through water measurement
- Economic practicality
- Physical feasibility

The plan is intended to provide the ditch owners an assessment of conditions associated with the ditch and its associated hydraulic structures. The ditch owner / manager can use the plan as a "resource or wish list" from which they can select projects for potential future funding assistance from sources such as the WWDC Small Water Project Program or NRCS EQIP.

In the sections which follow, the specific structures evaluated in the field in the company of landowners and ditch managers are discussed. The projects identified and their respective component identifiers in the watershed management plan are summarized in Table 4.3-1. Figure 4.3-1 displays the general location of all irrigation rehabilitation projects. Appendix 4A contains general location maps of those improvements for which the ditch/canal alignment was either discernible on aerial photos or their alignments had previously been digitized and incorporated in the NHD databases.

Table 4.3-1 Brush Creek Water Users Irrigation System Rehabilitation Projects.

Watershed Plan Component	Project Number	Ditch / Stream	Section / Township / Range	Recommendation
IRR-001	BC-001	Wiant Ditch	S. 16, T. 16 N., R. 82 W.	Install check structure with drop structure incorporated
IRR-002	BC-002	South 1 Ditch	S. 16, T. 16 N., R. 82 W.	Install grade control structure approximately 20-ft high
IRR-003	BC-003	Brush Creek Supply Ditch	S. 33, T. 16 N., R. 82 W.	Repair streambanks and align as necessary. Replace existing slide gate
IRR-004	BC-004	Condict No. 1 Ditch	S. 33, T. 16 N., R. 82 W.	Remove existing wooden structure and replace with check structure and slide gate turnout
IRR-005	BC-005	Condict No. 1 Ditch	S. 28, T. 16 N., R. 82 W.	Install diversion structure on Brush Creek and headgate
IRR-006	BC-006	Condict No. 1 Ditch	S. 33, T. 16 N., R. 82 W.	Install parshall flume (Approx. 8-ft)
IRR-007	BC-007	Johnson Ditch	S. 29, T. 16 N., R. 82 W.	Install diversion structure (splitter box type)
IRR-008	BC-008	Johnson Ditch	S. 29, T. 16 N., R. 82 W.	Install siphon inlet
IRR-009	BC-009	Johnson Ditch	S. 29, T. 16 N., R. 82 W.	Install concrete wall / Headgate / slide gate and drop structure
IRR-010	BC-011	Stewart Ditch	S. 20, T. 16 N., R. 81 W.	Rehabilitate structure: Add concrete apron, inspect and repair / replace slide gates
IRR-011	BC-012	Highline No. 4 Ditch at North Brush Creek	S. 7, T. 16 N., R. 81 W.	Rehabilitate structure: Repair left headwall where leakage occurs, install overflow weir on left bank upstream of structure.
IRR-012	BC-013	Wiant Ditch	S. 7, T. 16 N., R. 81 W.	Line segment
IRR-013	BC-014	Brush Creek / Wiant Ditch	S. 8, T. 16 N., R. 81 W.	Replace existing diversion and headgate
IRR-014	BC-015	Wiant Ditch / Buffalo Gulch	S. 12, T. 16 N., R. 82 W.	Replace existing headgate
IRR-015	BC-016	Wiant Ditch	S. 1, T. 16 N., R. 82 W.	Install measurement device on Wiant Ditch
IRR-016	BC-017	Elk Hollow Ditch	S. 2, T. 16 N., R. 82 W.	Remove diversion structure for abandoned ditch
IRR-017	BC-018	Cedar Creek / Right Hand Ditch	S. 19, T. 16 N., R. 82 W.	Install new diversion structure and headgate
IRR-018	BC-019	Lute Ditch / South Cedar Creek	S. 35, T. 16 N., R. 82 W.	Replace Diversion and Headgate
IRR-019	BC-020	Barrett Creek	S. 18, T. 16 N., R. 81 W.	Install diversion structure and headgate on Barrett Creek to facility flow control at Highline No. 2 ditch
IRR-020	BC-021	Highline No. 3 Ditch	S. 18, T. 16 N., R. 81 W.	Rehabilitate diversion structure (repair headwall,

4.3.1. IRR-001 through IRR-020

Water users in the Brush Creek portion of the project study area have developed an extensive and elaborate network of diversions and water supply ditches. The system and its administration is complex and historically problematic. Recent development of management protocols have resulted in greater cooperation among water users. The irrigation infrastructure in the area ranges in age and condition. In conjunction with the inventory phase of this watershed study, members of the project team toured the area in the company of representatives of the water users and inspected selected structures in need of rehabilitation or replacement. A total of 45 structures were evaluated and rehabilitation / replacement recommendations developed for 21 of them. Figure 4.3-2 displays a map of the area and the structure locations identified. Table 4.3-1 tabulates the recommendations for each.

4.3.2 IRR-021 through IRR-026

The sponsoring ranch spans several sections of land within the "checkerboard" portion of the study area north of Sinclair and adjacent to Seminoe Reservoir. In the vicinity of the ranch headquarters, several small reservoirs providing storage for livestock and for irrigation purposes have been built on Hurt Creek. Much of the area consists of sandy windblown dunes which makes water management difficult due to significant seepage losses; the reservoirs are frequently dry or at low levels. The reservoirs and their facilities vary in condition.

Figure 4.3-3 displays an overview of the ranch in the vicinity of its headquarters in Sections 29 and 30, Township 25 North, Range 84 West and the recommended rehabilitation efforts discussed below:

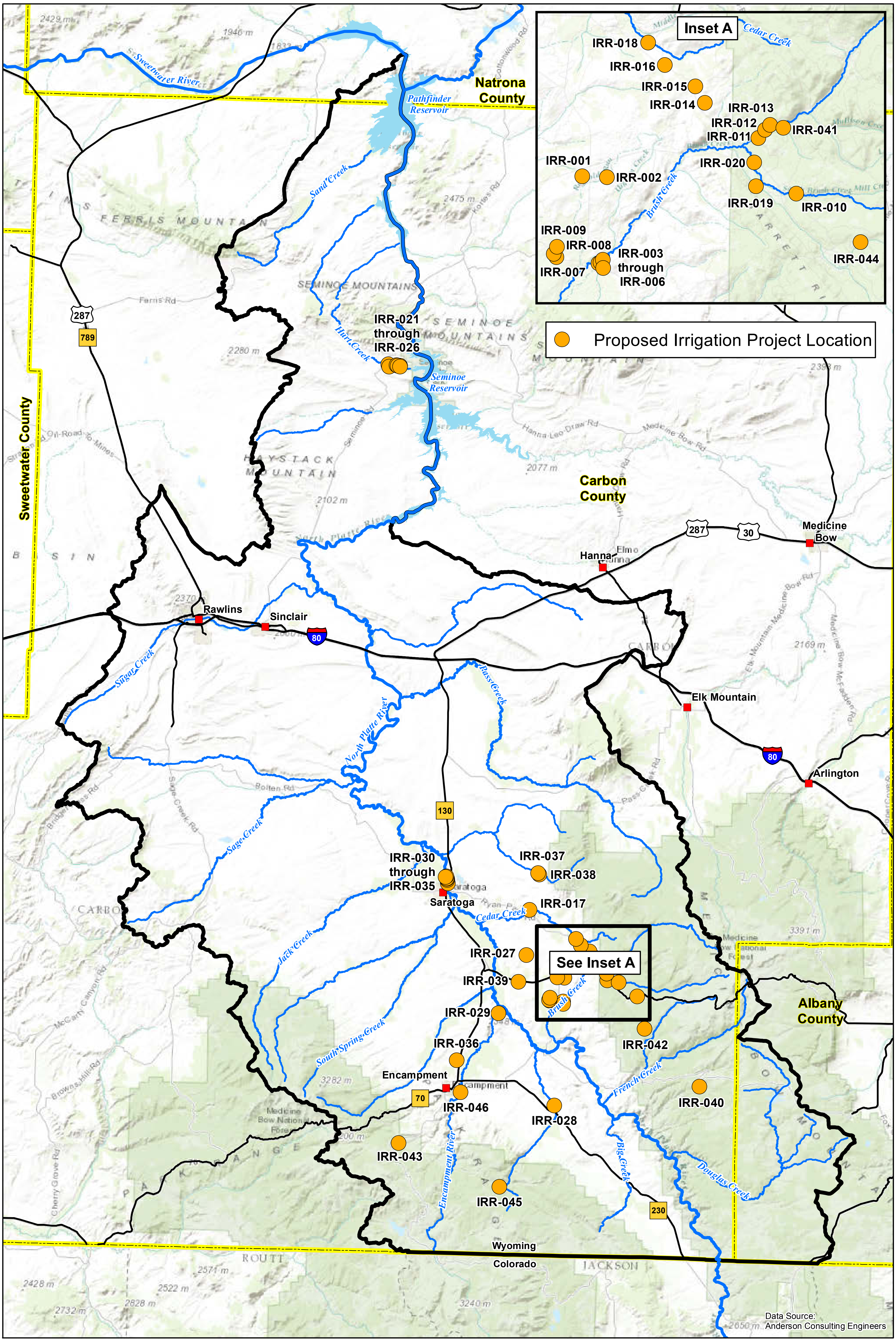


Figure 4.3-1 Upper North Platte River Watershed: Proposed Irrigation Project Locations

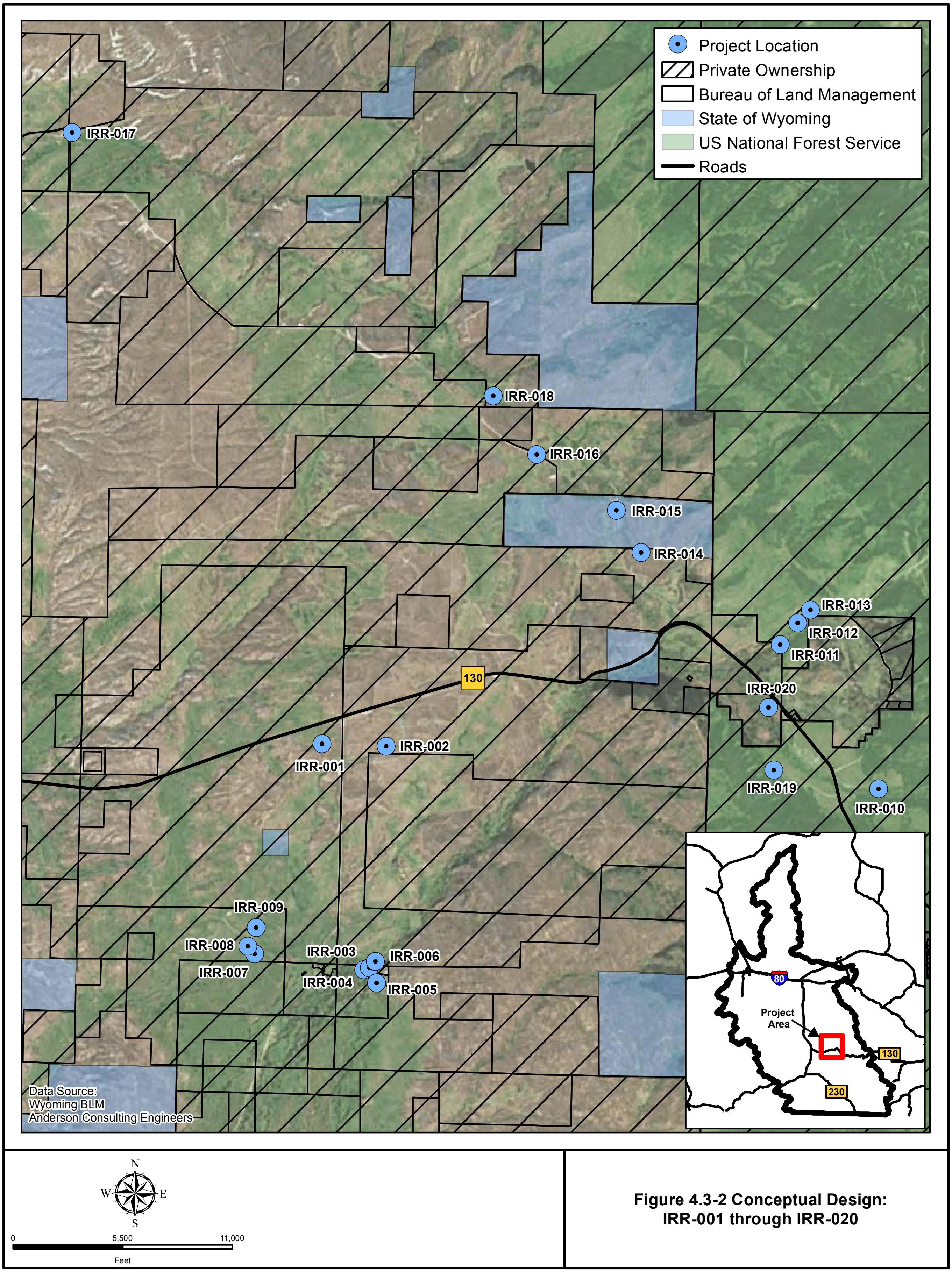


Figure 4.3-2 Conceptual Design: IRR-001 through IRR-020

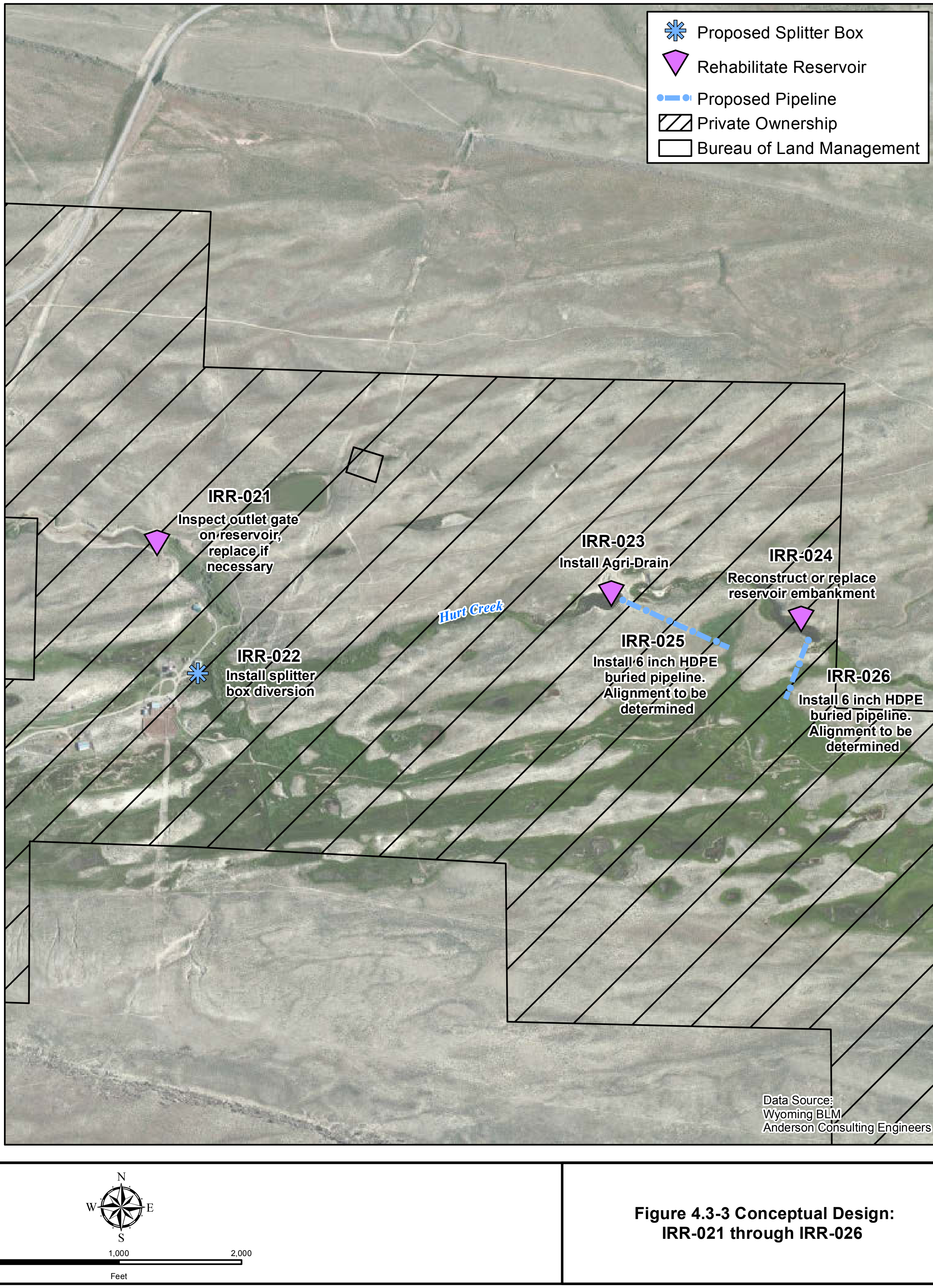


Figure 4.3-3 Conceptual Design: IRR-021 through IRR-026

IRR-021: The outlet gate at Reservoir 2 currently is difficult to control resulting in losses of water stored in the reservoir. The gate reservoir could be drained, the gate inspected, and replaced if deemed necessary. Existing framework supporting the slide gate could be used pending inspection of the facility following draining of the reservoir. The embankment appears to be in fair condition and no rehabilitation recommendations involving it are included.

IRR-022: A small splitter box type of diversion structure could be installed as indicated in Figure 4.3-3. At this location, it appears that management of streamflow would be greatly enhanced with the ability to control diversions to Reservoirs 4 and 5.

IRR-023: The Reservoir 3 outlet could be replaced with an Agri-Drain type of facility to improve capability of managing reservoir water levels. The replaced outlet could be designed to facilitate reservoir releases at lower elevations than the existing configuration.

IRR-024: Reservoir 4 embankment is in poor condition and in need of reconstruction or replacement. A new embankment could likely be built immediately upstream of the existing embankment and would incorporate an Agri-Drain type of reservoir outlet/control system.

IRR-025: A 6-inch buried pipeline could be installed between the Reservoir 4 outlet and irrigated meadows to the south. Alignment of the pipeline would be determined during the project design phase; however, the project appears feasible based upon available elevations data. Existing open irrigation ditches lose considerable amounts of supply water due to infiltration in sandy materials.

IRR-026: A 6-inch buried pipeline could be installed between the Reservoir 5 outlet and irrigated meadows to the south. Alignment of the pipeline would be determined during the project design phase; however, the project appears feasible based upon available elevations data. Existing open irrigation ditches lose considerable amounts of supply water due to infiltration in sandy materials.

4.3.3 IRR-027

IRR-027: This project consists of improvements to the existing Elk Hollow Ditch irrigation system in Section 12, Township 16 North, Range 83 West. The purpose of the project is to increase irrigation efficiency by installing a buried pipeline to replace an existing open ditch experiencing significant seepage losses. Figure 4.3-4 displays the conceptual layout of the proposed project.

The project would incorporate the following components:

- A pipe inlet would be constructed on the Elk Hollow Ditch. A slide headgate would be incorporate to facilitate adjustment of flow into the proposed pipeline
- Approximately 2,000 linear feet of buried 6-inch diameter HDPE pipeline would be installed.

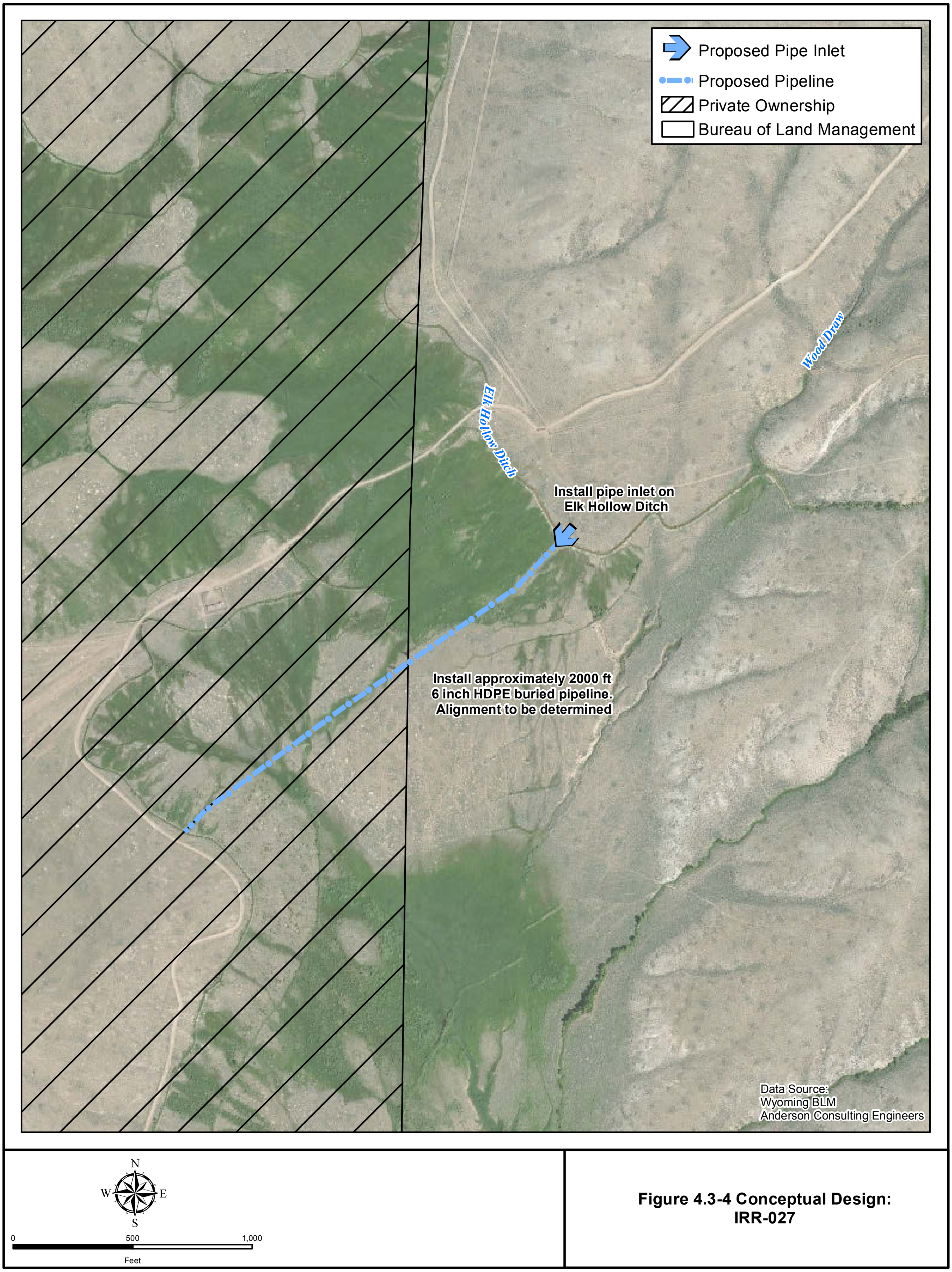


Figure 4.3-4 Conceptual Design: IRR-027

The actual alignment of the proposed project would be determined during the design phase of the project.

4.3.4 IRR-028

Toothaker Reservoir (WSEO Permit P5816R) is located on Beaver Creek in Section 16, Township 14 North, Range 82 West. The reservoir provides a source of irrigation and stock water and according to records of the WSEO, it has a storage capacity of approximately 215.45 acre-feet. An existing ditch supplied by the reservoir is sandy and erosive, consequently, significant quantities of water released from the reservoir is lost. Figure 4.3-5 displays the location of the proposed project.

At this location, approximately 1400 linear feet of 18-inch PVC pipe is recommended to replace the existing open ditch and reduce seepage losses and to eliminate erosion issues. The new pipeline would then connect to an existing pipeline serving an existing sprinkler system.

4.3.5 IRR-029

Barriers to fish passage are posed by irrigation diversions and other structures throughout the study area. Several structures have been removed in efforts to improve fisheries habitat in association with projects sponsored by the SERCD, Trout Unlimited, and Wyoming Game and Fish.

The Encampment Platte Valley Ditch diversion structure is an example of an existing structure which poses a significant barrier to fisheries (Figure 4.3-6). It is located on the Encampment River in Section Township North Range West about mile upstream of the confluence with the North Platte River. Water diverted at the structure is conveyed several miles along the west side of the Platte River providing water to irrigated hay and pastures. The structure consists of a concrete diversion structure, several feet high.

Redesign of the structure and its replacement was discussed at several of the project open houses and with staff of the SERCD. Modification of the structure would be desirable because:

- Slope of the ditch is extremely flat causing conveyance and management issues
- The structure poses a barrier to fish passage

Options considered include moving replacing the existing structure with a diversion facilitating fish passage at a location upstream of the existing site, thereby creating a steeper slope. Consequently, this concept would require reconstruction of the ditch to accommodate the greater slope. Given topographic constraints of the site, this option could be problematic. Another option discussed involved construction of a fish ladder at the existing site to facilitate fish passage. While likely more feasible than the first concept presented, it would provide no improvements in management to the ditch company.

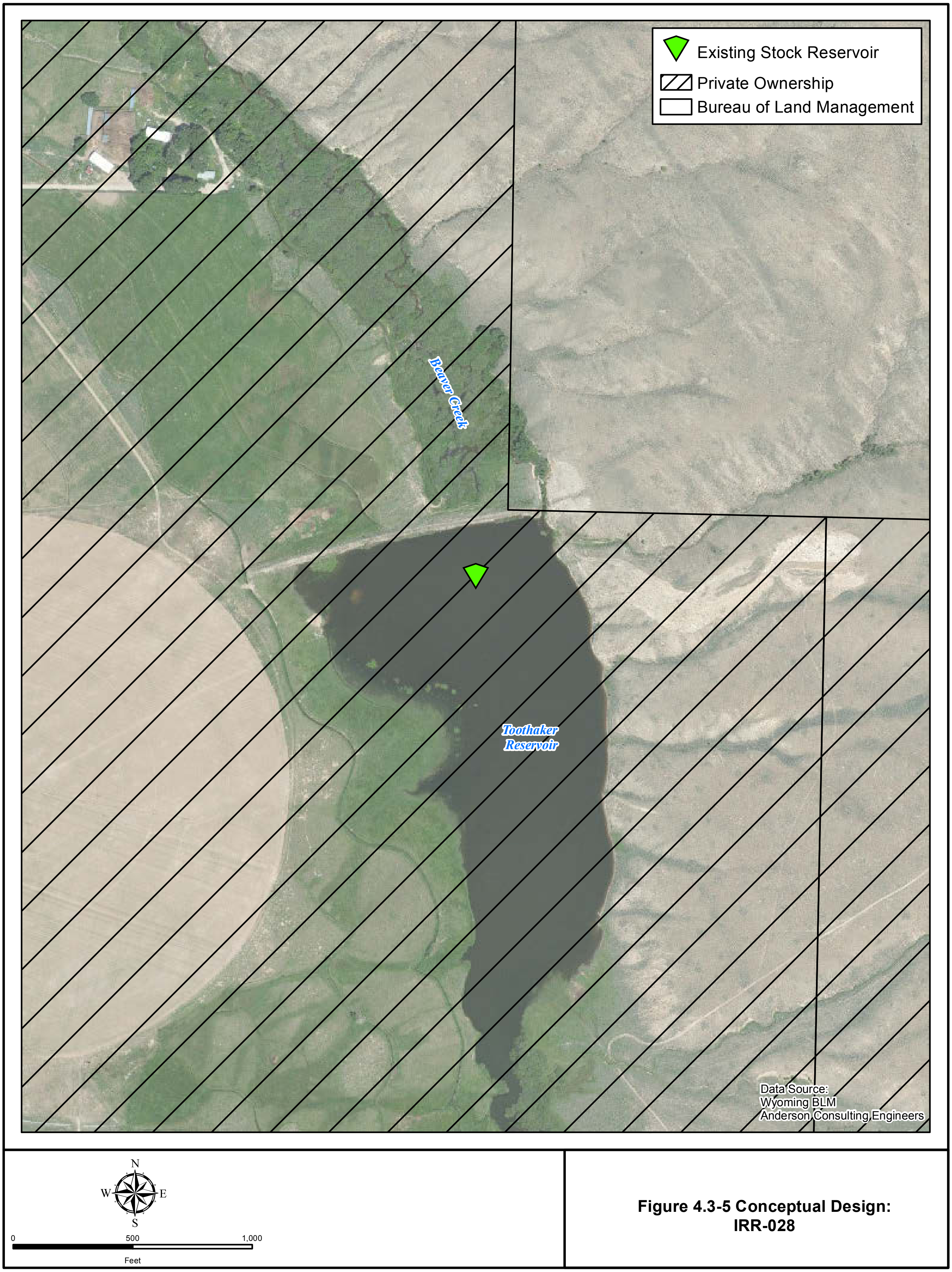


Figure 4.3-5 Conceptual Design: IRR-028

Figure 4.3-6 Encampment Platte Valley Ditch Diversion Structure.

4.3.6 IRR-030 through IRR-035

At the request of the landowner, individual structures associated with their irrigation ditch and distribution system were evaluated. The ditch system provides water to irrigated meadows used for hay production. Figure 4.3-7 displays the general location of the inventoried structures. Table 4.3-2 summarizes the results of the site investigation. All structures are located on privately owned property.

Table 4.3-2 Tabulation of One Pine Ranch Irrigation System Rehabilitation Projects.

Watershed Plan Component	Project Number	Section / Township / Range	Recommendation
IRR-030	OPR-001	S 11 , T. 17 N, R. 84 W.	Replace existing structure with concrete splitter box
IRR-031	OPR-002	S 2 , T. 17 N, R. 84 W.	Replace existing structure with concrete splitter box
IRR-032	OPR-003	S 2 , T. 17 N, R. 84 W.	Replace existing structure with concrete splitter box
IRR-033	OPR-004	S 2 , T. 17 N, R. 84 W.	Replace existing structure with concrete check structure
IRR-034	OPR-005	S 2 , T. 17 N, R. 84 W.	Replace existing structure with concrete check structure
IRR-035	OPR-006	S 2 , T. 17 N, R. 84 W.	Replace existing structure with concrete check structure

4.3.7 IRR-036

This project alternative would involve construction of a new stock / irrigation reservoir on private lands in Section 25, Township 15 North, Range 84 West. The purpose of the proposed reservoir is to facilitate management of irrigation water and to improve distribution of water in an existing irrigated hay field. The proposed reservoir would also provide a viable source of water to livestock as well as providing a small recreational fishing site. The proposed reservoir would have a storage capacity of less than 20 acre-feet. Figure 4.3-8 displays the general layout of the proposed stock / irrigation reservoir.

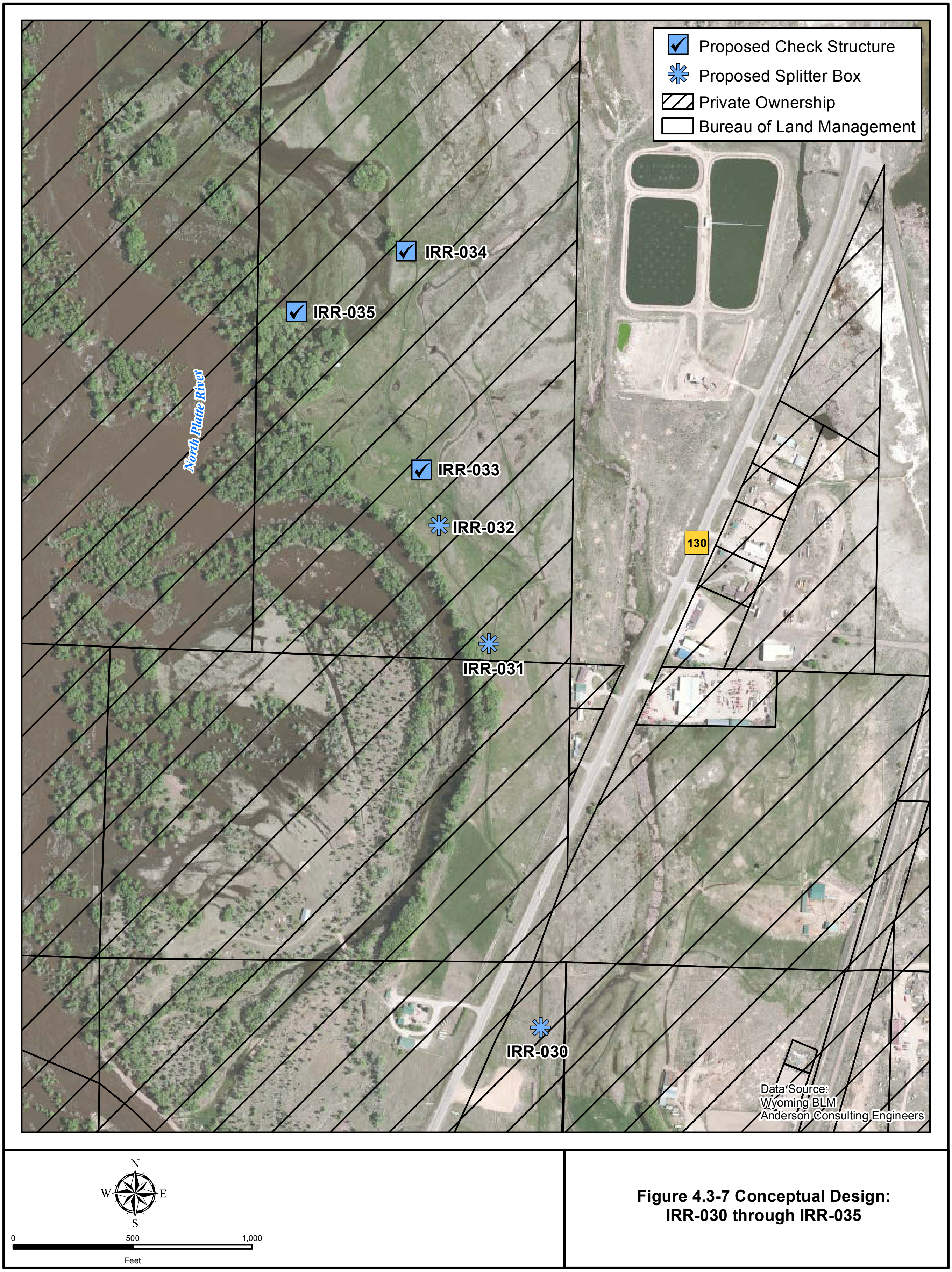


Figure 4.3-7 Conceptual Design: IRR-030 through IRR-035

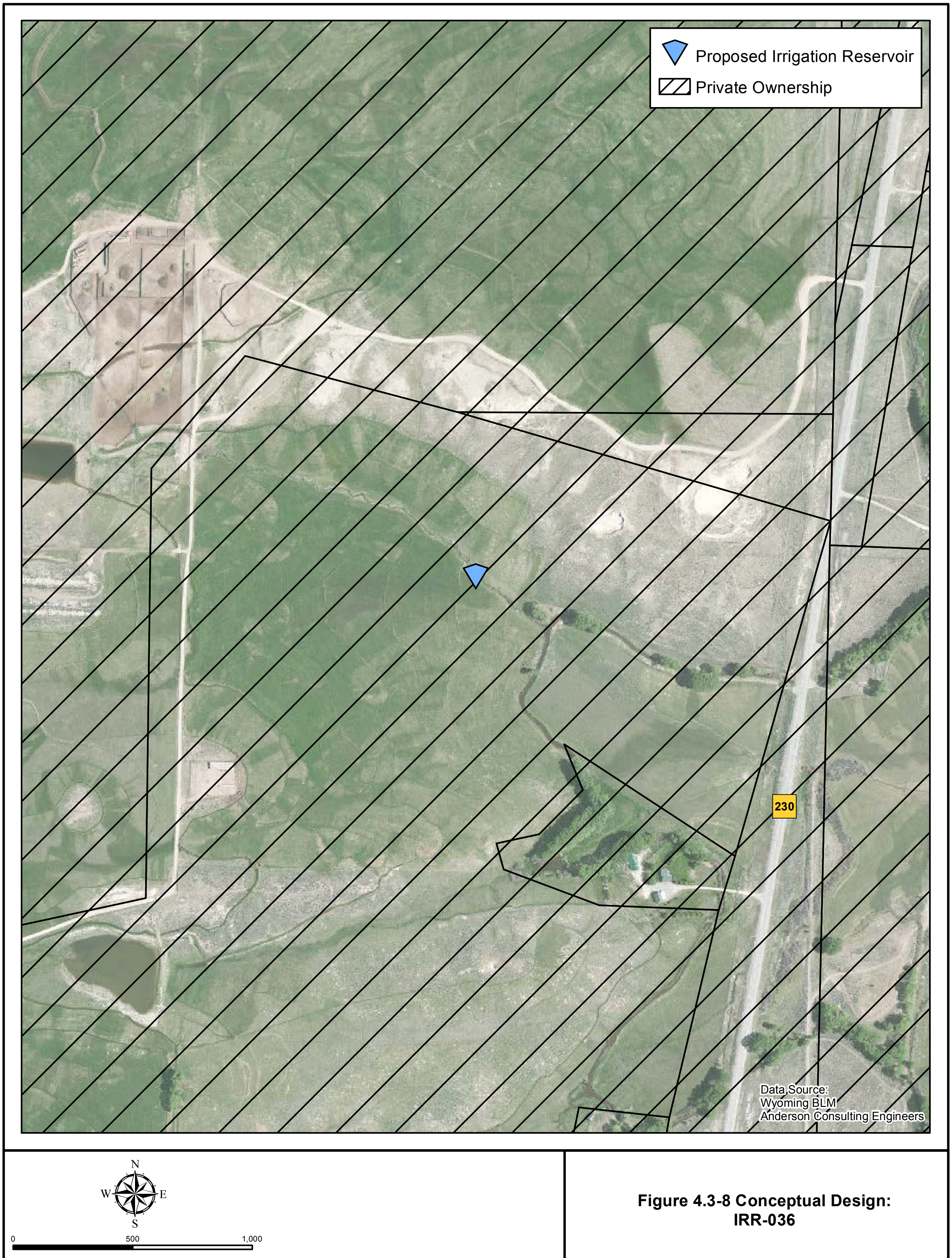


Figure 4.3-8 Conceptual Design: IRR-036

Incorporation of an Agri-Drain type of outlet would facilitate management of water levels within the reservoir.

The project applicant would need to acquire the proper permits to store water through the Wyoming State Engineers Office.

4.3.8 IRR-037 through IRR-038

IRR-037: The existing diversion and headgate of the North Meadow Ditch on the South Fork Lake Creek are currently in poor condition and in need of replacement (Figure 4.3-9). At this location, a structure similar in design to a sheet pile diversion located approximately 0.5 miles upstream of the project location is recommended. The new diversion would facilitate control of irrigation water diverted to the ditch while allowing sediment to pass downstream. A measurement device would also be recommended for installation on the North Meadow Ditch. Figure 4.3-10 displays the general location of the project.

Figure 4.3-9. Existing North Meadow Ditch Headgate (left) and recently constructed headgate on adjacent ditch (right). Both structures are located on South Fork Lake Creek.

IRR-038: Sediment transport and aggradation of accumulated sediment in the North Meadow Ditch presents continual maintenance problems for ditch managers. At the location indicated on Figure 4.3-10, approximately 2,000 linear feet of 12-inch diameter HDPE pipeline is recommended. The proposed pipeline would reduce maintenance requirements as well as reducing damage to irrigated meadows resulting from sediment deposition.

4.3.9 IRR-039

An existing siphon connecting the Alice Ditch Lateral with the Ryan Foreman ditch has failed and is in need of replacement. The siphon is located in Section 23, Township 16 North, Range 83 West and crosses Pearce Draw (tributary to Elk Hollow Creek). At this location, the following project components would be installed:

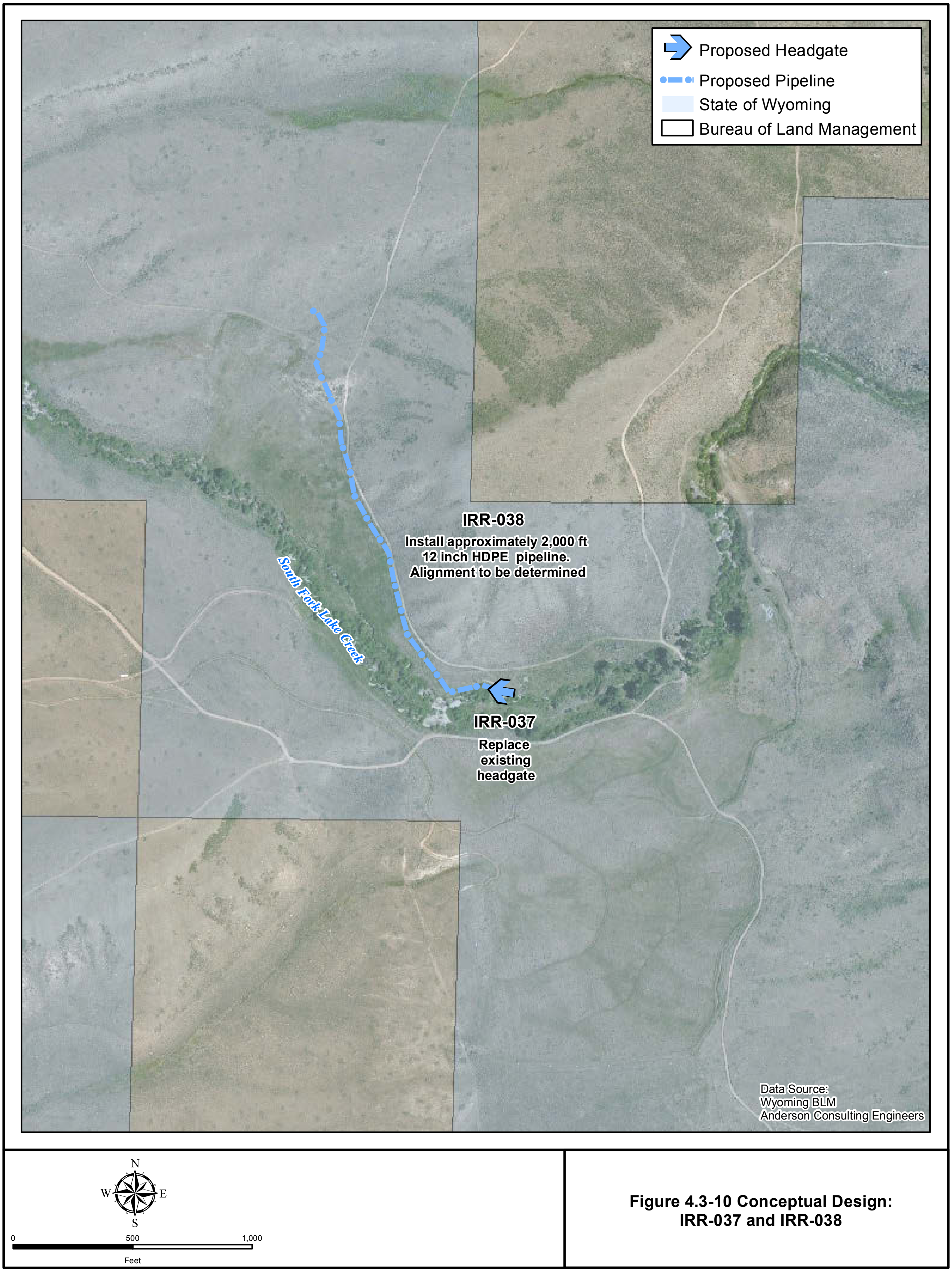


Figure 4.3-10 Conceptual Design: IRR-037 and IRR-038

- A concrete inlet structure would be built on Alice Ditch at the upstream end of the proposed siphon
- Approximately 1,200 lf of buried 18-inch diameter HDPE pipeline would be installed.
- The proposed siphon would span Pearce Draw at the location of an existing culvert, consequently no additional structure would be required at that point.
- A tee with valve would be installed the siphon's low point over Pearce Draw to facilitate draining the system for winter maintenance.

Figure 4.3-11 displays a conceptual design of the proposed project.

The proposed project would be constructed on privately owned property and federal land managed by the Bureau of Land Management.

4.3.10 IRR-040 through IRR-045

Representatives of the USFS met with the project team and the SERCD to discuss potential projects on National Forest lands. These projects are discussed in the paragraphs which follow.

IRR-040: As discussed previously in Chapter 3, forest lands within the project study area have suffered the effects of pine bark beetle infestation and the associated timber mortality. Subsequent timber fall has direct impacts to irrigation ditches originating on Forest lands. An internal USFS memo (Purchase, Carol, et al, 2008) describes the process:

> "Pine *beetle mortality is expected to increase the potential for adverse effects to ditch stability and function. Needle loss from dead trees increases overall debris in ditches. Once the trees start to fall over, the potential for debris dam development increases substantially which can inhibit flows, cause ditch failures through saturation of ditch banks, and overtopping of ditches due to loss of flow capacity. Ditch failures and breaches can significantly affect the soil, water, and aquatic resources through surface erosion and gully development, mass failures, delivery of large quantities of sediment to the stream system, and augmented stream flows to the receiving stream that exceeds the natural stream flow level."*

Figure 4.3-12 displays a ditch where timber deadfall has begun to choke the ditch creating a potential for debris dam development. Figure 4.3-13 shows the general location of irrigation ditches within the area of beetle infestation.

The memo included the following recommendations which have been incorporated into the watershed management plan:

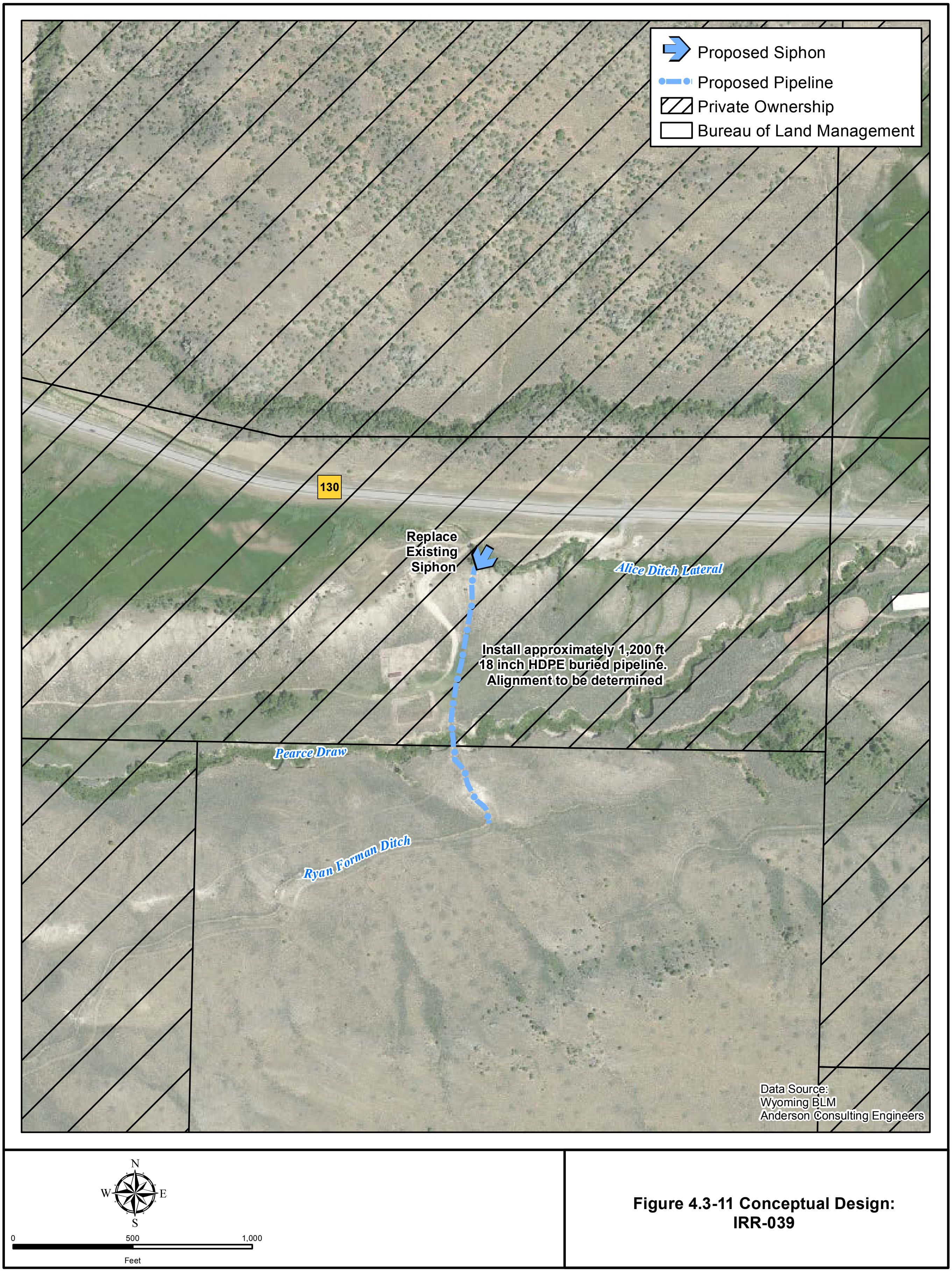


Figure 4.3-11 Conceptual Design: IRR-039

"This analysis identified four recommendations for addressing the effects of the beetle epidemic on ditches:

1. *Ditch Maintenance: Minimizing the risk of increased impacts to soil, water, and aquatic resources, will require additional ditch maintenance. It is the responsibility of the ditch operator to maintain their ditch in order to prevent resource damage. It is recommended that letters be sent to each ditch owner/operator of ditches within existing or projected beetle kill areas describing the projected beetle mortality, and potential effects to ditch function and increased probability for failures. This letter should strongly recommend that ditch owners plan to maintain their ditches every fall prior to snowfall in order to accommodate spring runoff, again in the spring prior to turning water into their ditches, and after each major windstorm to clear out the accelerated debris input that is expected to occur as a result of the beetle epidemic. Routine maintenance will both reduce resource impacts by preventing breaches and failures while also saving the ditch operator the cost of repairing damaged ditches. This letter should also remind ditch permitees that they are responsible for not only ditch maintenance which will likely be higher over the next decade, but also the cost of resource damages and resource rehabilitation costs associated with their ditches.*

2. *Land Use Authorization Administration: The Forest should expect increased time and costs associated with administering land use authorizations associated with ditches due to the beetle epidemic. This should be recognized and incorporated into the program of work for personnel who administer ditch authorizations.*

3. *Timber clearing opportunities: If there are opportunities to remove dead trees adjacent to ditches in areas where other work is already occurring such as salvage logging or roadside clearing, this would help to minimize the potential for dead trees to create debris dams and subsequent ditch failures. These actions are being incorporated into timber sale contracts for beetle salvage sales in the south zone, with specific design criteria to protect ditch integrity and function while removing hazardous dead trees.*

4. *Forestwide assessment: Water facility operators and the Forest may want to consider conducting a Forestwide environmental analysis to analyze the effects of clearing trees adjacent to ditches, similar to other road and powerline assessments conducted on the Forest. Such a planning effort may facilitate early removal of trees likely to fall into ditches and prevent resource problems before they occur."*

Figure 4.3-12 Typical ditch originating on Forest lands experiencing significant timber deadfall attributed to pine bark beetle kill.

IRR-041: The South Brush Creek Supply Ditch has created a deeply entrenched canyon near the USFS boundary on privately owned lands (Figure 4.3-14). The erosional feature has developed subsequent to decades long release of irrigation diversions down a steep slope with no grade controls. Based upon preliminary evaluation of the site, erosion is still active and sediment derived from the canyon is deposited in a fan downstream.

Remediation at the site would likely be highly problematic if 'in channel' methods are employed. Given the steep gradient, construction of grade control structures or check dams appears impractical. The solutions which would most likely be successful would be construction of a pipe drop structure parallel to the channel but offset on undisturbed lands. A similar structure was recently constructed on the Wiant Ditch using WWDC funding. Figure 4.3-15 displays the conceptual drawings associated with that structure.

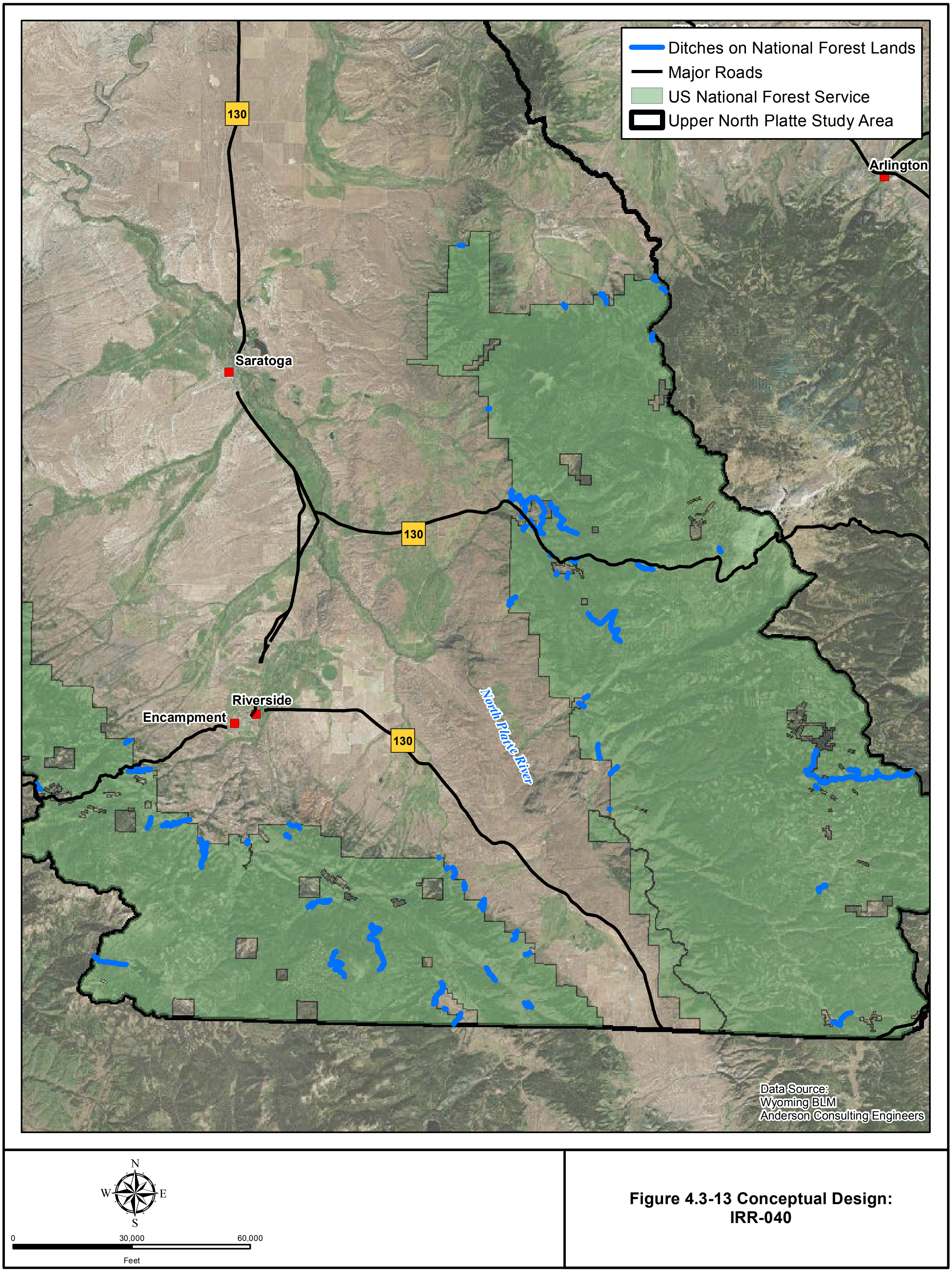


Figure 4.3-13 Conceptual Design: IRR-040

IRR-042: A drop structure on the Highline Canal No. 1 was inspected during a field tour with USFS and SERCD staff. The structure consists of a 36-inch diameter corrugated metal pipe (CMP) with welded joints to facilitate a vertical drop of approximately 10 to 12 feet in elevation. The welded joints have apparently failed and the CMP sections have separated allowing irrigation water to leave the pipe and erode the ground around the pipe. A large subsidence hole above the pipe is indicative of the leak and the angle of the CMP outlet and the supporting concrete wall which leans downstream support this conclusion (Figure 4.3-16). Inspection of the CMP should be conducted following the irrigation season to verify.

Replacement of the structure with a structure of similar design is recommended.

Figure 4.3-14. Erosional feature on South Brush Creek Supply Ditch.

IRR-043: The Kurtz-Chatterton Ditch has created a deeply entrenched canyon near the USFS boundary on privately owned lands. The feature is similar to the previously discussed erosional feature on the North Brush Creek Supply Ditch. The ditch is part of a trans-basin diversion system where water is conveyed “on-grade” on a steep side slope to a point where it is released directly down the slope with no means of control erosion or degradation. Based upon preliminary evaluation of the site, erosion is still active.

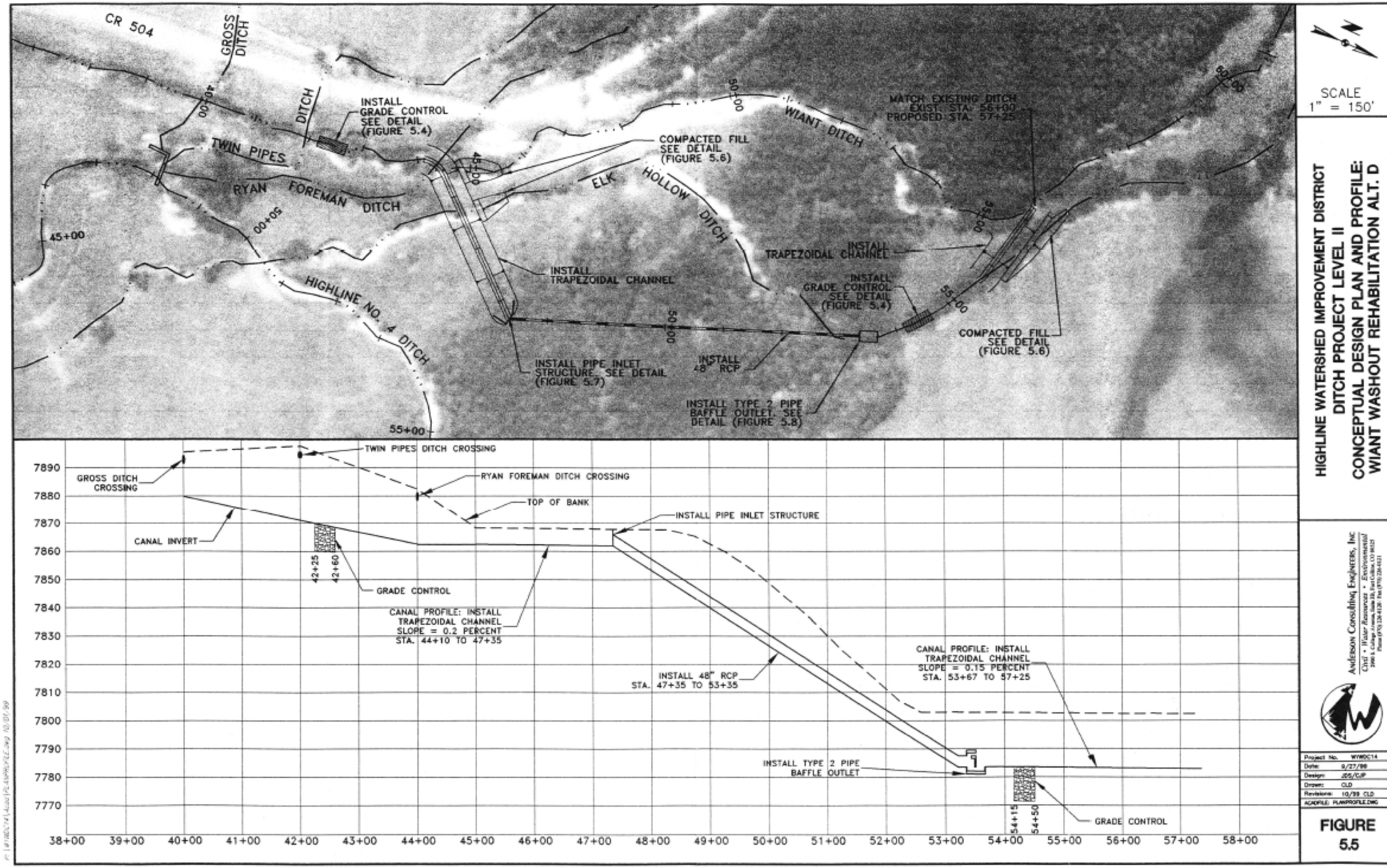


Figure 4.3-15
Conceptual Design of Wiant Ditch Pipe Drop Structure
(Anderson Consulting Engineers, 1999)

Remediation at the site would likely be highly problematic if 'in channel' methods are employed. Given the steep gradient, construction of grade control structures or check dams appears impractical. The solutions which would most likely be successful would be construction of a pipe drop structure parallel to the channel but offset on undisturbed lands. A similar structure was recently constructed on the Wiant Ditch using WWDC funding. Figure 4.3-15 displays the conceptual drawings associated with that structure.

Figure 4.3-16 Failing drop structure on the Highline No. 1 ditch. Note the leaning concrete support wall and slope of the CMP indicating failure of internal welded joint(s).

IRR-044: Carroll Ditch is diverted from Barrett Creek at upstream of the Ryan Park Campground (Section 27, Township 16 North, Range 81 West). There is no diversion structure or headgate associated with the diversion (Figure 4.3-17). Water is diverted using a "push up" dam in the creek and tarpaulins.

At this location, the following components are recommended:

- A headgate consisting of a concrete headwall and 18-inch slide gate should be placed at the head of Carroll Ditch to facilitate control of diverted flows
- A rock vortex weir should be constructed in Barrett Creek to provide the water surface elevation.

This project would involve only lands owned by the USFS.

Figure 4.3-17. Carrol Ditch diversion on Barrett Creek.

IRR-045: The Enlarged Encampment Range Ditch (Billie Creek Ditch) has created a deeply entrenched canyon on USFS lands (Figure 4.3-18). The ditch is part of a trans-basin diversion system where water is conveyed "on-grade" on a steep side slope to a point where it is released directly down the slope with no means of control erosion or degradation. Based upon preliminary evaluation of the site, erosion is still active.

Remediation at the site would likely be highly problematic if 'in channel' methods are employed. Given the steep gradient, construction of grade control structures or check dams appears impractical. The solutions which would most likely be successful would be construction of a pipe drop structure parallel to the channel but offset on undisturbed lands. A similar structure was recently constructed on the Wiant Ditch using WWDC funding. Figure 4.3-15 displays the conceptual drawings associated with that structure.

4.3.11 IRR-046

The Wagoner and Cherokee Ditch diversions on the Encampment River have been the subject of study for several years. In 2002 a Level I investigation conducted on behalf of the WWDC was completed. The investigation concluded with several recommendations pertaining to replacement of the existing diversions and consideration of combining the ditches for a portion of their extent. A Level II investigation explored these recommendations in greater detail.

Figure 4.3-18 Erosional feature formed by Enlarged Encampment Range Ditch (Billie Creek Ditch).

According to the Level I report:

> *"Water from the Encampment River is diverted into the Wagoner and Cherokee Ditches to irrigate the Project area. The Wagoner Ditch has water rights dated from 1885 through 1954 with an appropriation of 15.41 cfs (1,079 acres) and the Cherokee Ditch has water rights dated from 1895 through 1968 and has an appropriation of23.6 cfs (1,659 acres) plus 7.21 cfs (505 acres) of supplemental supply. A total of 3,243 acres, including the supplemental supply, can be irrigated through these ditches. During low flows in the Encampment River, numerous downstream ditches are supplied through the Cherokee Ditch without properly changing the point of diversion on record with the State Board of Control.*
>
> *The point of diversion for the Wagoner Ditch is approximately 800 feet downstream of the Cherokee Ditch, see Figure 4.3-19). The two ditches run parallel to each other for approximately 1.5 miles, from the diversions to Highway 230. Both ditches seep between their points of diversion and their intersection with State Highway 230"* (PMPC, 2002).

The Level II investigation culminated in recommendation of several design alternatives to replace the existing diversion dams. At this time, none of the recommendations of the Level II study have been implemented.

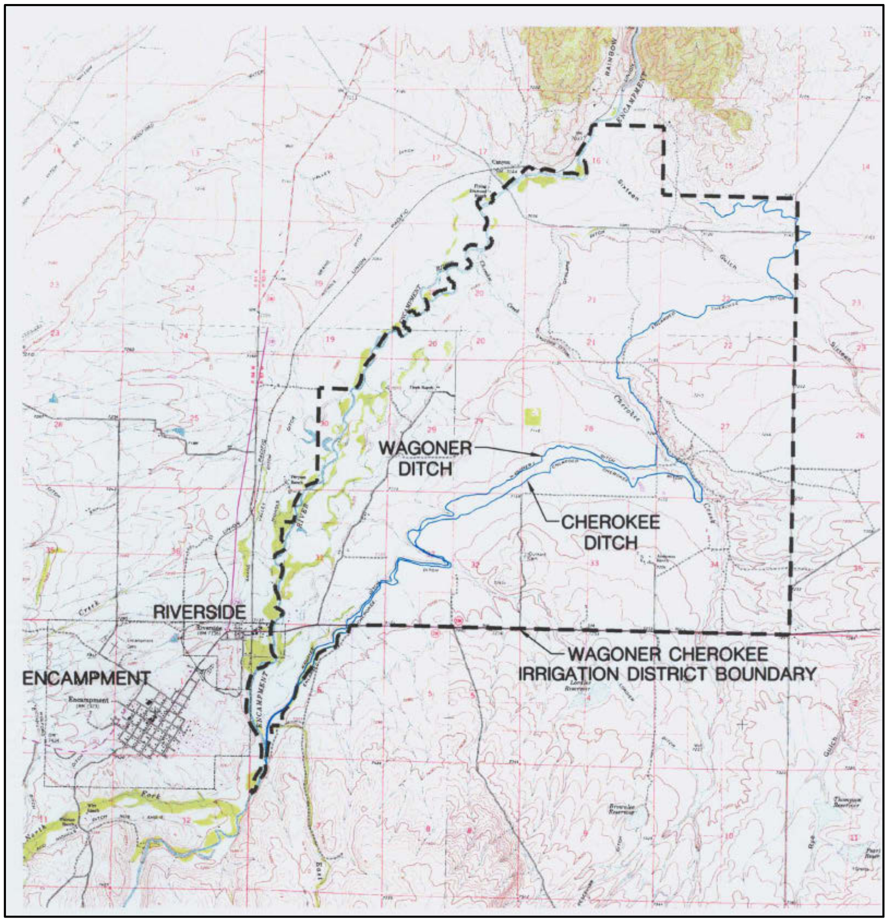


Figure 4.3-19 Overview map of the Wagoner Cherokee Ditches (source PMPC, 2002).

4.4 Upland Wildlife/Livestock Watering Sources (Watershed Management Plan Component L/W)

4.4.1 Alternative New Watering Opportunities

Based upon the premise that existing water sources are capable of providing water to livestock within a one mile radius, buffers were drawn around existing water sources discussed in Chapter 3 (Figure 4.4-1). Note that this figure does not show buffers about perennial/intermittent streams, nor springs. A general objective of this effort was to provide means of providing reliable sources of livestock/wildlife drinking water as alternative water supplies to riparian corridors. As indicated in this figure, much of the study area appears to be adequately supplied with water sources. However, it is important to note that many of these sources are stock reservoirs located on intermittent/ephemeral channels and are consequently reliant upon uncertain runoff. Long-term or season-long utility is not always certain. Based upon this analysis, much of the study area may benefit by the development of upland water sources. In addition, land owners indicated locations where existing sources could benefit from enhanced or improved infrastructure. It must be noted that any water project involving a change in water use or location of water use must be permitted with the Wyoming State Engineers office prior to construction.

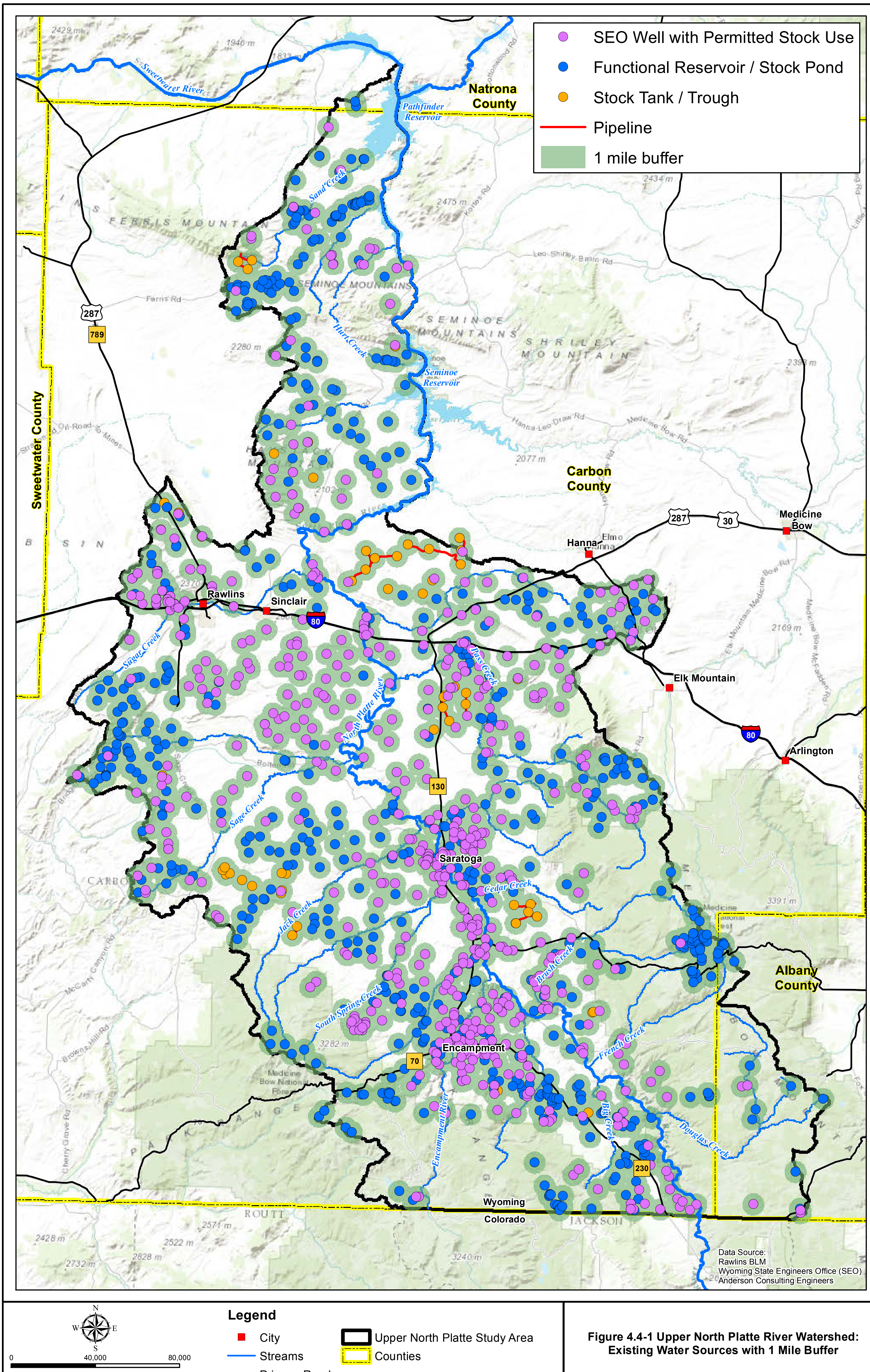


Figure 4.4-1 Upper North Platte River Watershed: Existing Water Sources with 1 Mile Buffer

As presented in Chapter 3, there are numerous springs scattered throughout the study area. Many of these could conceivably be developed as upland water sources for wildlife and livestock. Prior to the design of any project, site-specific evaluation of the water source would be required to ensure adequate water yield and to develop environmental safeguards. Final design of any upland water projects would consequently require consideration of the yield of the water source and the number of animals the project is anticipated to serve. Sizing of water facilities cannot be determined at this time due to the uncertainties associated with the grazing management plan proposed by the BLM. For the purposes of this project, watering facilities were assumed to consist of rubber tire stock tanks providing approximately 1,200 gallons of storage. This volume would facilitate the water needs of approximately 80 cattle per day assuming a water requirement of 15 gallons per day. A water source capable of providing 1 gallon per minute would be required to supply these facilities. By incorporating closed storage tanks in a project design, greater use of existing water sources could be realized.

It must be kept in mind that designs presented in this report are conceptual only. The indicated alignments of pipelines and placement of livestock / wildlife watering facilities are general and intended to represent the concept behind the alternatives if implemented, detailed design would be required.

4.4.2 Upland Wildlife/Livestock Water Development Projects

A list of interested land owners and allotment permittees was generated based upon input obtained at project meetings. Individual meetings were scheduled and completed to gain their input on the water needs of their respective geographical areas of interest. Based upon the results of these interviews and the information presented above pertaining to existing water supplies and areas in need of upland water development, several conceptual water development projects were identified. The general objective of this effort was to create a means of providing reliable sources of livestock / wildlife drinking water in water-short portions of the watershed as well as alternative water supplies to riparian corridors.

Federal lands are significant in extent within the project area, particularly within the Checkerboard portion of the region. Consequently, many of the upland water development projects could involve coordination with the BLM in order for construction to occur. Additionally, pipeline projects have the potential to require cooperation among multiple landowners. Written agreements would be required which define the maintenance responsibility and ownership liability associated with each project.

In addition, environmental evaluations would be required for the impacts identified with each project. BLM typically conducts these evaluations; however, the NRCS or other agencies may provide input, particularly on archaeological or cultural resources issues. Consequently, implementation would be partially contingent upon BLM scheduling and manpower for their completion of the requisite evaluation and documentation. It is our understanding that the permitting process is simplified for those projects which do not involve placement of above ground facilities pipeline alignment only and thus requiring granting of easement for buried pipelines.

Figure 4.4-2 displays the general location of all livestock/wildlife water opportunity projects.

4.4.3 L/W-001 through L/W-005

The sponsoring ranch consists of numerous parcels within the southern portion of the project study area and extends well into Colorado. The ranch manager indicated that there are numerous projects in the ranch's planning horizon involving development of livestock / wildlife water opportunities. The objectives of the projects include optimization of resources and enhancement of grazing management plans as well as relief of pressures upon riparian sources. The five projects selected by the project manager as being highest priority are included in the current study. Figure 4.4-3 displays the location of the proposed projects.

Project L/W-001: This project involves drilling a new well (250 feet in depth), installing a solar pump, and 2 stock tanks. The project is located in the Section 31, Township 13 North, Range 80 West. The project lies within the Spring Creek-Big Creek subwatershed. The alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.4-2 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing poorly producing well located on BLM property would be abandoned.
- A new well would be constructed on privately owned property. The precise location of the well would be determined during the well design phase of the project but would likely be in the vicinity indicated on Figure 4.4-4. Based upon information pertaining to existing wells in the immediate vicinity, the depth of the proposed well would likely be on the order of 250 feet deep.
- The proposed well would be equipped with a solar pump facility.
- Approximately 200 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed northerly to a 1,200 gallon stock tank to be sited near the boundary between private property and BLM property.
- An additional 1,000 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be installed and routed northerly to an additional stock tank on BLM property
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve both privately owned and BLM lands.

Projects L/W-002 through L/W-005: These project recommendations all consist of similar basic spring developments located throughout the ranch property. The general location of each project is tabulated as follows:

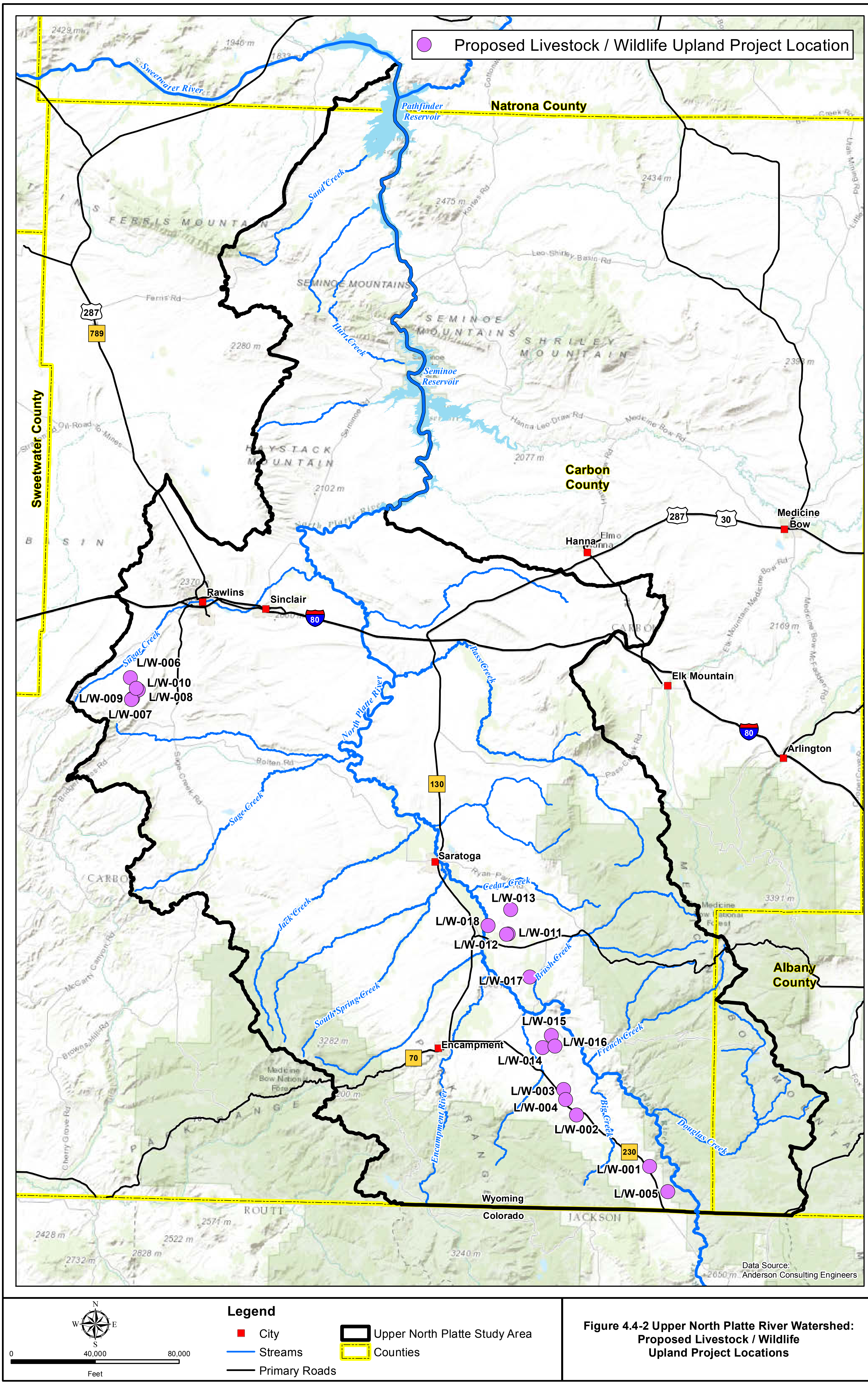


Figure 4.4-2 Upper North Platte River Watershed: Proposed Livestock / Wildlife Upland Project Locations

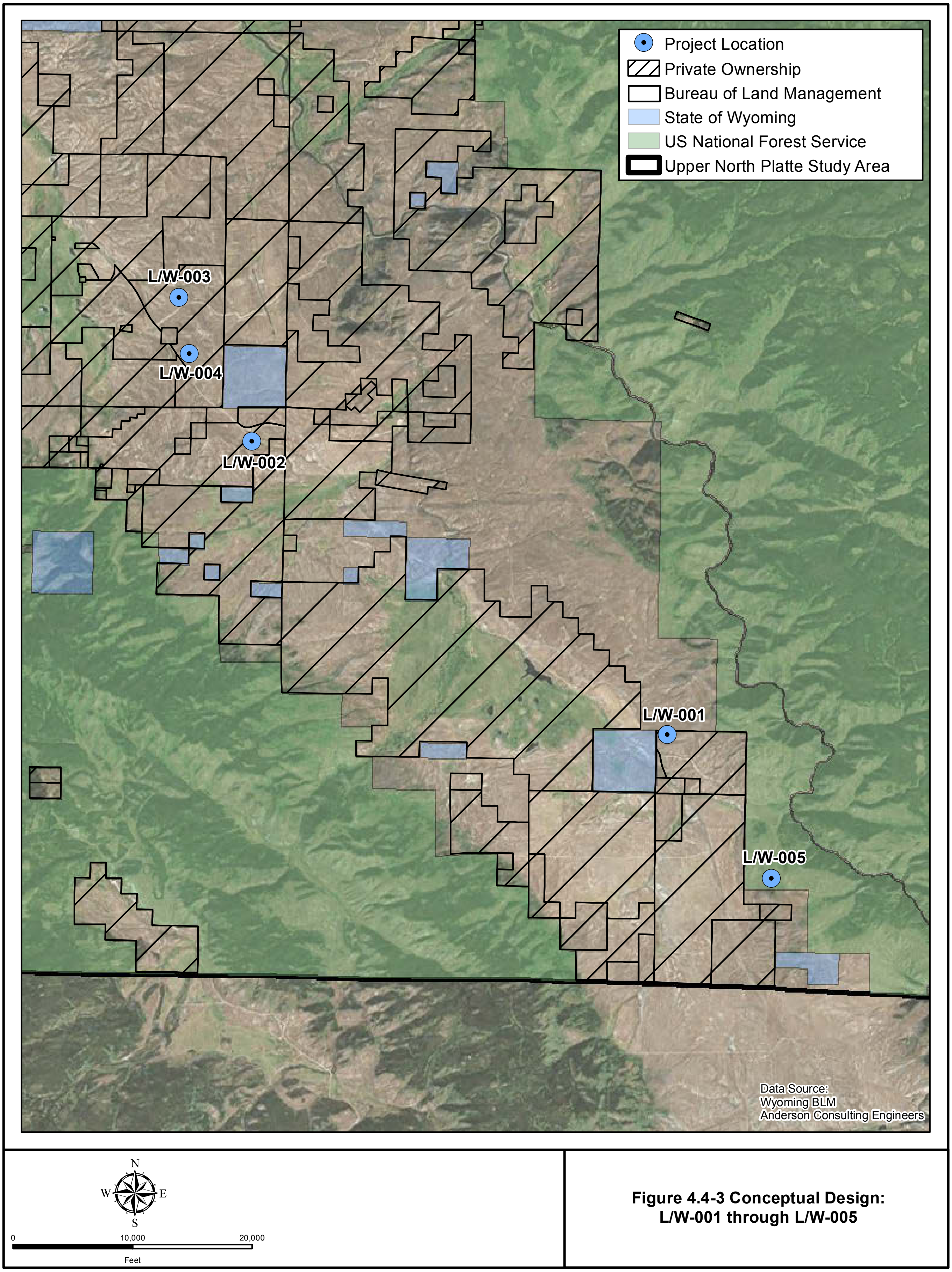


Figure 4.4-3 Conceptual Design: L/W-001 through L/W-005

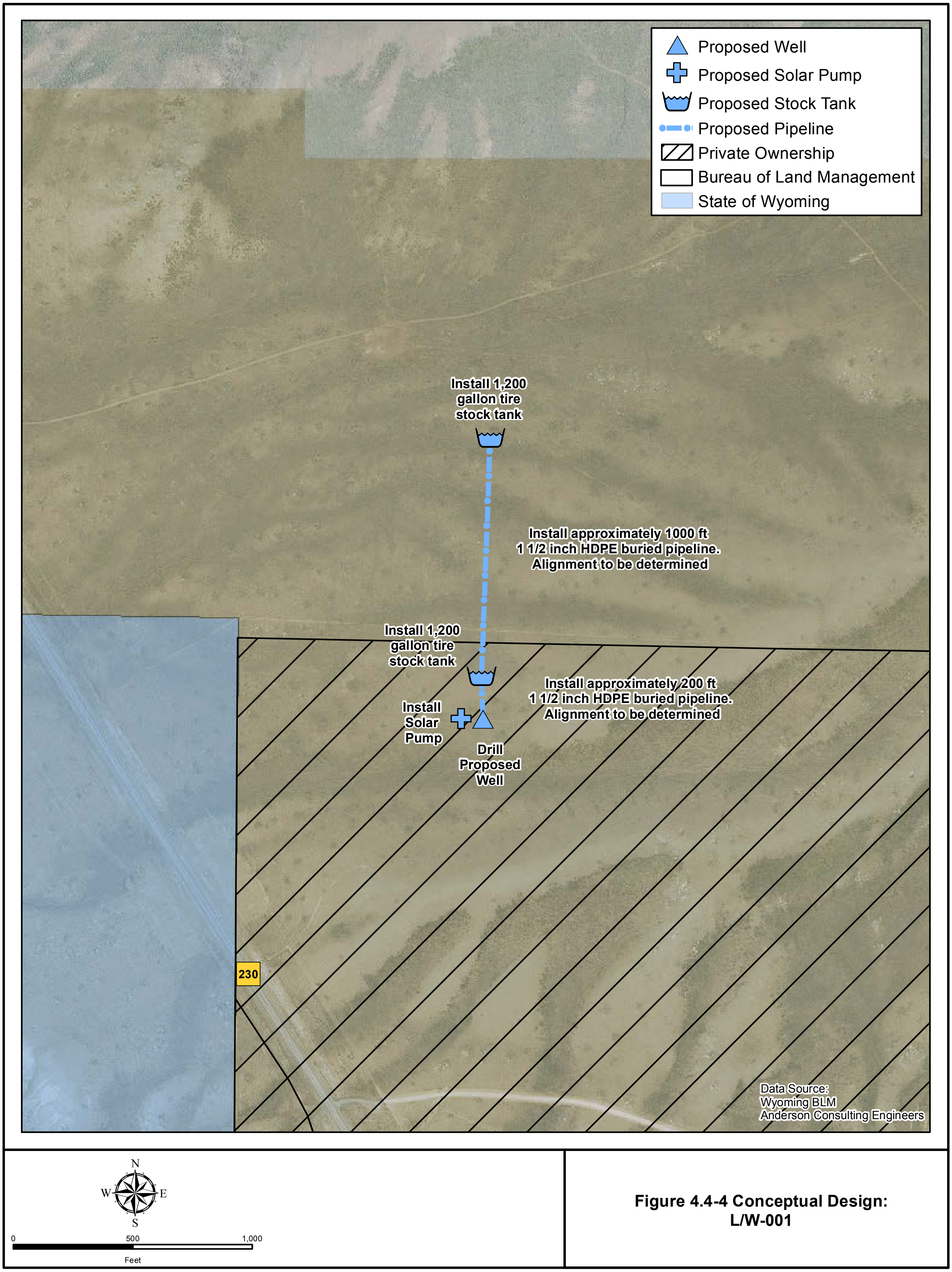


Figure 4.4-4 Conceptual Design: L/W-001

L/W -002	SW ¼ Section 1, Township 13 North, Range 82 West
L/W -003	NW ¼ Section 26, Township 14 North, Range 82 West
L/W -004	NW ¼ Section 35, Township 14 North, Range 82 West
L/W -005	NE ¼ Section 8, Township 12 North, Range 80 West

Each of the proposed projects would include the following components:

- An existing spring would be developed. A valve would be included for management of pipeline flows.
- From the spring, water would drain by gravity downslope to a 1,200 gallon stock tank.
- 200 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be required.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife. Approximately 500 linear feet of fencing would be required for each project.

Figure 4.4-5 displays the conceptual design for only L/W-002, however the remaining three projects have identical components. Three of these projects would be situated entirely on privately owned properties. One (L/W -005) would be situated on federal lands managed by the USFS.

4.4.4 L/W-006 through L/W-010

L/W-006: This alternative would involve the development and improvement of an existing spring in the west central portion of the watershed, southwest of Rawlins (Section 30, Township 20 North, Range 88 West). The alternative would provide a reliable supply water to a portion of the watershed lacking adequate livestock and wildlife upland water sources. Figure 4.4-6 displays the conceptual design of the proposed project.

Under this alternative, the following components would be employed:

- An existing spring would be developed NRCS spring development designs. A valve would be included for management of pipeline flows.
- An existing concrete cistern would be used to collect spring water.
- Approximately 2,700 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be required. Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Two 1,200 gallon rubber tire stock tanks will be installed
- Wildlife egress ramps would be installed in the proposed stock tank.
- The spring vicinity would be fenced with approximately 500 linear feet of fencing to prevent damage from livestock and wildlife.

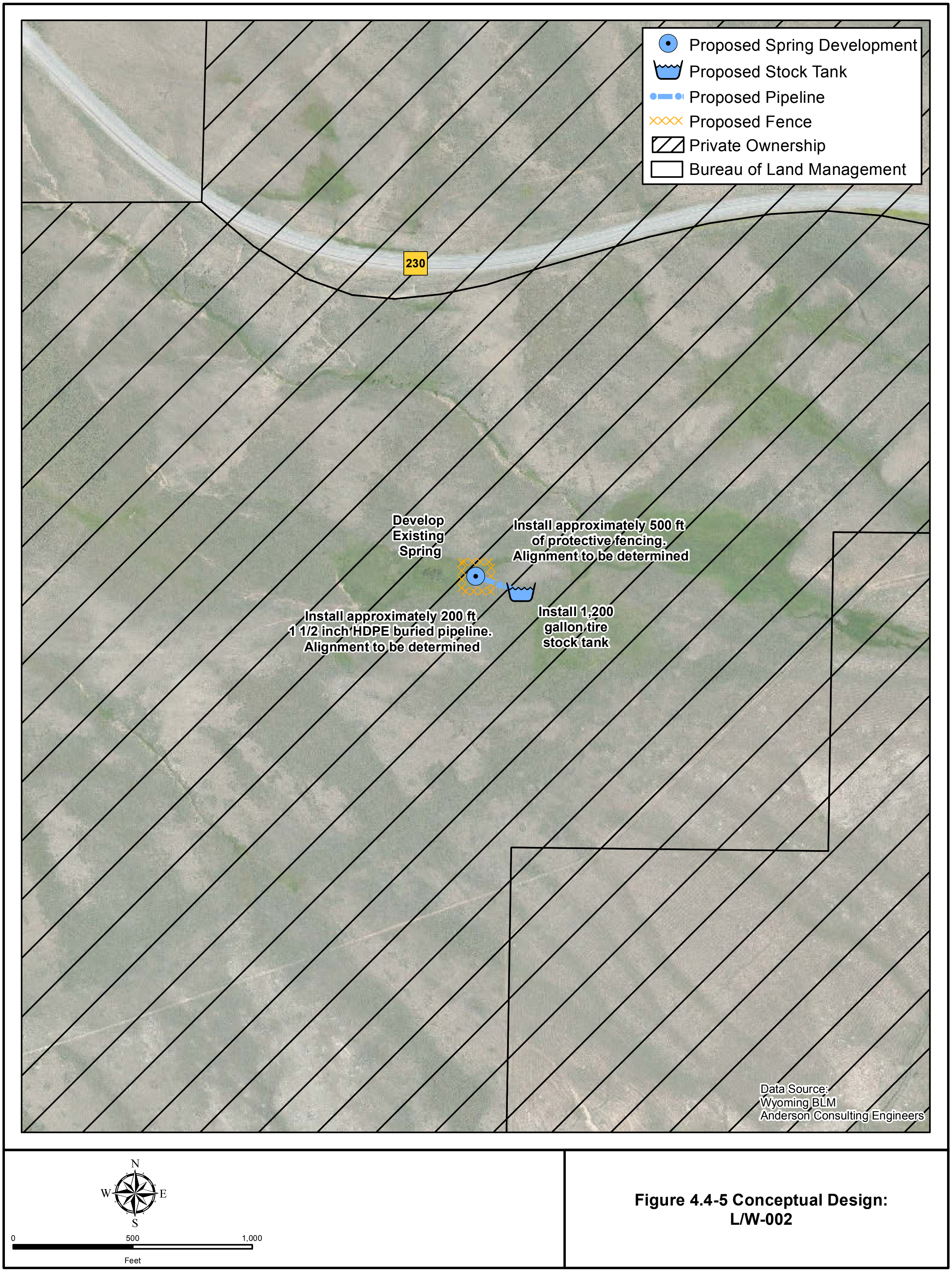


Figure 4.4-5 Conceptual Design: L/W-002

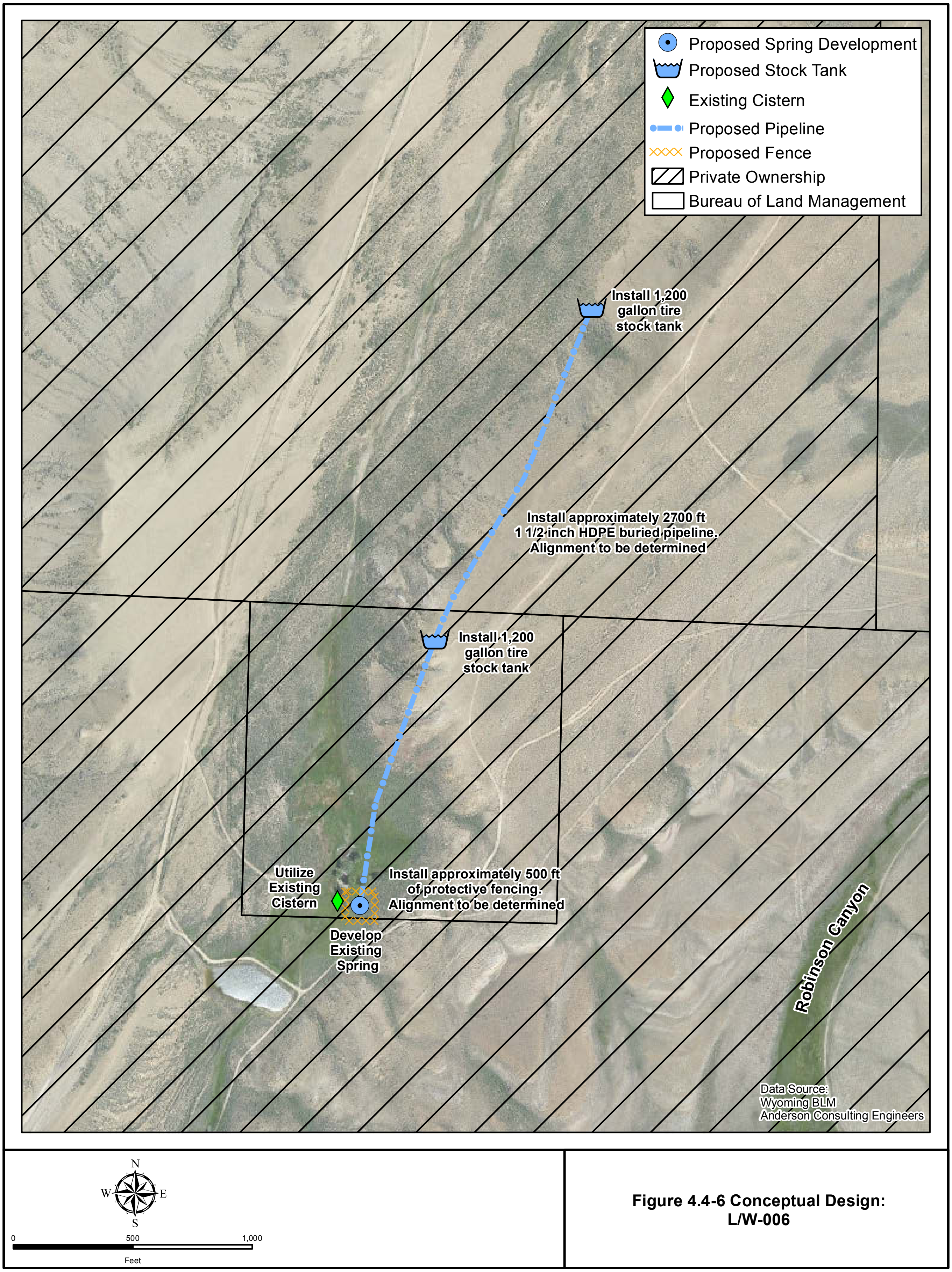


Figure 4.4-6 Conceptual Design: L/W-006

The proposed project is located entirely on privately owned lands.

L/W-007: This alternative would involve the development and improvement of an existing spring in the west central portion of the watershed, southwest of Rawlins (Section 6, Township 19 North, Range 88 West). The alternative would provide a reliable supply water to a portion of the watershed lacking adequate livestock and wildlife upland water sources. Figure 4.4-7 displays the conceptual design of the proposed project

Under this alternative, the following components would be employed:

- An existing spring would be developed NRCS spring development designs. A valve would be included for management of pipeline flows.
- An existing concrete cistern would be used to collect spring water.
- Approximately 2,700 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be required. Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Two 1,200 gallon rubber tire stock tanks will be installed
- Wildlife egress ramps would be installed in the proposed stock tank.
- The spring vicinity would be fenced with approximately 500 linear feet of fencing to prevent damage from livestock and wildlife.

The proposed project is located entirely on privately owned lands.

L/W-008: This alternative involves the rehabilitation of an existing small stock reservoir located in Section 32, Township 20 North, Range 88 West (Figure 4.4-8). Under this alternative, the following components would be employed:

- Existing sediment would be excavated from the pond
- The pond would be sealed with agricultural grade bentonite at a rate of 4 pounds per square foot based upon NRCS guidelines.

As delineated, the project would involve only privately-owned land.

Note: Several options exist to reduce seepage in small stock reservoirs, including geotextile liners, bentonite mat liners, or placement of agricultural grade bentonite. Options involving liners were deemed cost-prohibitive; cost associated with lining a stock reservoir using commercial lining products would range from approximately $2.50 to $5 per square foot depending upon the type of material. Typical lining projects would therefore be approximately $12,000 to $24,000 per site for a small stock reservoir. Bentonite fabrics (Bentomat) can sometimes be obtained free or at very low cost from distributors when there are over-runs or excess available. However, the reliability is not certain.

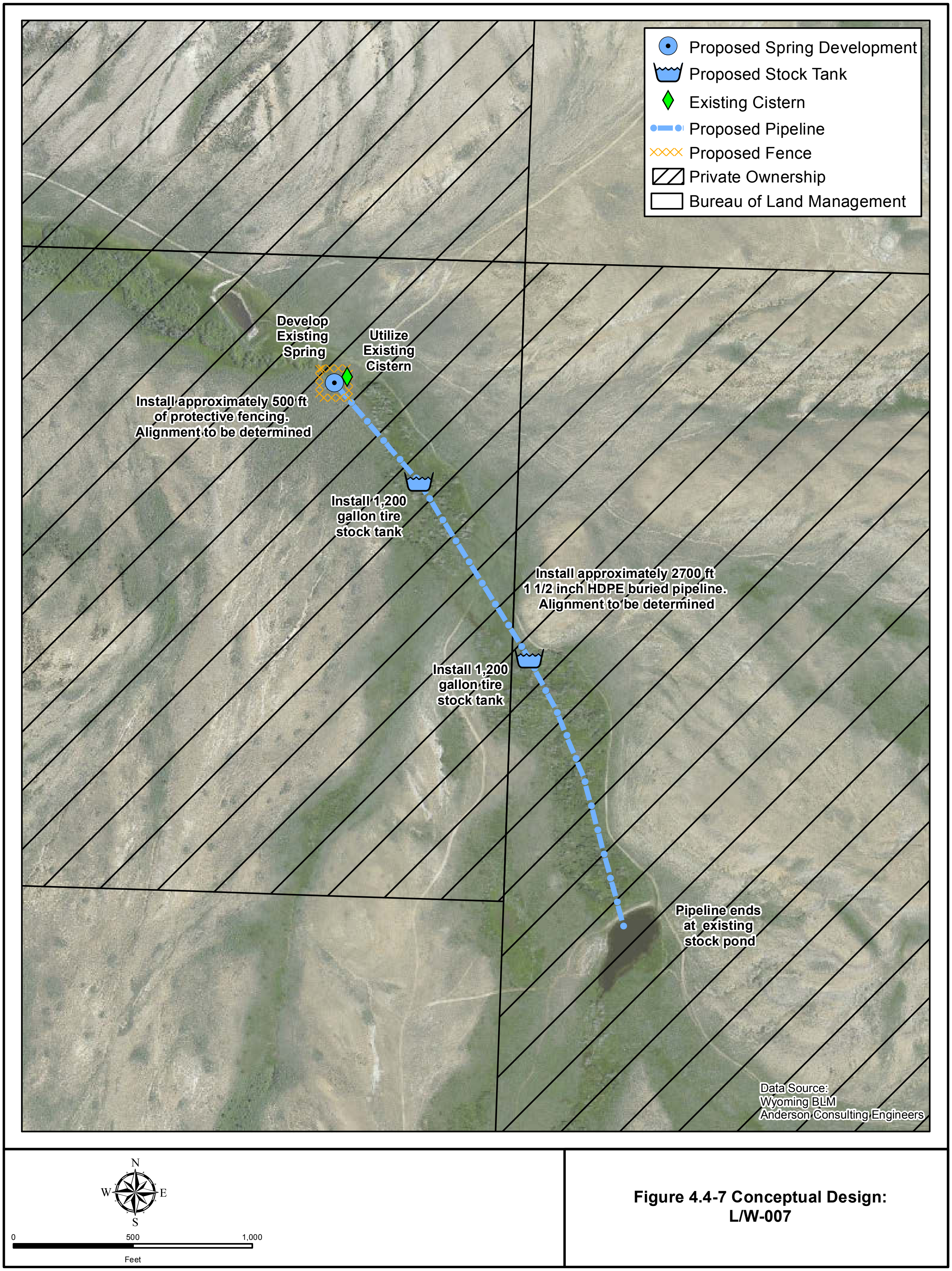


Figure 4.4-7 Conceptual Design: L/W-007

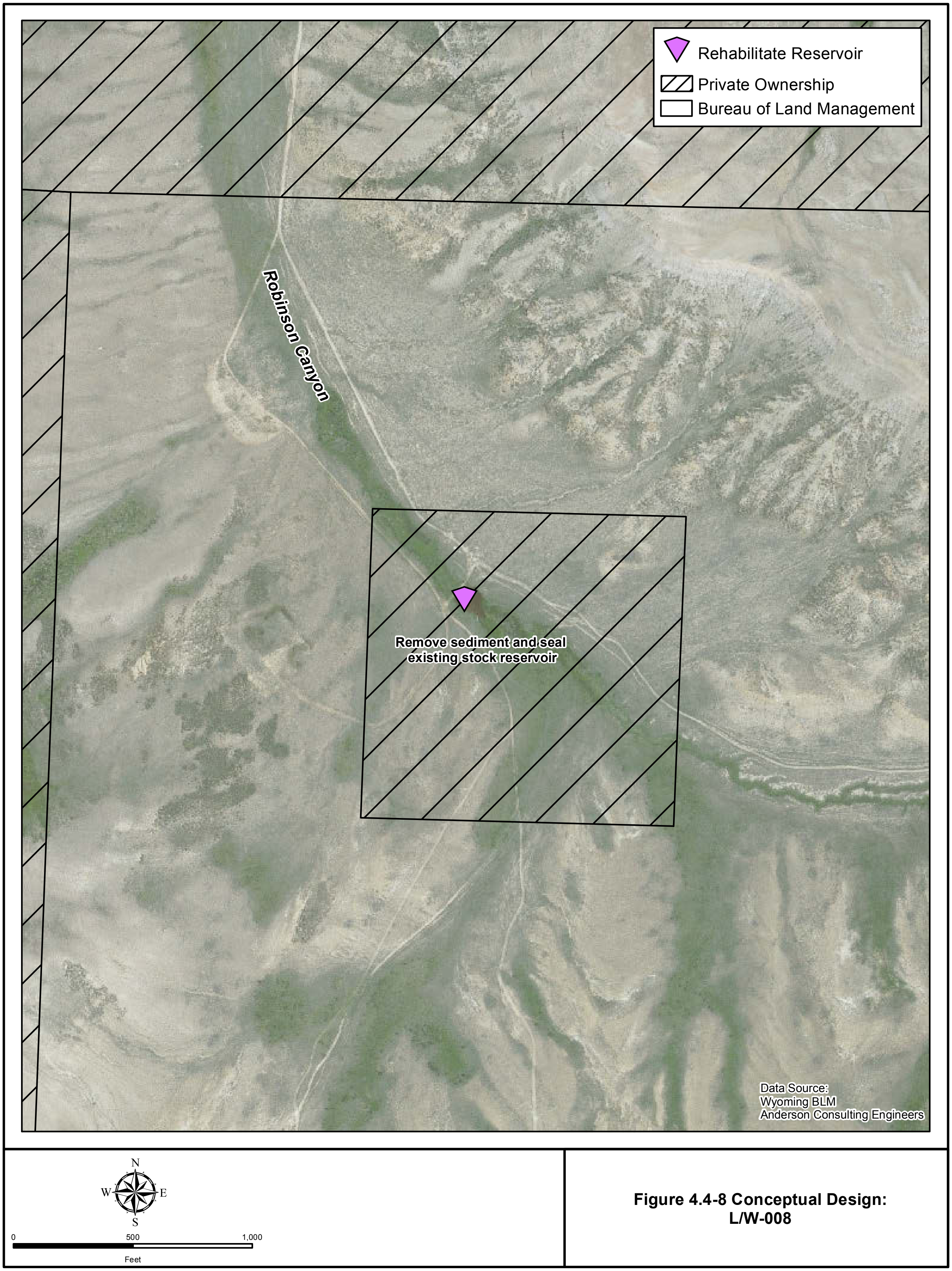


Figure 4.4-8 Conceptual Design: L/W-008

L/W-009: This alternative involves the improvement of an existing well located in Section 6, Township 19 North, Range 88 West. Figure 4.4-9 displays the conceptual design of the proposed project. Under this alternative, the following components would be employed:

- The existing well would be equipped with a solar platform consisting of solar panels, solar powered pump, batteries, and all requisite regulators, connections and housings.
- From the well, approximately 2,700 linear feet of 1 ½ inch low-pressure buried HDPE pipeline
- Install one 1,200 rubber tire stock tank

L/W-010: This alternative involves the improvement of an existing well located in Section 32, Township 20 North, Range 88 West Figure 4.4-10. Under this alternative, the following components would be employed:

- The existing well would be equipped with a solar platform consisting of solar panels, solar powered pump, batteries, and all requisite regulators, connections and housings.
- From the well, approximately 2,700 linear feet of 1 ½ inch low-pressure buried HDPE pipeline
- Install one 1,200 rubber tire stock tank

The project would involve both privately and federally owned lands.

4.4.5 L/W-011 through L/W-013

L/W-011: This proposed project would entail construction of a stock reservoir on Wood Draw in Section 13, Township 16 North, Range 83 West. The purpose of the reservoir is to provide a viable source of water for livestock and wildlife in an area where other sources are not available during much of the year. The stock reservoir is sited in close proximity to another proposed stock reservoir (L/W-012). Note that the project is located entirely on privately owned property (Figure 4.4-11).

L/W-012: This proposed project would entail construction of a stock reservoir on Wood Draw in Section 14, Township 16 North, Range 83 West. The purpose of the reservoir is to provide a viable source of water for livestock and wildlife in an area where other sources are not available during much of the year. The stock reservoir is sited in close proximity to another proposed stock reservoir (L/W-011). Note that the project is located entirely on privately owned property (Figure 4.4-11).

L/W-013: This proposed project would entail construction of a stock reservoir on Cottonwood Creek in Section 1, Township 16 North, Range 83 West. The purpose of the reservoir is to provide a viable source of water for livestock and wildlife in an area where other sources are not available during much of the year. Note that the project is located entirely on privately owned property (Figure 4.4-12).

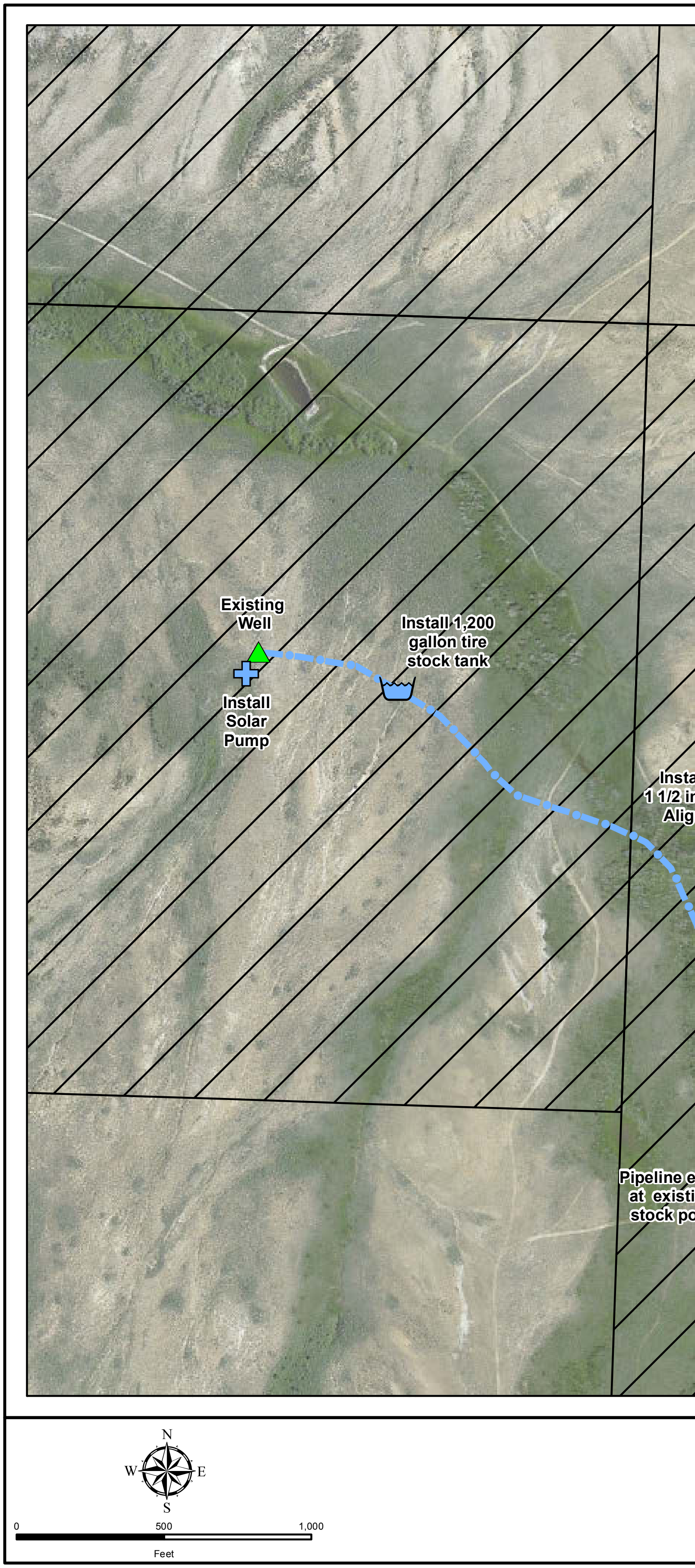


Figure 4.4-9 Conceptual Design: L/W-009

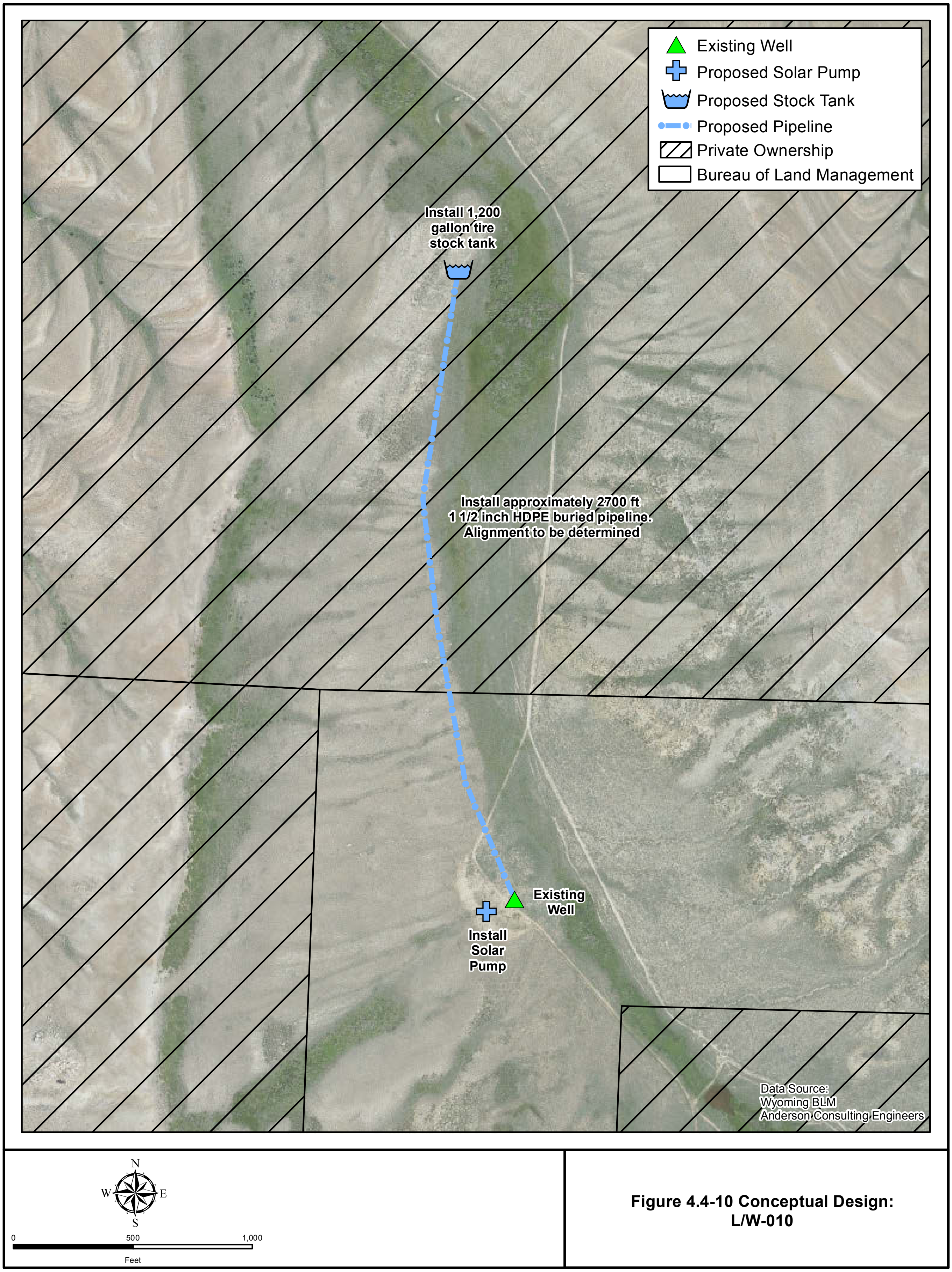


Figure 4.4-10 Conceptual Design: L/W-010

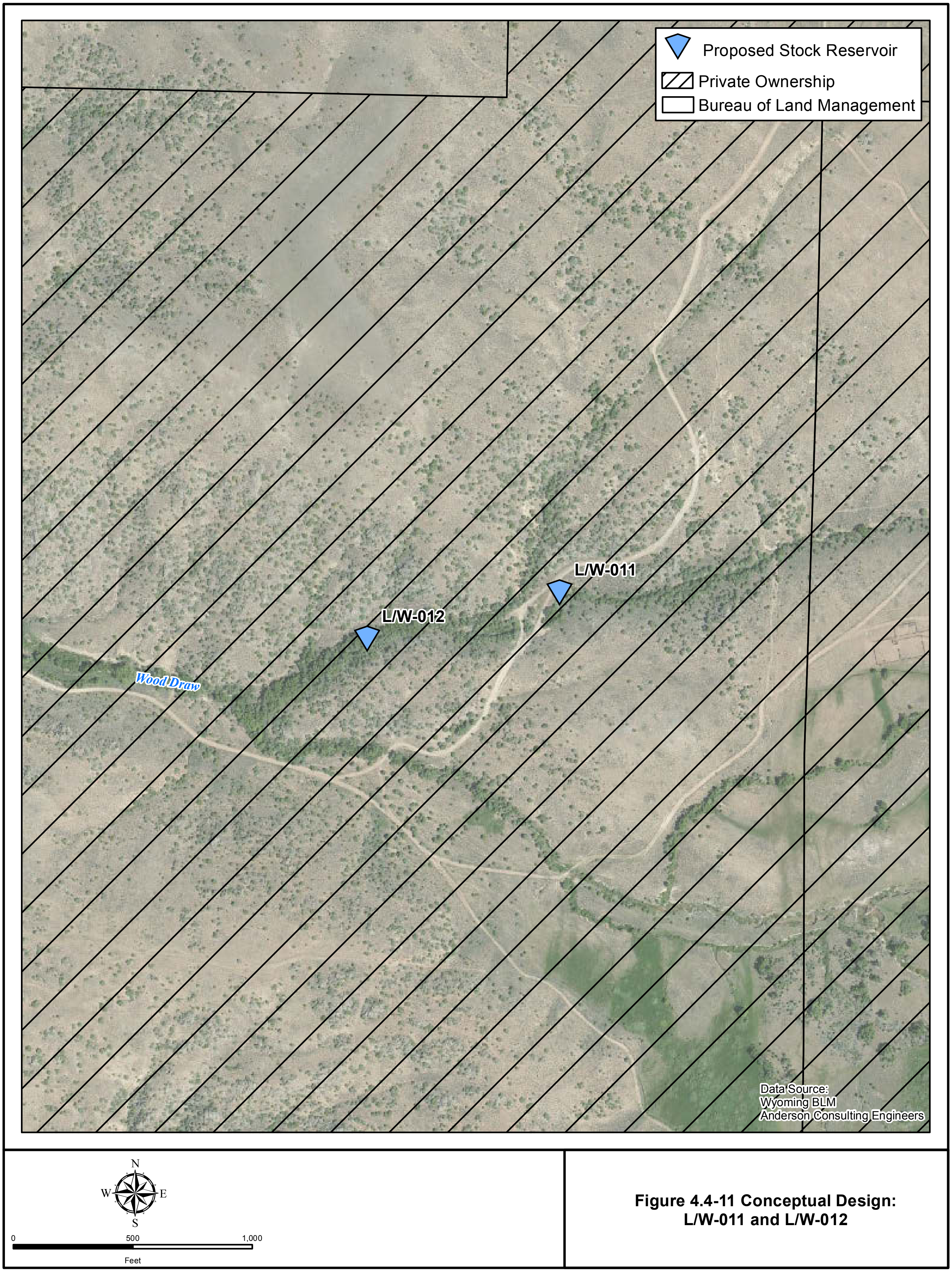


Figure 4.4-11 Conceptual Design: L/W-011 and L/W-012

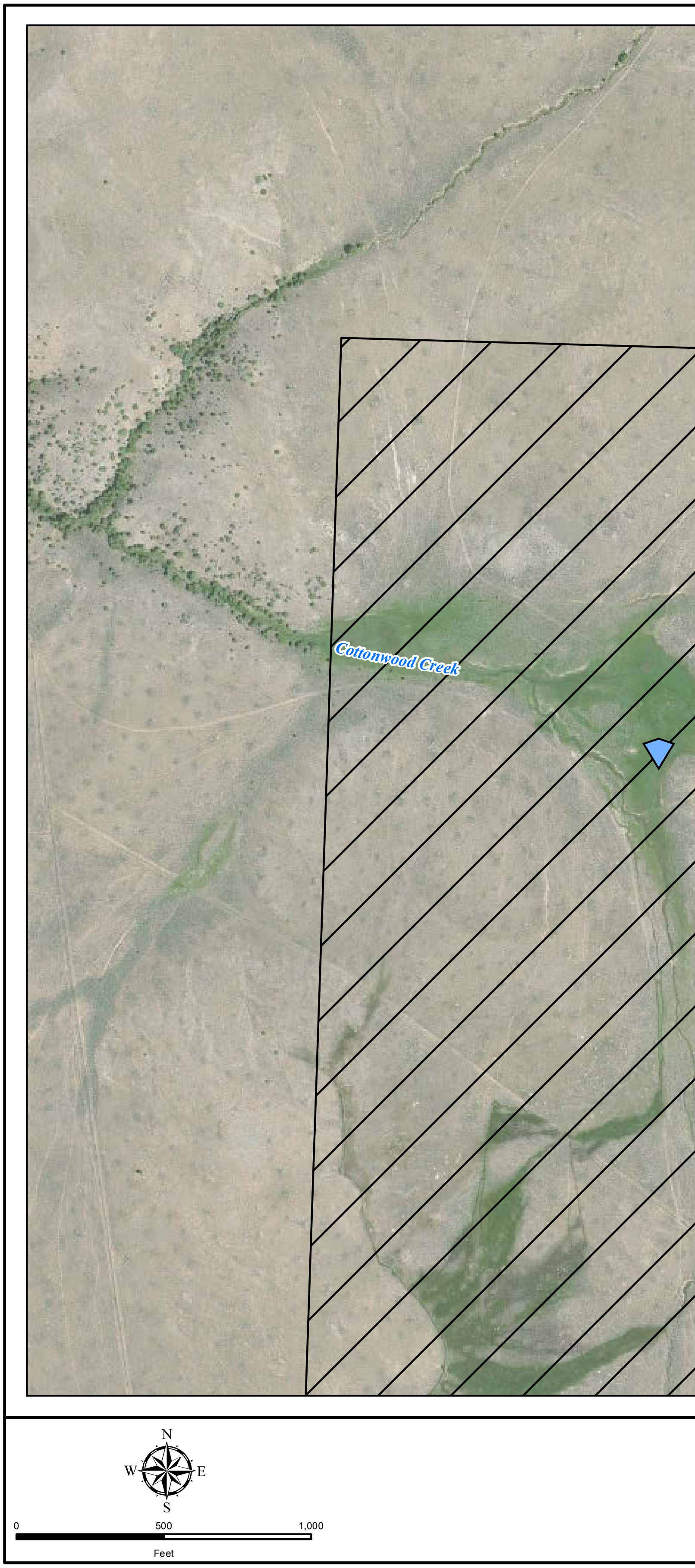


Figure 4.4-12 Conceptual Design: L/W-013

4.4.6 L/W-014

L/W-014: This alternative would involve the development of an existing spring in the Beaver Creek subwatershed in Section 4, Township 14 North, Range 82 West. The alternative would provide a reliable supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.4-13 displays the conceptual design of the proposed project.

It is our understanding that this project has been funded by the BLM and is slated for construction. Under this alternative, the following components would be employed:

- An existing spring would be developed NRCS spring development designs. A valve would be included for management of pipeline flows.
- Approximately 2,700 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be required. Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Two 1,200 gallon rubber tire stock tanks will be installed
- Wildlife egress ramps would be installed in the proposed stock tank.
- The spring vicinity would be fenced with approximately 500 linear feet of fencing to prevent damage from livestock and wildlife.

The proposed project is located entirely on federally owned lands managed by the Bureau of Land Management.

L/W-015: This alternative would involve the development of an existing spring in Section 34, Township 15 North, Range 82 West (Figure 4.4-14). The alternative would provide a reliable supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources.

Under this alternative, the following components would be employed:

- An existing spring would be developed using NRCS spring development designs. A valve would be included for management of pipeline flows.
- Approximately 300 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be required. Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- One 1,200 gallon rubber tire stock tank will be installed
- Wildlife egress ramps would be installed in the proposed stock tank.
- The spring vicinity would be fenced with approximately 500 linear feet of fencing to prevent damage from livestock and wildlife.

The proposed project is located entirely on privately owned lands.

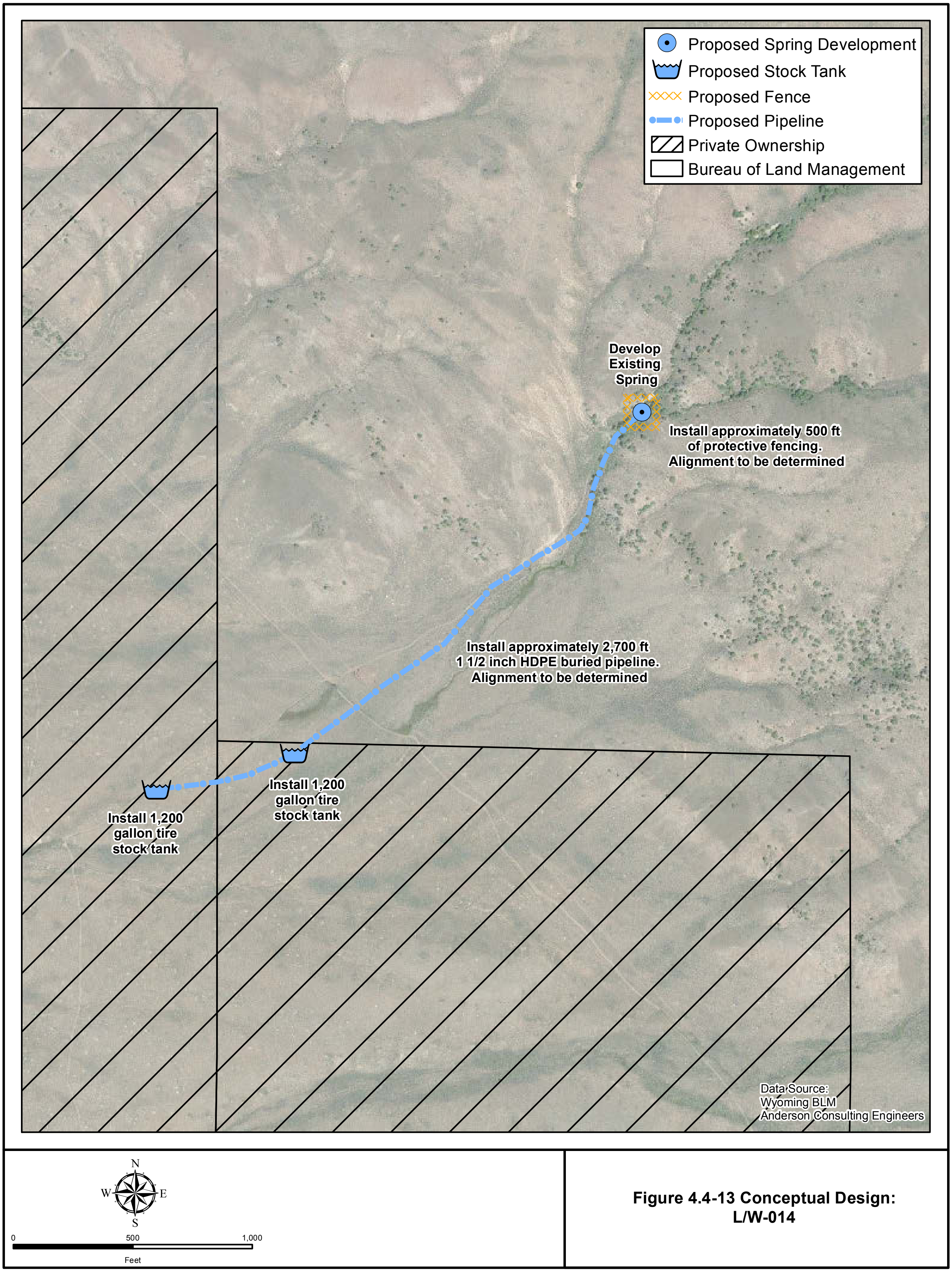


Figure 4.4-13 Conceptual Design: L/W-014

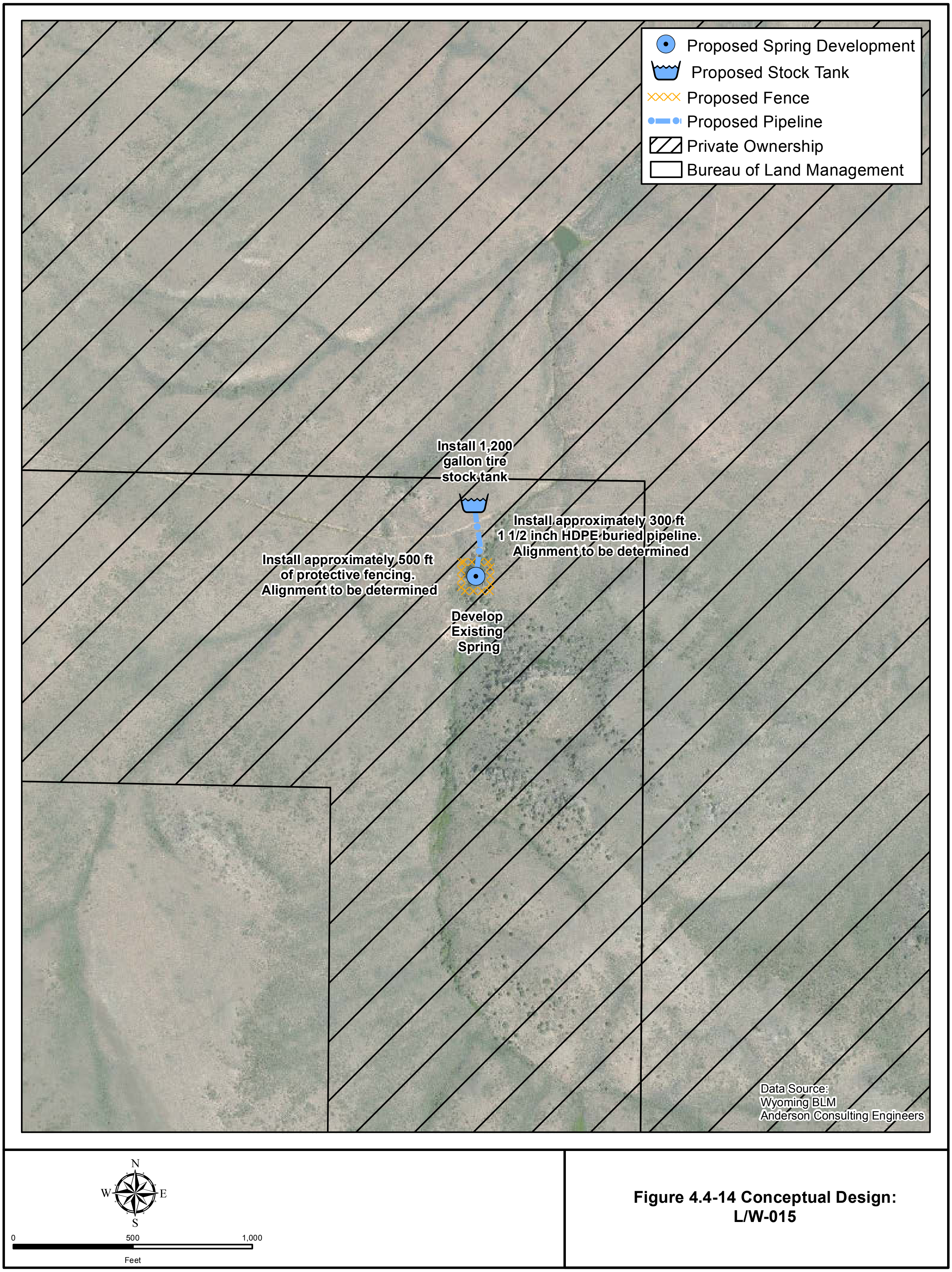


Figure 4.4-14 Conceptual Design: L/W-015

L/W-016: This alternative would involve the development of an existing spring in Section 13, Township 14 North, Range 82 West (Figure 4.4-15). The alternative would provide a reliable supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources.

Under this alternative, the following components would be employed:

- An existing spring would be developed using NRCS spring development designs. A valve would be included for management of pipeline flows.
- Approximately 2700 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be required. Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Two 1,200 gallon rubber tire stock tanks will be installed.
- Wildlife egress ramps would be installed in the proposed stock tank.
- The spring vicinity would be fenced with approximately 500 linear feet of fencing to prevent damage from livestock and wildlife.

The proposed project is located entirely on privately owned lands.

4.4.7 L/W-017

L/W-017: This alternative would involve the installation of a stock tank and a limited amount of buried pipeline in development of an existing spring in Section 32, Township 16 North, Range 82 West and Section 5, Township 15 North, Range 82 West (Figure 4.4-16). The alternative would provide additional supply water to livestock and wildlife.

Under this alternative, the following components would be employed:

- Approximately 230 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be required. Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- One 1,200 gallon rubber tire stock tank will be installed.
- Wildlife egress ramps would be installed in the proposed stock tank.

The proposed project is located entirely on privately owned lands.

4.4.8 L/W-018

This project would involve construction of a small stock reservoir, capable of supporting fish, on private property in Section 10, Township 16 North, Range 83 West (Figure 4.4-17). The purpose of the project is to provide a small body of water to provide a reliable source of water as an alternative to riparian

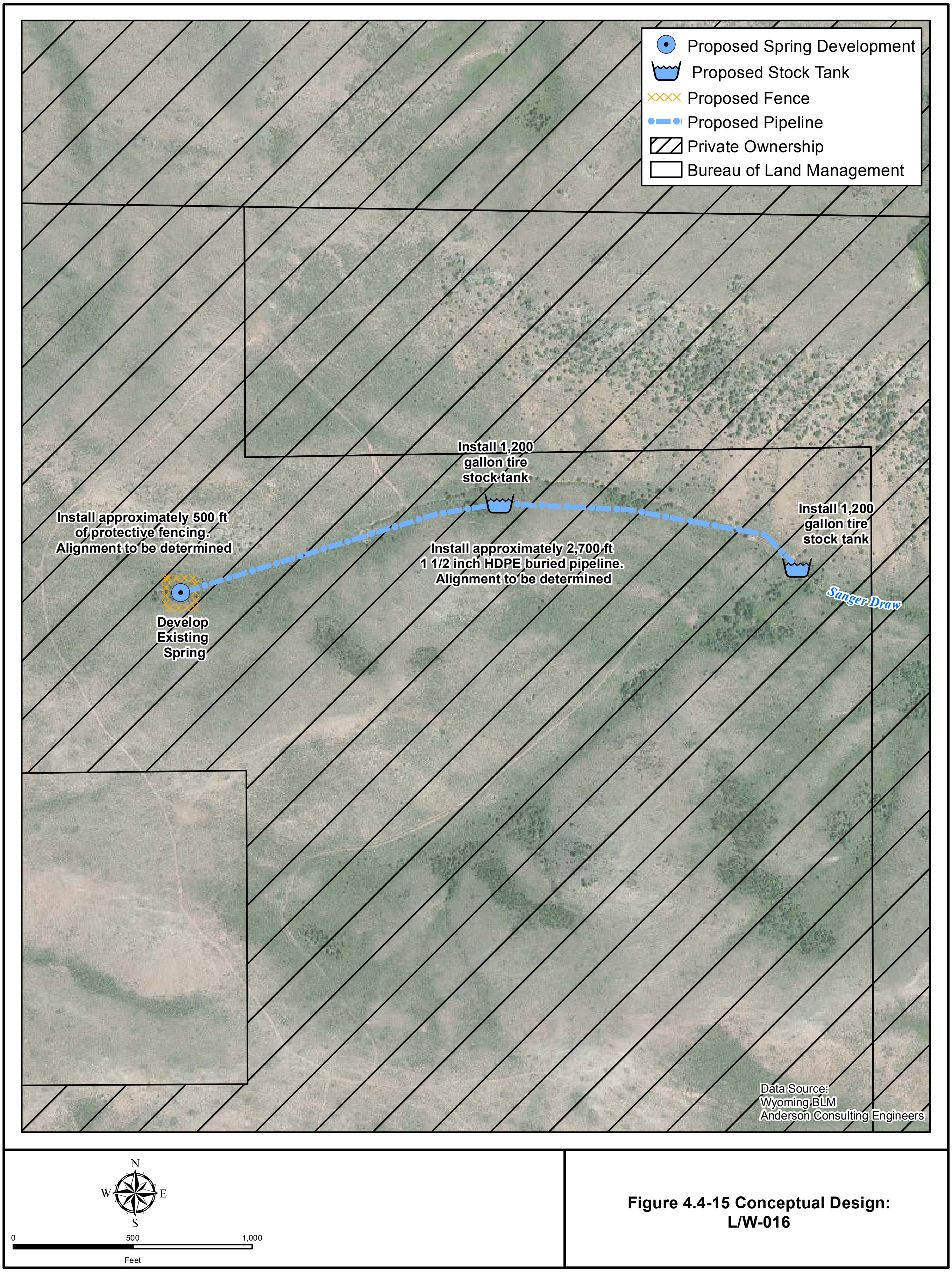


Figure 4.4-15 Conceptual Design: L/W-016

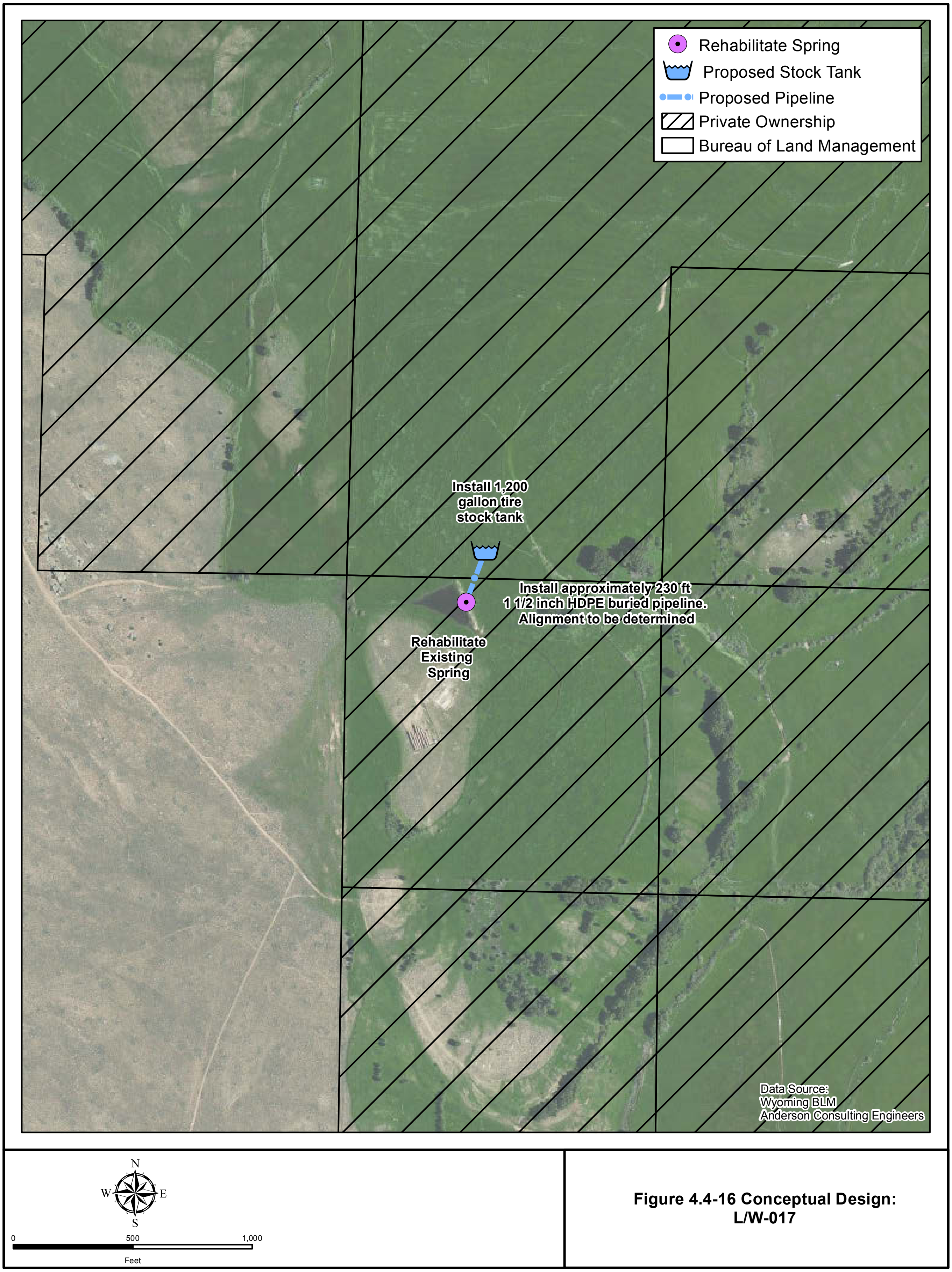


Figure 4.4-16 Conceptual Design: L/W-017

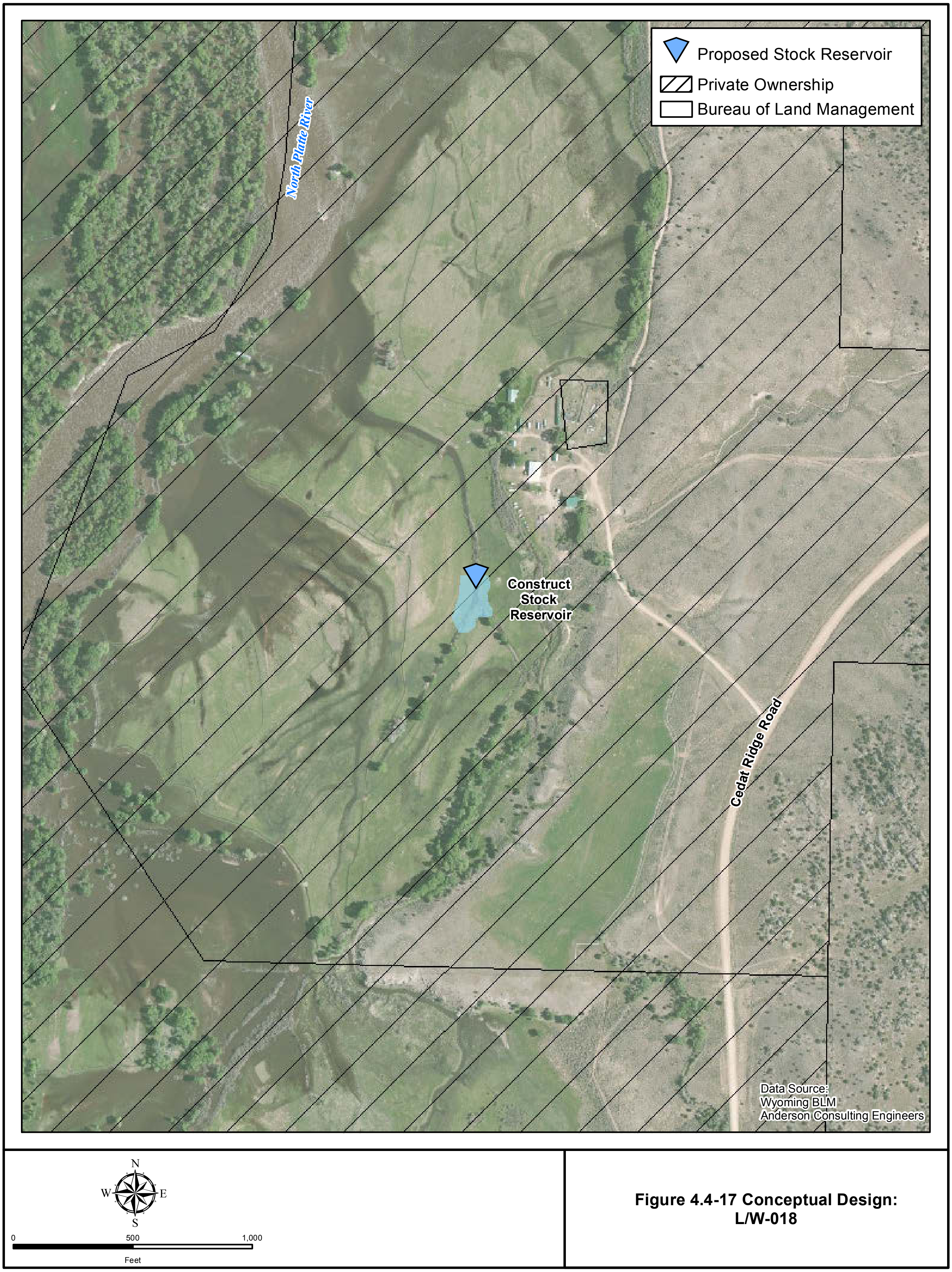


Figure 4.4-17 Conceptual Design: L/W-018

sources, for livestock and wildlife. The property owner also would like to configure the pond such that a year round fish population could be sustained. Given the topography of the site, pond construction would likely require the majority of its storage pool to be excavated behind a small embankment.

4.5 Grazing Management Opportunities (Watershed Management Plan Component G)

4.5.1 State and Transition Models

In Chapter 3, the ecological sites found within the watershed were presented and the concept of the ecological site description (ESD) was introduced. The ESD for a given ecological site contains a wealth of information pertaining to the site and its community. Within each ESD is a State and Transition model.

State and transition models describe the patterns, causes, and indicators of transitions between communities within an ecological site based upon the ecological site description (ESD). In a graphical form, they display information obtained from literature supplemented by the knowledge and experience of range scientists and managers. Basically, they display the response of a given ecological site to various range management practices or disturbances. They help to distinguish changes in vegetation and soils that are easily reversible versus changes that are subject to thresholds beyond which reversal is costly or unlikely. By being aware of the predicted response of a given ecological site to a treatment, the land manager can use this knowledge to best prescribe land management practices or treatments to direct the transition in a desirable direction. For instance, land management strategies can be prescribed which could result in restoration of the Historic Climax Plant Community (HCPC) under the right circumstances.

Based upon the assumptions presented in Chapter 3, the three dominant ecological sites found within the mapped portions of the Upper North Platte River Watershed study area are likely to be the following:

Based upon the mapping which is available, the ecological sites which are predominant are:

- Shallow Sandy (SwSy) 10-14" P.Z., High Plains Southeast
- Loamy (Ly) 10-14" P.Z., High Plains Southeast
- Shallow Loamy (SwLy) 10-14” Foothills and Basins West

It is important to note that other ecological sites will be encountered and that the list above is provided as an initial point for prescription of grazing practices. Prior to prescription of a grazing management plan, local site-specific conditions must be considered and the appropriate ESD determined.

4.5.1.1 Shallow Sandy (SwSy) 10-14" P.Z., High Plains Southeast

A prevalent ecological site in the basin is the shallow sandy 10-14 inch precipitation zone, Southeast Site. Figure 4.5-1 displays the State and Transition Model for the site. The following description of the ecological site's HCPC and transitions to and from it was extracted from the NRCS ESD for the site:

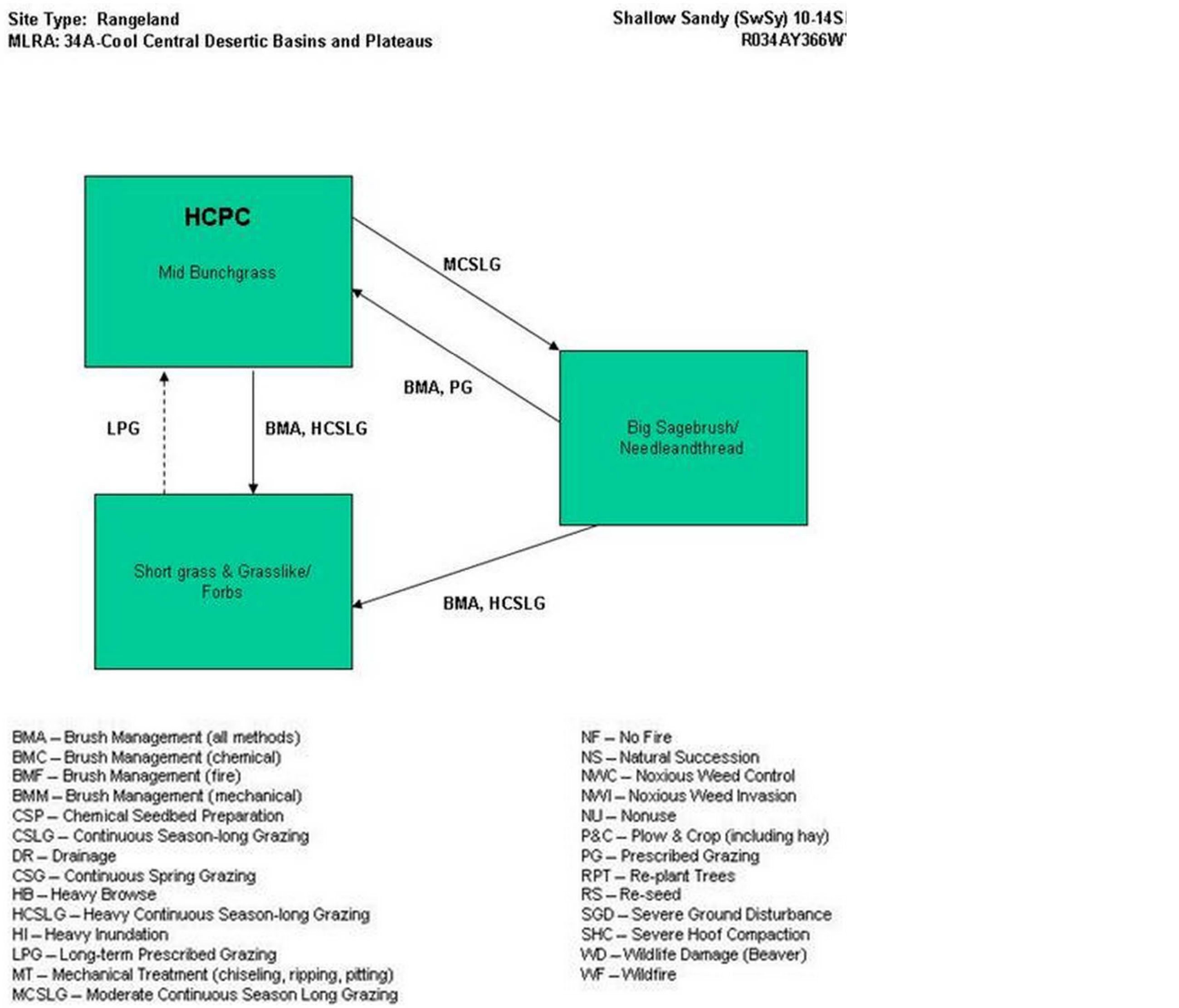


Figure 4.5-1 State and Transition Model: Shallow Sandy (SwSy) 10-14" P.Z., High Plains Southeast.

"The interpretive plant community for this site is the Historic Climax Plant Community. Potential vegetation is about 75% grasses or grass-like plants, 10% forbs, and 15% woody plants.

The major grasses include needleandthread, Indian ricegrass, and bluebunch wheatgrass. Other grasses and grasslikes include thickspike wheatgrass, Sandberg and mutton bluegrass, prairie junegrass, *bottlebrush squirreltail, plains reedgrass, and threadleaf sedge. Wyoming big sagebrush and green rabbitbrush are the major woody plants.*

A typical plant composition for this state consists of bluebunch wheatgrass 15-25%, Indian ricegrass 10-20%, needleandthread 10-30%, other grasses and grass-like plants 10-25%, perennial forbs 5-10%, and shrubs 5-15% Ground cover, by ocular estimate, varies from 15-25%.

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 1200 lbs./acre in above average years.

The state is stable and well adapted to the Cool Central Desertic Basins and Plateaus 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:

• Moderate Continuous Season Long Grazing will convert this plant community to the Big Sagebrush/Needleandthread Plant Community.
• Brush Management followed by Heavy Continuous Season-long Grazing will convert this plant community to the Short Grass & Grasslike/Forbs plant community."

4.5.1.2 Loamy (Ly) 10-14" P.Z., High Plains Southeast

A second prevalent ecological site within the watershed is the loamy 10-14 inch High Plains Southeast site. Figure 4.5-2 displays the state and transition model for this site. The following description of the ecological site was extracted from the NRCS ESD for the site"

"The interpretive plant community for this site is the Historic Climax Plant Community. Potential vegetation is estimated at 80% grasses or grass-like plants, 10% forbs and 10% woody plants. The major grasses include rhizomatous wheatgrass, needle and thread, bluebunch wheatgrass, and green needlegrass. Big sagebrush and rubber rabbitbrush are the major woody plants.

A typical plant composition for this state consists of rhizomatous wheatgrass 30-40%, needle and thread 10-20%, bluebunch wheatgrass 5-15%, green needlegrass 5-10%, muttongrass 5-10%, perennial forbs 5-10%,and big sagebrush 5-15%. Ground cover, by ocular estimate, varies from 30-40%.

The total annual production (air-dry weight) of this state is about 1100 pounds per acre, but it can range from about 600lbs./acre in unfavorable years to about 1400 lbs./acre in above average years.

This state is extremely stable and well adapted to the Cool Central Desertic Basins and Plateaus climate. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

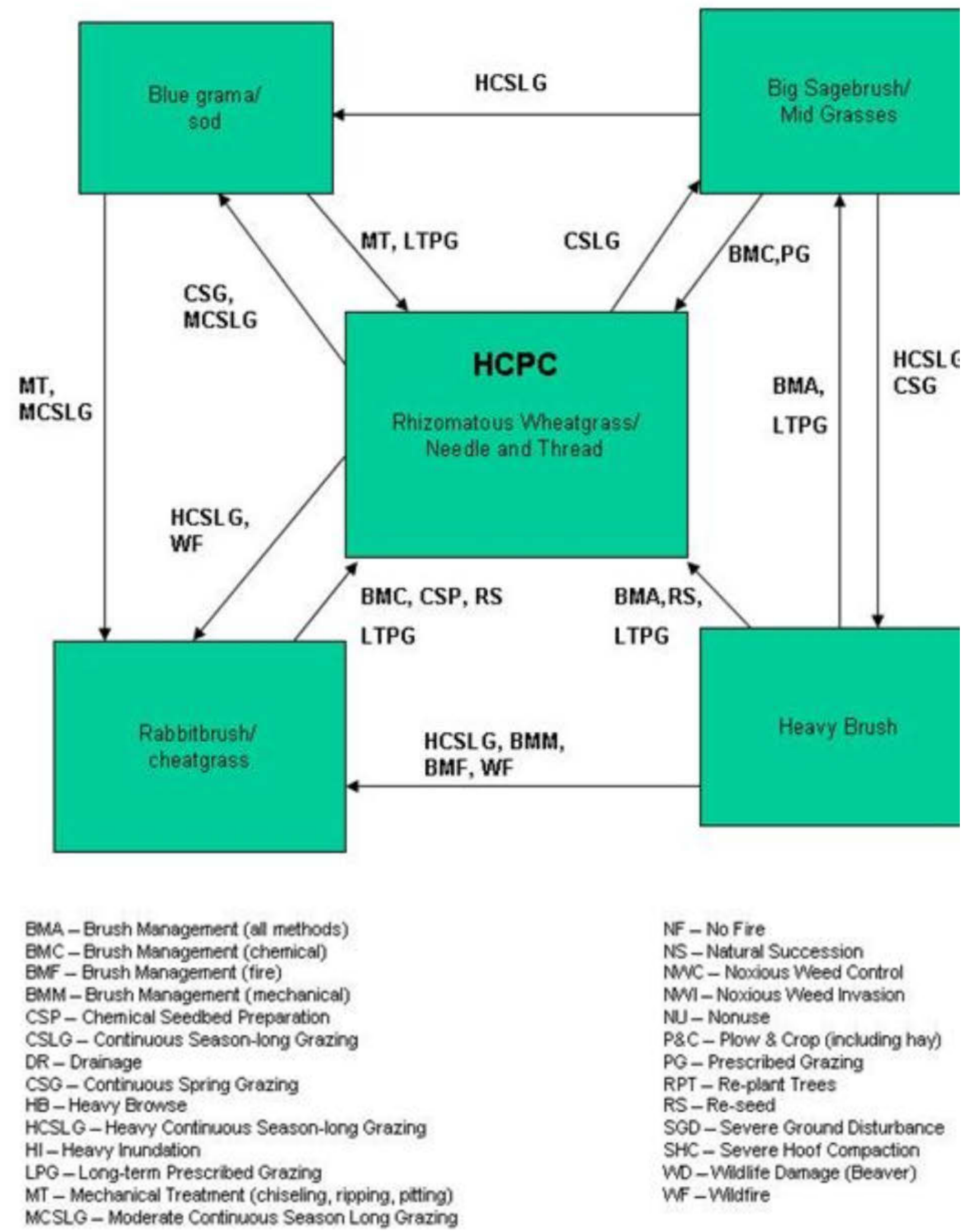


Figure 4.5-2 State and Transition Model: Loamy (Ly) 10-14" P.Z., High Plains Southeast.

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

• Continuous Season-long Grazing will convert the plant community to the Big Sagebrush/Mid Grass Plant Community if big sagebrush is present at 5-10%.

• Moderate Continuous Season-long Grazing or Continuous Spring Grazing will convert the plant community to the Blue Grama Sod Plant Community

• Heavy Continuous Season Long Grazing with Wild Fire will convert this plant community to the Rabbitbrush/Cheatgrass plant community."

4.5.1.3 Shallow Loamy (SwLy) 10-14" Foothills and Basins West

A third prevalent ecological site within the watershed is the shallow loamy 10-14 inch Foothills and Basins West site. Figure 4.5-3 displays the state and transition model for this site. The following description of the ecological site was extracted from the NRCS ESD for the site".

The interpretive plant community for this site is the Historic Climax Plant Community. Potential vegetation is about 75% grasses or grass-like plants, 10% forbs, and 15% woody plants. The major grasses include bluebunch wheatgrass, rhizomatous wheatgrass, Indian ricegrass, needleandthread, and bottlebrush squirreltail. Other grasses include Canby, mutton, and Sandberg bluegrass, Letterman needlegrass, needleleaf sedge, plains reedgrass, and prairie junegrass. Big sagebrush is the major woody plant. Other woody plants include green rabbitbrush and winterfat.

A typical plant composition for this state consists of bluebunch wheatgrass 10-25%, rhizomatous wheatgrass 10-25%, needleandthread 5-15%, Indian ricegrass 5-15%, bottlebrush squirreltail 5-10%, other grasses and grass-like plants 10-20%, perennial forbs 5-10%, Wyoming big sagebrush 5-10%, and 5-10% other woody species. Ground cover, by ocular estimate, varies greatly depending on the amount of exposed parent material, and herbage cover ranges from 15-30%
.
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 1200 lbs./acre in above average years. The state is extremely stable and well adapted to the Cool Central Desertic Basins and Plateaus 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:

• Wildfire or Severe Ground Disturbance followed by Heavy Continuous Season-long Grazing will convert this plant community to the Big Sagebrush/Cheatgrass State.

• Heavy Continuous Season-long Grazing will convert this plant community to the Big Sagebrush/Rhizomatous Wheatgrass State.

Watershed Plan Component G-1: Water developments can be used to expand grazing distribution to areas that do not currently have reliable water. Riparian area plant community condition can be enhanced by development of water into upland areas.

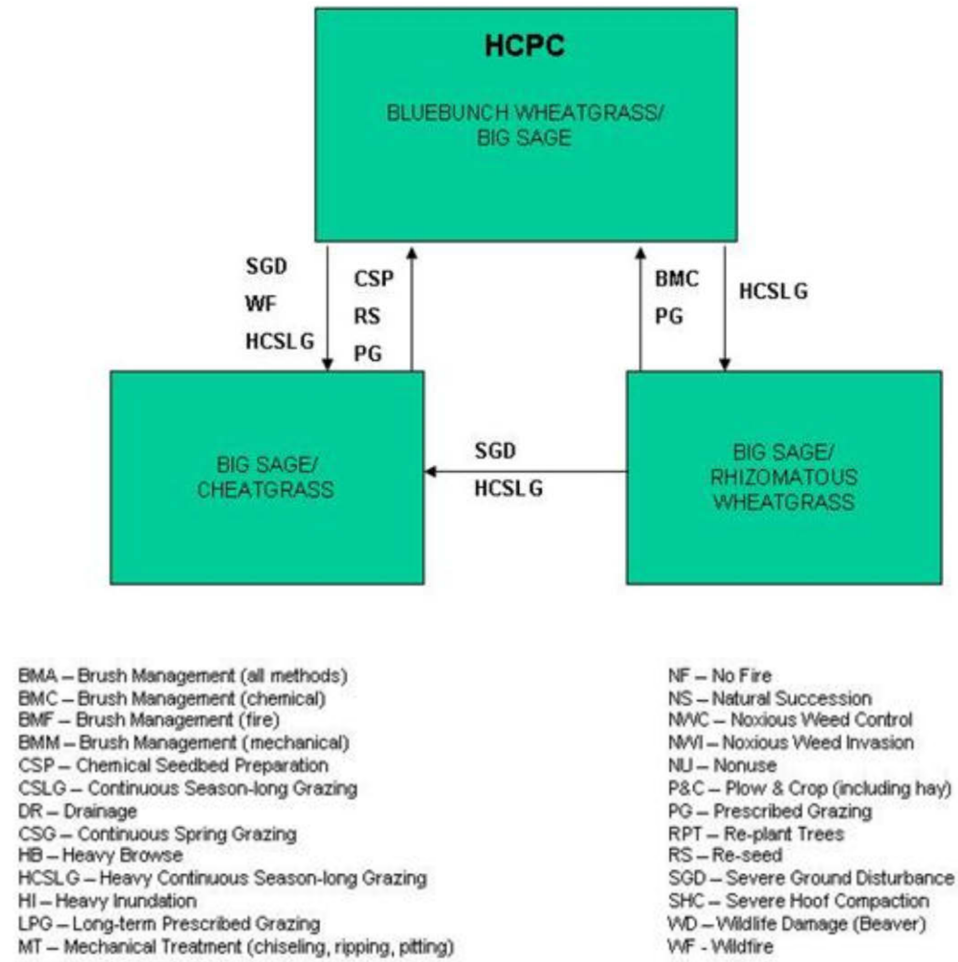


Figure 4.5-3 State and Transition Model: Shallow Loamy (SwLy) 10-14" Foothills and Basins West.

Watershed Plan Component G-2: Fencing can be used to enhance grazing management options and to facilitate the planned grazing system.

Watershed Plan Component G-3: Strategic salting and herding are other tools that can be used to enhance grazing distribution.

Watershed Plan Component G-4: Most range improvement practices which improve watershed condition, may also improve wildlife habitat. Wildlife needs should be considered when installing practices such as wildlife friendly fences, wildlife escape ramps from tanks, and wildlife watering facilities.

Watershed Plan Component G-5: Strategies recommended in the state and transition models associated with NRCS descriptions of the ecological sites found within the watershed should be adopted and employed to optimize range conditions through prescribed grazing management and best management practices.

Watershed Plan Component G-6: Prescribed fire may be utilized as a tool to assist in the restoration of range health areas benefitting by this treatment according to the state and transition models. Delineation of specific areas potentially benefitting from this practice was beyond the scope of this Level I project. However, based upon input from landowners and land managers and observations made during the completion of this investigation, it is evident that there are areas which would likely benefit from prescribed fires.

Watershed Plan Component G-7: Application of chemicals may be utilized as a tool to assist in the restoration of range health areas benefitting by this treatment according to the state and transition models. Delineation of specific areas potentially benefitting from this practice was beyond the scope of this Level I project.

These tools can be used to maintain and/or improve watershed function particularly when coupled with implementation of appropriate grazing management strategies.

4.6 Water Storage Opportunities

Construction of new water storage facilities greater than 20 acre feet in size, within the study area must be viewed within the constraints and limitations of Wyoming Water Law and doctrines regarding court settlement with the State of Nebraska. Development of new storage facilities is not prohibited within these constraints, however, they are heavily restricted. Appendix 4B contains a memo prepared to provide a brief summary of the permitting requirements for reservoirs greater than 20 acre feet.

STO-001 Beaver Lake Reservoir

This project alternative involves the construction of a medium sized reservoir in Section 24, Township 14 North, Range 85 West on Beaver Creek, a tributary to the Encampment River. The project was originally conceived in the early 1900's according to records of the WSEO. Initial permit applications by the Town of Encampment were ultimately cancelled due to lack of completion. Through the 1950's subsequent permit applications were submitted, approved, and also ultimately cancelled. Figure 4.6-1 displays the project location and the conceptual layout of the reservoir as presented in the cancelled water rights permit documents.

As initially conceived, the earthen embankment would be approximately 31 feet high and be built using approximately 20,000 cubic yards of material. The reservoir would cover approximately 37 acres and would provide approximately 300 acre-feet of storage for municipal use.

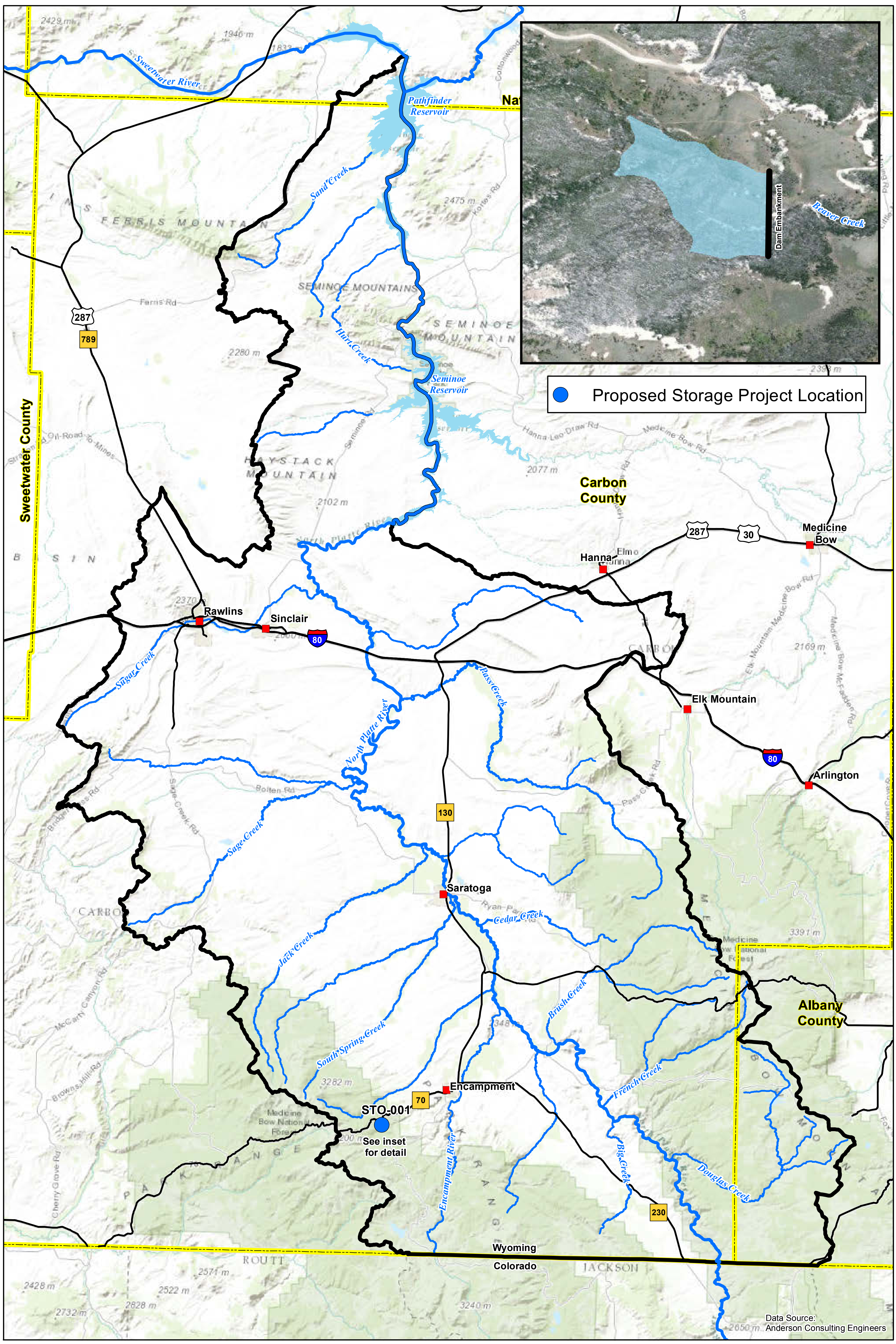


Figure 4.6-1 Upper North Platte River Watershed: Proposed Storage Project Location (STO-001)

Although the level of interest in this reservoir was not perceived as high at project meetings and during interaction with the public, it is included in the watershed management plan as a potential source of domestic water for the Town of Encampment.

4.7 Stream Channel Condition and Stability

The general condition of the principal stream channels and primary tributaries were evaluated during the geomorphic investigation which included:

- classification of approximately 759 miles of stream channel within the GIS environment,
- review of BLM Proper Functioning Condition assessments,
- field reconnaissance,

These efforts and their results are presented in Chapter 3. During the evaluation of existing channel conditions, several impaired reaches were identified and three general classes of impairments noted. The general categories of impairments were classified as indicated below:

- channel degradation/incision,
- bank erosion associated with channel migration and/or widening, and
- loss or reduction of riparian vegetation.

4.7.1 Stream Channel Rehabilitation Components

With respect to overall stream stabilization efforts, the SERCD is currently involved with several on-going restoration projection projects of varying magnitude and extent. As discussed in Chapter 3, the SERCD and the Town of Saratoga are in the process of investigating and design of a rehabilitation project of the North Platte River through the town. In addition, an investigation is being completed to stabilize the Encampment River in the reach extending downstream from the recently reconstructed Grand Valley Ditch diversion.

The scope of this Level I investigation preclude an in-depth evaluation of stream channel conditions. Locations where stability issues exist were documented largely through project workshops and word of mouth. Consequently, only a limited number of specific locations where stream channel or bank stabilization projects may be beneficial were noted. Given the magnitude of the extent of the study area, the complexity of the stream system, and the variety of land uses encompassed within it, there are certainly additional locations where further investigation may be warranted. The two specific projects recommended in this watershed management plan, however, serve as examples of the types of local projects which could be completed and provide benefit to landowners and watershed health (Figure 4.7-1).

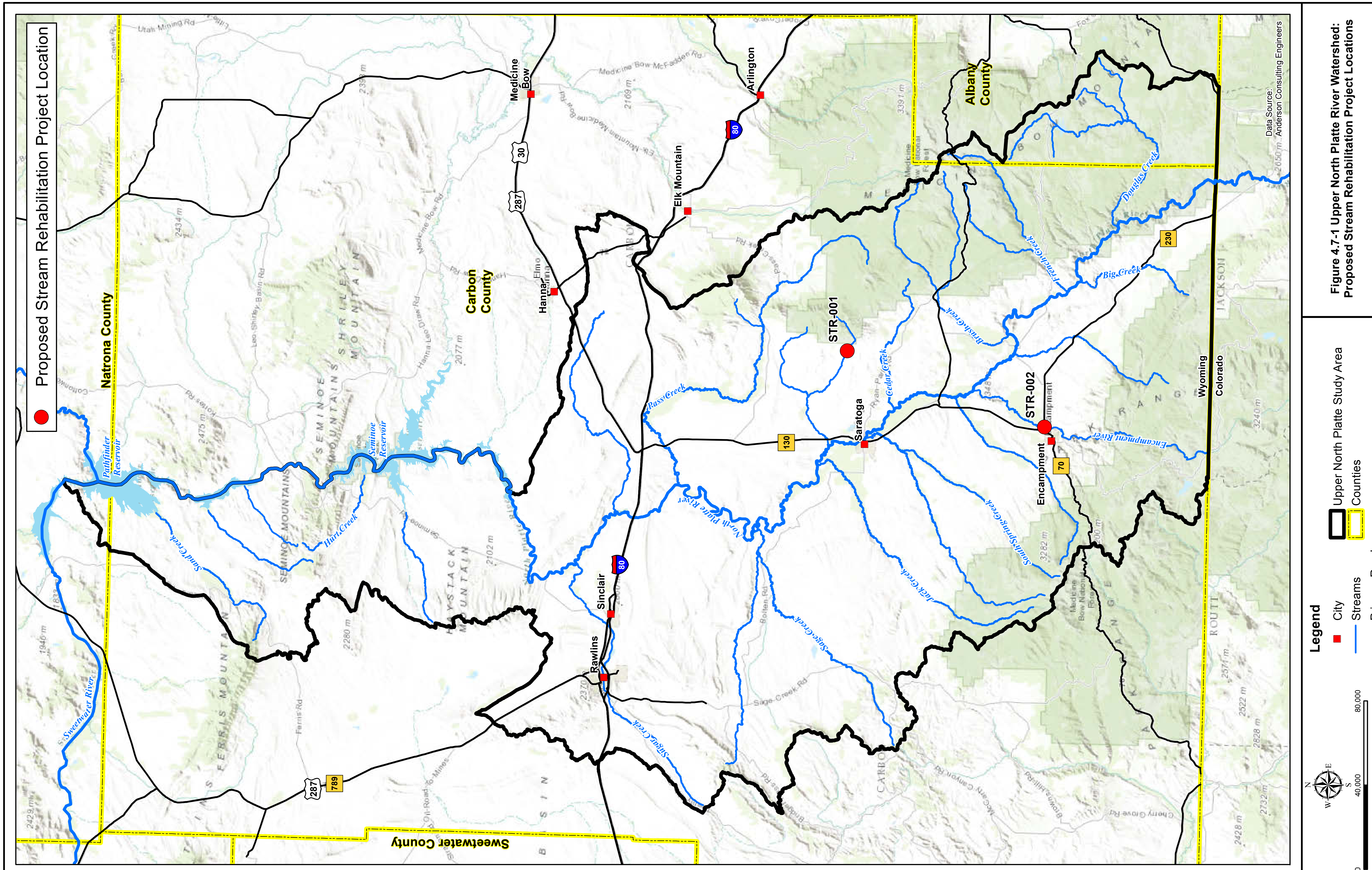


Figure 4.7-1 Upper North Platte River Watershed: Proposed Stream Rehabilitation Project Locations

STR-001 Cumberland Gulch Headcut stabilization: A large and active headcut, approximately 8 to 10-ft high is located on the South Fork Lake Creek (Figure 4.7-2). At this location, a sheet-pile type grade control structure is recommended due to the magnitude of the headcut and the slope of the channel which would likely preclude alternative designs.

Figure 4.7-2 Headcut on Cumberland Gulch at Pennock Ranch.

STR-002 Encampment River at Highway 230
The Encampment River downstream of the Grand Valley Ditch diversion is currently being evaluated on behalf of the SERCD to determine the stabilization needs for the reach. Concern has been expressed regarding longevity of irrigation diversions downstream which could be threatened if bank erosion were to continue.

In the reach immediately downstream of Highway 230, landowners have completed a stabilization project to protect a privately owned campground. Their effort consisted of incorporation of several large wooden barbs and construction of a wooden retaining wall backfilled with gravel (Figure 4.7-3). Figure 4.7-4 displays an aerial photograph of the area taken during high flows on June 8, 2011 showing flooding of the property. It is also important to note the presence of the irrigation diversion located approximately 750 feet downstream. Continued bank erosion at the proposed project location could exacerbate channel stability issues downstream in the vicinity of the irrigation diversion.

According to the landowner, the USACE has requested the stabilization structures be removed and replaced, presumably with a more permanent stabilization method. At this time, a more detailed evaluation of streambank stabilization methods and coordination with the USACE is highly recommended. Stabilization of this reach in conjunction with existing SERCD efforts associated with the larger reach extending from the Grand Valley Ditch could minimize streambank erosion and provide flood protection for the land owners and their private business enterprise.

Figure 4.7-3 Encampment River Bank Stabilization Downstream of Highway 230.

4.7.2 Stabilization Strategies

Various approaches can be taken during channel restoration and stabilization efforts, including both "hard" engineering and "soft" approaches and combinations of the two. Examples of "hard" approaches would include construction of channel structures or reconstruction of channels themselves. The selection of the appropriate mitigation/ restoration technique depends upon site-specific information and critical review of hydrologic and hydraulic data. Installation of an inappropriate type of structure or improper installation could exacerbate conditions.

Figure 4.7-4 Encampment River at high stage showing flooding of adjacent property.

For instance, methods of restoring incised channels may include construction of gradient restoration facilities (i.e., drop structures, check structures) within the incised channel. Figure 4.7-5 displays a diagram of a typical stream channel stabilization strategy for a small channel experiencing minor downcutting or bank erosion. A vortex weir can be placed within a problematic reach to serve as a grade control structure as well as directing and centralizing streamflow. Weir configuration can be varied to provide additional functions such as facilitating irrigation diversions. Figure 4.7-6 displays a photograph of a typical installation.

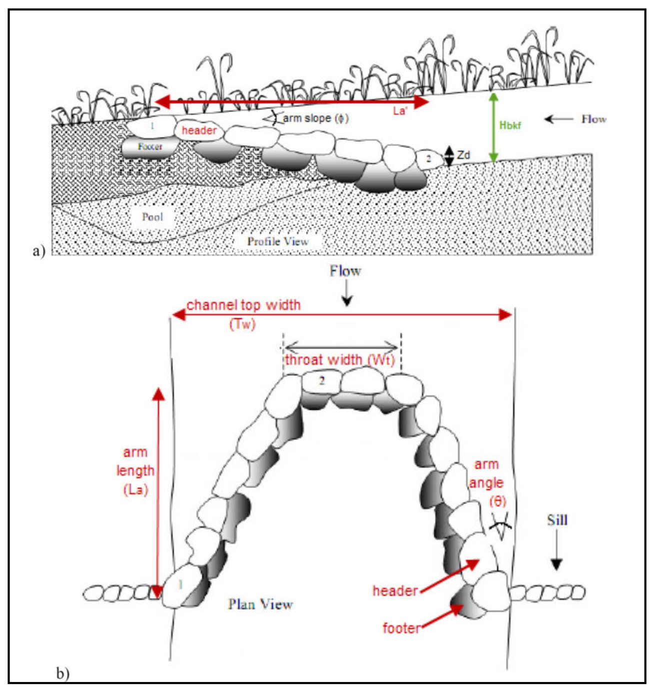


Figure 4.7-5 Rock Vortex Weir Structure Diagram (Adapted from Rosgen, 2006).

Re-establishment of pre-incision channel elevations can be accomplished by means of check dams. Figure 4.7-7 displays a photo of a large-scale check dam on Muddy Creek in the Little Snake River watershed near Baggs, Wyoming. This structure serves as a good example of how gradient restoration strategies can be utilized to restore diversion capabilities at irrigation headgates rendered inoperable by changes in channel configuration.

Figure 4.7-6 Stream Stabilization Structure: Rock Vortex Weir.

Figure 4.7-7 Channel Gradient Restoration Feature on Muddy Creek near Baggs, WY. Photo on left is viewed downstream from the dam at incised channel. Photo on the right is viewed upstream at restored gradient.

Examples of "soft" approaches include a variety of Best Management Practices (BMPs). Examples of potentially applicable BMPs designed for channel restoration activities include those that result in reducing or, at least temporarily excluding wildlife and livestock from accessing designated riparian zones, establishment of riparian buffers, etc. The proposed wildlife/livestock water developments discussed previously (and others that may be identified in the future) can be considered elements of a range management BMP that will help restore over time those areas of channel impairment that have resulted from overutilization of riparian areas or adjacent upland range. Figure 4.7-8 displays a photo of willow fascine installation. This strategy could be employed on many of the perennial channels or intermittent where sufficient flow exists to support the vegetation, in an effort to restore riparian habitat and stabilize streambanks.

These examples of "hard" and "soft" approaches represent both extremes of the continuum of channel restoration strategies that exist. In practice, it must be kept in mind that it is generally a combination of strategies, integrated into a cohesive plan that provides the most effective solution. Table 4.7-1 presents a summary of some of these channel restoration strategies which can be employed during future restoration efforts. Development of more specific projects and BMPs was beyond the scope of this Level I study. Such projects can be identified and developed on the basis of more detailed geomorphic analysis of impaired stream reaches.

Figure 4.7-8 Stream Stabilization Measure: Willow Fascine Installation.

As would be recommended with any similar project, monitoring of the success of the project(s) is highly recommended. At a minimum, monitoring should include visual inspection of rehabilitation features to determine the effectiveness and ability of the rehabilitation to withstand high flow events. Evidence of existing or induced erosion, movement of rehabilitation features (rock, root wads, etc.), sedimentation, vegetation establishment, etc. should be noted. In addition, long term monitoring of rehabilitation sites should include:

- Photographic documentation
- Cross sections
- Longitudinal profiles
- Bank surveys
- Bank erosion pins
- Scour chains
- Pebble counts

Several stream reaches were identified which would benefit from site-specific stream restoration strategies. These stream segments were either classified as F-type channels in the stream channel characterization phase of the project (see Chapter 3) or were brought to the attention of the project team during completion of field investigations or project meetings. The bulk of the channels identified as entrenched lie in the lower (northern) portions of the study area. This list is not intended to be all-inclusive; additional impaired streams are certain to exist. It is understood that there will be stream segments throughout the watershed that could benefit from stream restoration activities.

- Sugar Creek
- Sage Creek
- Corral Creek
- Sand Creek
- Saint Mary’s Creek

Table 4.7-1 Summary of Potential Stream Channel Stabilization/Restoration Techniques.

Flow-Redirection Techniques	Biotechnical Techniques
Vanes	Woody Plantings
Groins	Herbaceous Cover
Buried Groins	Soil Reinforcement
Barbs	Coir Logs
Engineered Log Jams	Bank Reshaping
Drop Structures	**Internal Bank-Drainage Techniques**
Porous Weirs	Subsurface Drainage Systems
Structural Techniques	**Avulsion-Prevention Techniques**
Anchor Points	Floodplain Roughness
Roughness Trees	Floodplain Grade Control
Riprap	Floodplain Flow Spreaders
Log Toes	**Other Techniques**
Roughened-Rock Toes	Channel Modifications
Log Cribwalls	Riparian-Buffer Management
Manufactured Retention Systems	Spawning-Habitat Restoration
	Fish Ladders/bypass structures
	Fish Screens/entrainment prevention

4.8 Other Upland Management Opportunities (Watershed Management Plan Component O)

4.8.1 Noxious Weed and Undesirable Plant Control

The Carbon County Weed and Pest District implements aggressive, well planned, and cost-effective treatment and control measures for noxious and other weeds as available staffing and funding allow. The Districts have been successful in enlisting broadly based participation in various control programs, work days and workshops. The most effective overall strategy going forward would appear to be to assist the Districts in applying for additional grant funding, participate with in-kind efforts on work days and attend/support workshops and planning sessions.

4.9 Watershed Improvement Projects

The information presented in this chapter provides recommendations for improvements associated with:

- Irrigation system rehabilitation components
- Livestock / wildlife upland watering opportunities
- Grazing management opportunities
- Storage opportunities
- Stream channel stability components
- Other watershed management plan alternatives

These improvements focus on potential mitigation of several key issues that presently exist within the watershed. For the Upper North Platte River watershed, the watershed management plan consists of a compilation of the recommendations for each category. The plan is summarized in Table 4.9-1.

In an effort to assist the SERCD and the WWDC with their future planning effort, the projects were assigned priorities consistent with those of the WWDC. According to the WWDC's recently revised operating guidelines, project priorities are as follows:

1. Source water development
2. Storage
3. Pipelines, conveyance facilities, solar platforms and windmills
4. Irrigation
5. Environmental

In addition, projects that have completed permitting requirements, certified designs, agency notifications, land procurement and finalized other financial agreements (in other words, "shovel ready" projects) may be considered as a funding priority at the discretion of the WWDC.

4.10 Potential Effects and Benefits of Upper North Platte Watershed Management Plan Components

In the following sections, the potential effects and benefits associated with key BMPs and conservation practices are discussed in relation to the various plan components: Livestock/Wildlife water supply (Components LW), irrigation system rehabilitation (Components I), and storage (Components S). The intent of this discussion is to provide the decision makers with the background necessary to make informed decisions regarding future planning efforts.

Table 4.9-1 Upper North Platte River Watershed Management Plan.

Watershed Plan Component: Irrigation Rehabilitation Projects (IRR)					
Watershed Management Plan Component	Project Type	Longitude	Latitude	Section, Township, Range	Priority
IRR-001	New Structure Construction	-106.6209760	41.3484970	S. 16 ,T. 16 N., R. 82 W.	4
IRR-002	New Structure Construction	-106.6091800	41.3483310	S. 16 ,T. 16 N., R. 82 W.	4
IRR-003	Structure Rehabilitation	-106.6125240	41.3174640	S. 33 ,T. 16 N., R. 82 W.	4
IRR-004	Structure Rehabilitation	-106.6115500	41.3177820	S. 33 ,T. 16 N., R. 82 W.	4
IRR-005	New Structure Construction	-106.6104380	41.3186820	S. 28 ,T. 16 N., R. 82 W.	4
IRR-006	New Structure Construction	-106.6101870	41.3157300	S. 33 ,T. 16 N., R. 82 W.	4
IRR-007	New Structure Construction	-106.6325180	41.3194090	S. 29 ,T. 16 N., R. 82 W.	4
IRR-008	New Structure Construction	-106.6337650	41.3204560	S. 29 ,T. 16 N., R. 82 W.	4
IRR-009	New Structure Construction	-106.6323160	41.3230590	S. 29 ,T. 16 N., R. 82 W.	4
IRR-010	Structure Rehabilitation	-106.5190500	41.3437030	S. 20 ,T. 16 N., R. 81 W.	4
IRR-011	Structure Rehabilitation	-106.5375150	41.3633250	S. 7 ,T. 16 N., R. 81 W.	4
IRR-012	New Structure Construction	-106.5343790	41.3663390	S. 7 ,T. 16 N., R. 81 W.	4
IRR-013	Structure Rehabilitation	-106.5320490	41.3681480	S. 8 ,T. 16 N., R. 81 W.	4
IRR-014	Structure Rehabilitation	-106.5632490	41.3756730	S. 12 ,T. 16 N., R. 82 W.	4
IRR-015	New Structure Construction	-106.5679120	41.3814190	S. 1 ,T. 16 N., R. 82 W.	4
IRR-016	Structure Rehabilitation	-106.5826580	41.3889300	S. 2 ,T. 16 N., R. 82 W.	4
IRR-017	New Structure Construction	-106.6687540	41.4320560	S. 19 ,T. 17 N., R. 82 W.	4
IRR-018	New Structure Construction	-106.5907710	41.3968840	S. 35 ,T. 17 N., R. 82 W.	4
IRR-019	New Structure Construction	-106.5382420	41.3460310	S. 18 ,T. 16 N., R. 81 W.	4
IRR-020	Structure Rehabilitation	-106.5393920	41.3545970	S. 18 ,T. 16 N., R. 81 W.	4
IRR-021	Structure Rehabilitation	-106.9223730	42.1079200	S. 30 ,T. 25 N., R. 84 W.	4
IRR-022	New Structure Construction	-106.9210560	42.1050400	S. 29 ,T. 25 N., R. 84 W.	4
IRR-023	Structure Rehabilitation	-106.9087000	42.1070230	S. 29 ,T. 25 N., R. 84 W.	4
IRR-024	Structure Rehabilitation	-106.9029840	42.1065460	S. 29 ,T. 25 N., R. 84 W.	4
IRR-025	New Structure Construction	-106.9087000	42.1070230	S. 29 ,T. 25 N., R. 84 W.	4
IRR-026	New Structure Construction	-106.9029840	42.1065460	S. 29 ,T. 25 N., R. 84 W.	4
IRR-027	New Structure Construction	-106.6722560	41.3758330	S. 12 ,T. 16 N., R. 83 W.	4
IRR-028	New Structure Construction	-106.6215880	41.1890680	S. 16 ,T. 14 N., R. 82 W.	4
IRR-029	New Structure Construction	-106.7168620	41.3026890	S. 3 ,T. 15 N., R. 83 W.	4
IRR-030	New Structure Construction	-106.8047860	41.4629670	S. 11 ,T. 17 N., R. 84 W.	4
IRR-031	New Structure Construction	-106.8057040	41.4673580	S. 2 ,T. 17 N., R. 84 W.	4
IRR-032	New Structure Construction	-106.8064990	41.4687020	S. 2 ,T. 17 N., R. 84 W.	4
IRR-033	New Structure Construction	-106.8067820	41.4693370	S. 2 ,T. 17 N., R. 84 W.	4
IRR-034	New Structure Construction	-106.8070910	41.4718430	S. 2 ,T. 17 N., R. 84 W.	4
IRR-035	New Structure Construction	-106.8087410	41.4711200	S. 2 ,T. 17 N., R. 84 W.	4
IRR-036	New Structure Construction	-106.7840830	41.2430610	S. 25 ,T. 15 N., R. 84 W.	4
IRR-037	New Structure Construction	-106.6537810	41.4762230	S. 6 ,T. 17 N., R. 82 W.	4
IRR-039	New Structure Construction	-106.6846170	41.3421800	S. 23 ,T. 16 N., R. 83 W.	4
IRR-041	Structure Rehabilitation	-106.5258070	41.3671800	S. 8 ,T. 16 N., R. 81 W.	4
IRR-042	Structure Rehabilitation	-106.4749770	41.2865320	S. 10 ,T. 15 N., R. 81 W.	4
IRR-043	New Structure Construction	-106.8768990	41.1384630	S. 31 ,T. 14 N., R. 84 W.	4
IRR-044	New Structure Construction	-106.4880910	41.3267210	S. 27 ,T. 16 N., R. 81 W.	4
IRR-045	New Structure Construction	-106.7097520	41.0863550	S. 22 ,T. 13 N., R. 83 W.	4
IRR-046	New Structure Construction	-106.7764740	41.2033630	S. 7 ,T. 14 N., R. 83 W.	4

Watershed Management Plan Component	Project Type	Spring Development	Well Construction / Rehabilitation	Solar Pump / Generator	Stock Tank	Storage Tank	Pipeline (ft)	Fencing (ft)	Stock Reservoir Rehabilitation	Stock Reservoir Construction	Longitude	Latitude	Section, Township, Range	Priority
L/W-001	Stock Tank		1	1	2		1,200				-106.4311	41.0588	T. 13 N., R.	3
L/W-002	Spring	1			1		200	500			-106.5592	41.1245	. 13 N., R.	1
L/W-003	Spring	1			1		200	500			-106.5820	41.1572	T. 14 N., R.	1
L/W-004	Spring	1			1		200	500			-106.5786	41.1444	T. 14 N., R.	1
L/W-005	Spring	1			1		200	500			-106.3993	41.0262	. 12 N., R.	1
L/W-006	Spring	1			2		2,700	500			-107.3507	41.6831	T. 20 N., R.	1
L/W-007	Spring	1			2		2,700	500			-107.3460	41.6562	. 19 N., R.	1
L/W-008	Stock Reservoir								1		-107.3367	41.6673	T. 20 N., R.	2
L/W-009	Well		1	1	1		2,700				-107.3479	41.6545	. 19 N., R.	1
L/W-010	Well		1	1	1		2,700				-107.3399	41.6695	T. 20 N., R.	1
L/W-011	Stock Reservoir									1	-106.6831	41.3596	T. 16 N., R.	2
L/W-012	Stock Reservoir									1	-106.6861	41.3590	T. 16 N., R.	2
L/W-013	Stock Reservoir									1	-106.6799	41.3915	. 16 N., R.	2
L/W-014	Spring	1			2		2,700	500			-106.6197	41.2119	. 14 N., R.	1
L/W-015	Spring	1			1		300	500			-106.6051	41.2277	T. 15 N., R.	1
L/W-016	Spring	1			2		2,700	500			-106.5985	41.2137	. 14 N., R.	1
L/W-017	Spring	1			1		230	500			-106.6446	41.3036	. 15 N., R.	1
L/W-018	Stock Reservoir									1	-106.7183	41.3698	T. 16 N., R.	2

Watershed Plan Component: Storage Opportunities (STO)						
Watershed Plan Component	Project name	Action	Source	Storage		Priority
				Existing	New Construcion /	
Large Reservoirs						
No Large Reservoir Projects Were Identified						NA
Medium Reservoirs						
STO-001	Beaver Dam Reservoir	New Reservoir Construction	Beaver Creek	NA	300	2
Small Reservoirs						
No Small Reservoir Projects Were Identified						NA

Watershed Plan Component: Stream Channel Opportunities (STR)				
Watershed Plan Component	Project name	Action	Source	Priority
STR-001	Cumberland Gulch Headcut stabilization	Stabilize Headcut	Cumberland Gulch	5
STR-002	Encampment River at Highway 230	Streambank Stabilization	Encampment River	5

The NRCS prepares NEDs of conservation practices or BMPs which act together to achieve desired purposes. The NEDs "are flow charts of direct, indirect and cumulative effects resulting from installation of the practices. Completed network diagrams are an overview of expert consensus on the direct, indirect and cumulative effects of installing proposed practice installation. They show the potential positive and negative outcomes of practice installation, and are useful as a reference point for next steps, and as a communication tool with partners and the public" [Natural Resources Conservation Service, 2014].

Benefits associated with a particular conservation practice or BMP can be classified as direct, indirect or cumulative. Direct and indirect benefits would be considered measureable or tangible benefits. For example, construction of a reservoir designed to augment late season irrigation water supplies provides the direct or measurable benefit, of providing a supply of water commensurate with its storage capacity. An indirect benefit could be the habitat provided to wildlife. Likewise, the same reservoir could provide the cumulative benefit of increased income to producers and improved health of the local economy.

As previously discussed, such benefits can be either quantitative or qualitative or both. Benefits can be local or global and specific or surrogate, depending on multiple factors unique and specific to the BMP, ecological site, watershed, or major land resource area. Project benefits can be related to ecological enhancement, water quantity, economic stability, stream corridor or riverine stability, or maintenance of open spaces. Where appropriate, the NRCS NED for the conservation practice is presented within this document.

4.10.1 Irrigation Rehabilitation Projects

The Watershed Management Plan includes seven recommendations. These projects include various forms of irrigation improvements and rehabilitation projects.

Irrigation Water Conveyance—Pipeline

The rehabilitation and replacement of existing irrigation system delivery conveyance structures help to efficiently deliver or convey water from a source of supply or diversion structures to areas of application or storage to facilitate management of irrigation water. The practice reduces erosion, conserves water, and protects water quality. Underground pipelines serve as an integral part of the irrigation water distribution system and significantly improve the overall efficiency of the system.

Strategies defining placement of irrigation water conveyance pipelines typically involve:

- Rehabilitation/replacement of existing structures
- Mitigation of seepage losses
- Enhanced delivery of irrigation water
- Reduction in annual operation and maintenance costs

- Improvement in ditch management and efficiency through water management
- Facilitation of irrigation water management plans
- Economic practicality
- Physical feasibility.

Effects and benefits of rehabilitating and improving water conveyance for irrigation systems are numerous and are displayed in the NRCS's NED in Figure 4.10-1. As shown in this figure, direct and indirect benefits associated with this BMP include:

- Water availability for irrigation
    - Plant growth and productivity
- Infiltration and evaporation losses
    - Increased plant growth and productivity
    - Decreased leaching of nutrients
- Erosion associated with practice
    - Decreased sediment delivery to surface waters

Cumulative effects/benefits of provision of reliable water supplies are described as:

- Positive impacts to income and stability of individual producers and the community
- Improved aquatic health of humans, domestic animals and wildlife
- Improved stream fauna and environmental quality.

4.10.2 Livestock/Wildlife Water Supply Projects

The Watershed Management Plan includes 114 livestock/wildlife water supply projects. These projects include various forms of water facilities, water wells, spring developments, pipelines, and stock ponds.

Water Facilities

The development of reliable watering facilities in areas otherwise lacking reliable sources of water for livestock and wildlife, help to promote improved rangeland conditions in several ways. Water facilities may be associated with wells, springs, streams, ponds or hauled water. ***Reliable sources of water are integral aspects of any range management plan involving distribution of livestock.***

Strategies defining placement of water facilities typically involve:

- Facilitation of prescribed grazing management plans
- Alternative water supplies to riparian sources
- Provision of a reliable source where no other sources may exist
- Optimization of upland range resources.

Benefits of providing reliable water facilities for livestock and wildlife are numerous and are displayed in the NRCS's NED in Figure 4.10-2. As shown in this figure, direct and indirect benefits associated with this BMP include:

- Controlled access to streams, ponds, water supplies, and sensitive areas (when combined with proper fencing),
  - Decreased loading of pathogens, sediments, and nutrients to existing surface waters,
  - Improved water quality, quantity and distribution of livestock and wildlife
  - Increased plant productivity
  - Improved wildlife habitat
  - Increased species diversity
  - Increased livestock food sources

Cumulative benefits of provision of reliable water supplies are described as:

- Positive impacts to income and stability of individual producers and the community,
- Improved aquatic health of humans, domestic animals and wildlife, and
- Improved health of humans, domestic animals and wildlife

4.10.3 Grazing Management Alternatives

These alternatives include conservation practices and BMPs such as water developments, fencing, salting and herding, ecological sites and state and transition models, prescribed fire, and application of chemicals along with other tools that can be used to facilitate and enhance grazing distribution and optimize range conditions through prescribed grazing practices.

Prescribed Grazing

Prescribed grazing is the controlled harvest of vegetation with grazing animals managed with the intent to achieve a specific objective. Prescribed grazing may be applied on lands where grazing and/or browsing animals are managed. A grazing schedule is prepared for allotments, pastures to be grazed. Removal of vegetation by the grazing animals is in conformity with realistic yield goals, plant growth needs, and management goals. Duration and intensity of grazing is based on desired plant health and expected productivity of the forage species to meet management objectives.

Strategies for applying prescribed grazing involve managing the intensity, frequency, duration, distribution, and season of grazing by:

- Defining landowner and/or manager goals and objectives
- Identifying needs for reliable water sources and supplies
- Feed and forage inventories and analyses

- o Range condition and health evaluations and assessments
- o Managing desirable and undesirable plant communities to meet grazing objectives

Benefits of implementing prescribed grazing and associated BMPs and conservation practices are numerous and are displayed in the NRCS's NED in Figure 4.10-3. As shown in this figure, direct and indirect benefits associated with this BMP include:

- Increased control of livestock grazing, feeding, watering locations
- Decreased loading of pathogens, sediments, and nutrients to surface waters,
- Increased manure distribution
- Increased soil quality
- Reduced contaminants, pathogens, sediments to receiving waters
- Soil erosion and compaction
- Increased plant productivity and maintenance
- Increased livestock production and health
- Increased wildlife health and populations

Cumulative benefits of implementing prescribing grazing could include:

- Positive impacts to income and stability of individual producers and the community
- Improved water quality and aquatic habitat
- Improved health of humans, domestic animals and wildlife

4.10.4 Stream Channel Restoration Projects

These alternatives include conservation practices and BMPs such as installation of stream channel degradation/incision and streambank erosion mitigation measures based upon site-specific evaluation of conditions along with routine monitoring of completed stream projects to identify necessary maintenance repairs and determine their effectiveness. Appropriate measures could be 'hard' engineering, 'soft' approaches, or combinations of both.

Streambank and Shoreline Protection

Streambank and shoreline protection is the stabilization and protection of streambanks, constructed channels, and shorelines of lakes and reservoirs. Strategies for applying streambank and shoreline protection involve:

- Streambanks of natural or constructed channels and shorelines of lakes and reservoirs where they are susceptible to erosion.
- Various materials may be used for protection of streambanks and shorelines,

- A site-specific assessment should be conducted to determine if the causes are local or systemic and used to select appropriate treatment to achieve the desired objective,
- Functional and stable treatments for design flows and sustainable for higher flows.
- Preventing the loss of adjacent land or damage to land uses or other facilities
- Protecting historical, archeological, and traditional cultural properties
- Reducing the offsite or downstream effects of sediment resulting from bank erosion
- Improving the stream corridor for fish and wildlife habitat, aesthetics, and recreation

Benefits of implementing streambank and shoreline protection and associated BMPs and conservation practices are numerous and are displayed in the NRCS's NED in Figure 4.10-4. As shown in this figure, direct and indirect benefits associated with this BMP include:

- Decreased streambank and/or shoreline erosion
  - Increased soil quality
  - Decreased sedimentation
- Increased flow capacity of streams and channels
- Increased streambank vegetation and root matrices
  - Increased soil quality
  - Increased native plant recruitment
  - Decreased invasive/noxious species

Cumulative benefits of implementing streambank and shoreline protection could include:

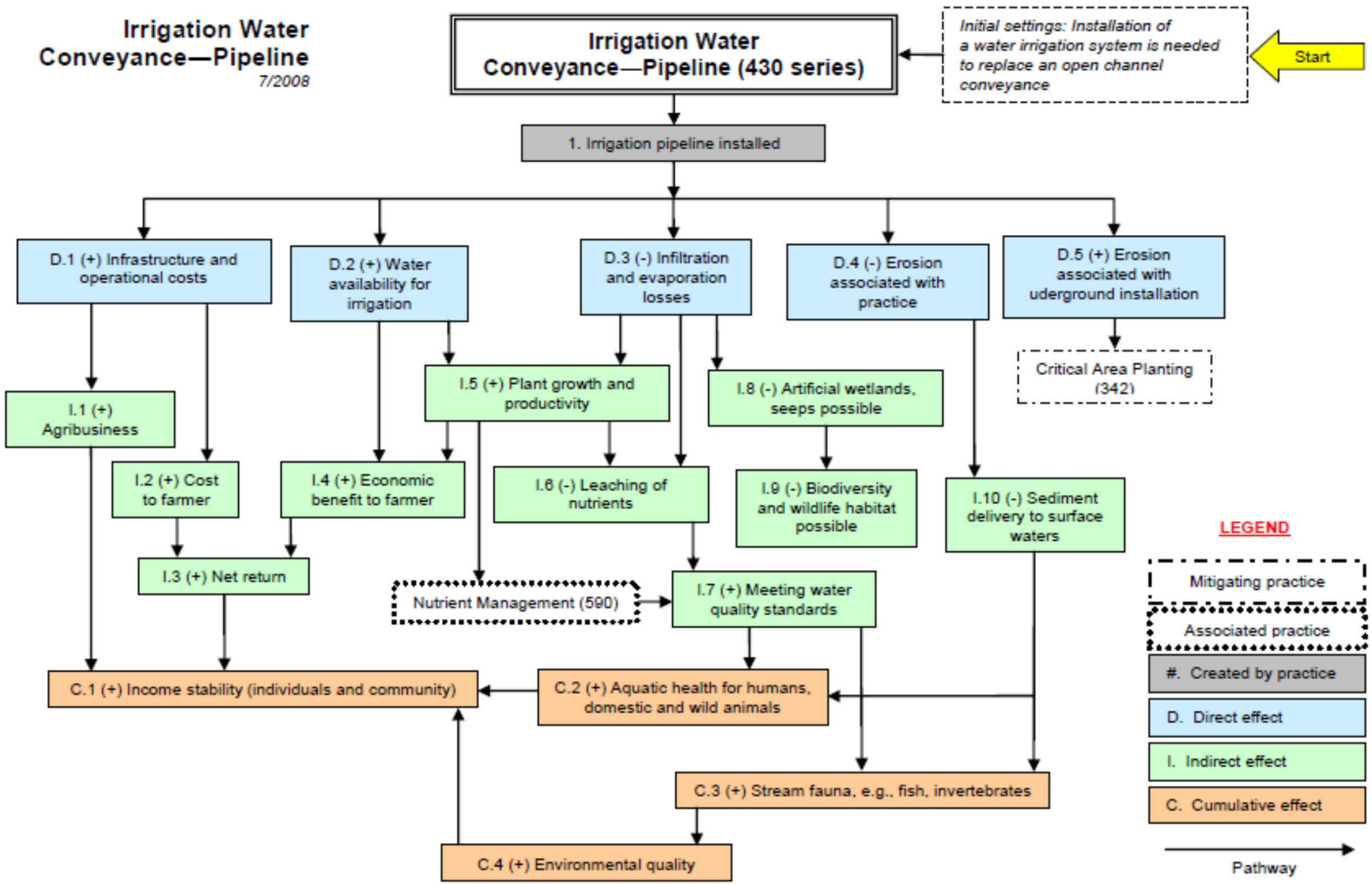
- Positive impacts to income and stability of individual producers and the community,
- Improved water quality and aquatic and/or terrestrial habitat,
- Improved recreational opportunities

4.10.5 Water Storage Facilities / Irrigation Reservoir

Benefits of storage facilities and associated BMPs and conservation practices are numerous and are displayed in the NRCS's NED in Figure 4.10-5. As shown in this figure, direct and indirect benefits associated with this BMP include:

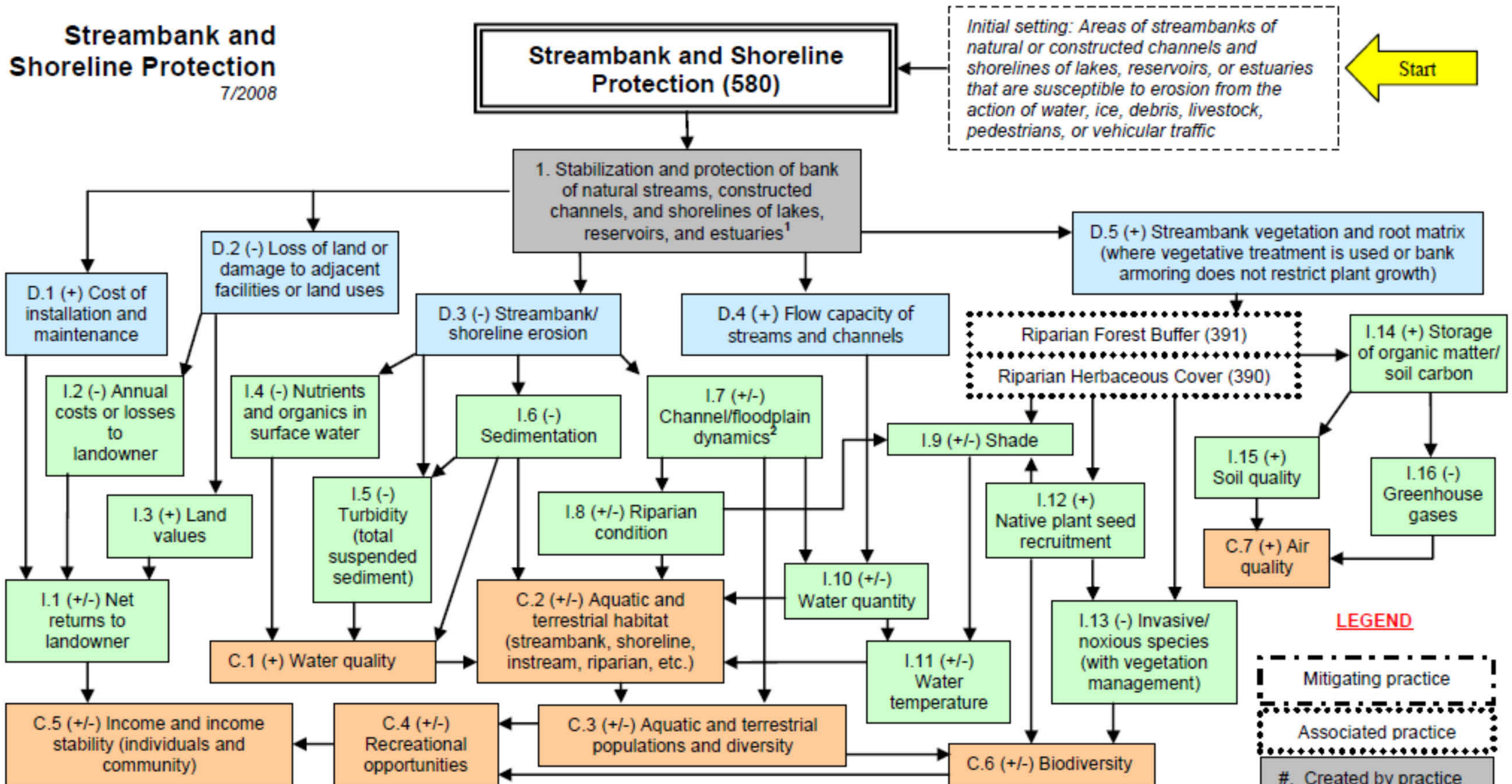
- Storage of water for late season irrigation supply
- Storage of water for municipal and industrial use
- Supply of flow augmentation
- Flood control and attenuation of peak flows downstream
- Wetland enhancement and development
- Sediment management
- Aquatic habitat
- Recreation opportunities

Figure 4.10-1 Network Effects Diagram for Irrigation Conveyance – Pipeline.



Note: Effects are qualified with a plus (+) or minus (-). These symbols indicate only an increase (+) or a decrease (-) in the effect upon the resource, not whether the effect is beneficial or adverse.

Figure 4.10-2 Network Effects Diagram for Streambank and Shoreline Protection.



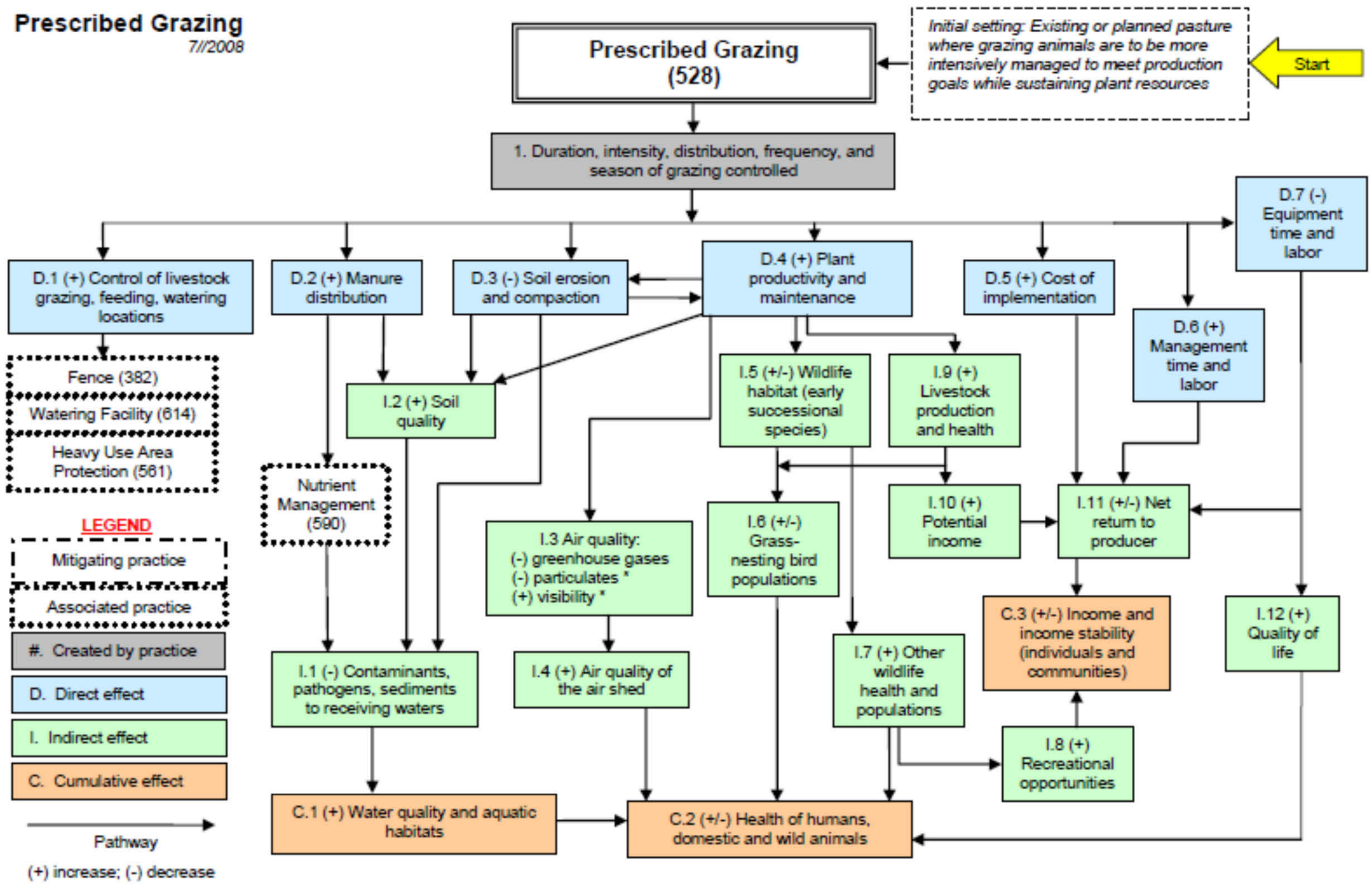
Notes: Effects are qualified with a plus (+) or minus (-). These symbols indicate only an increase (+) or a decrease (-) in the effect upon the resource, not whether the effect is beneficial or adverse.

Projects involving long lengths of bank or shoreline, structural controls, substantial earth moving and/or fill, or sensitive waters may need to be evaluated in a site-specific EA or EIS.

[1] Additional information about potential protection measures and their impacts is available in the EIS for the Emergency Watershed Protection (EWP) Program.

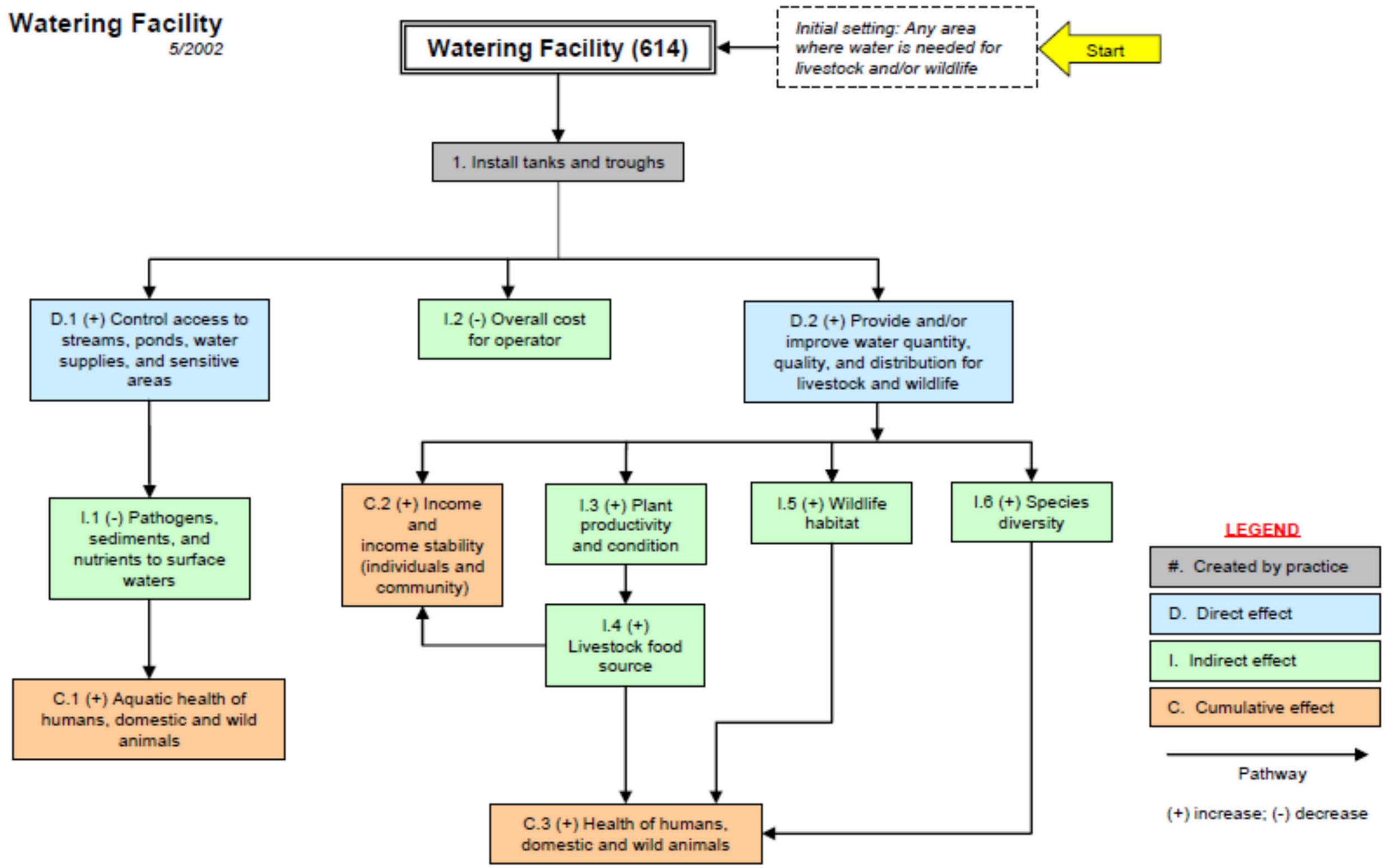
[2] Conventional bank armoring (e.g., rip rap, gabions) may result in decreased (-) channel/flood plain dynamics, and associated impacts, while other less intrusive methods (e.g., stream barbs, stone toes with sloped, vegetated banks) may result in increased (+) channel/flood plain dynamics.

Figure 4.10-3 Network Effects Diagram for Prescribed Grazing.



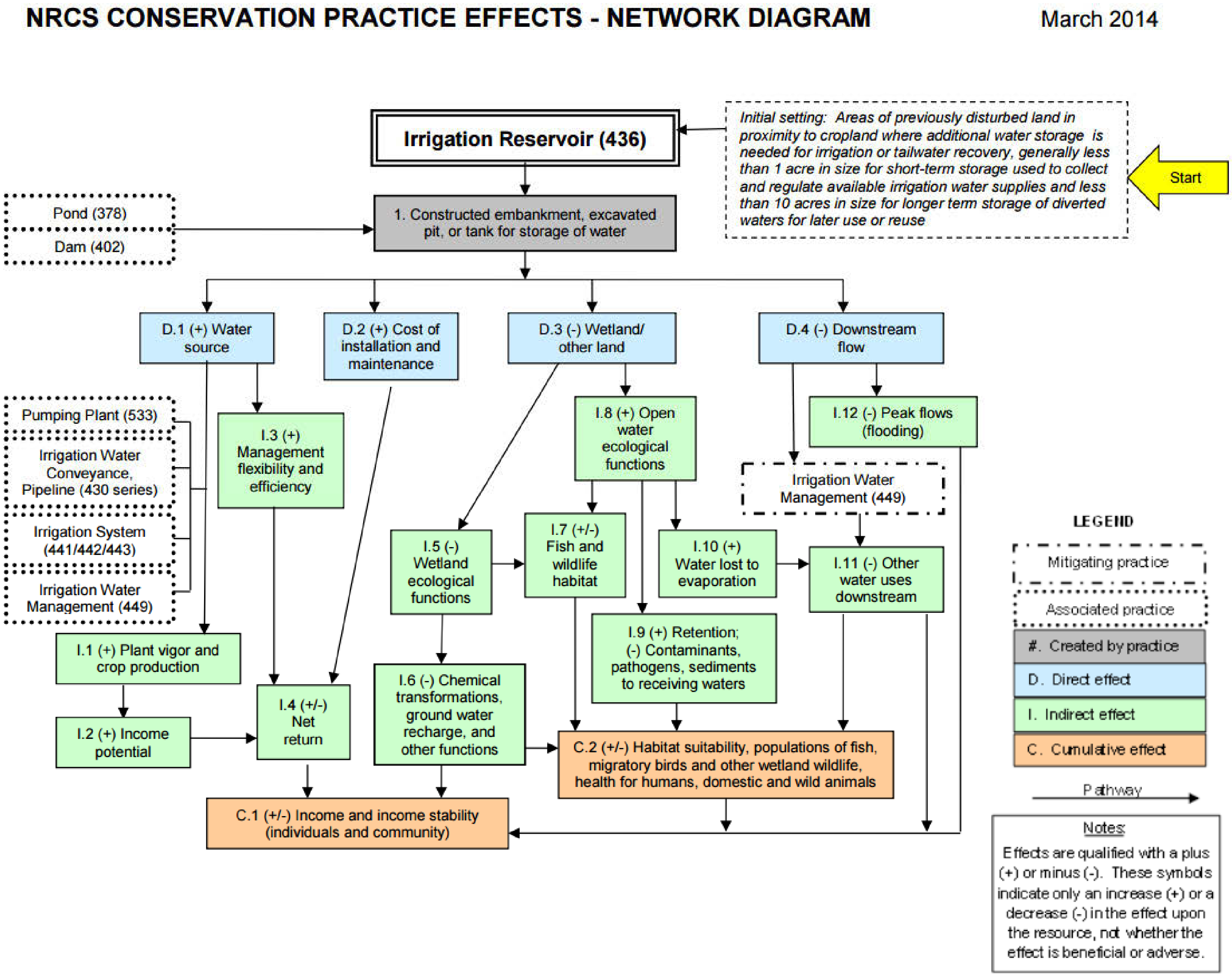
Note: Effects are qualified with a plus (+) or minus (-). These symbols indicate only an increase (+) or a decrease (-) in the effect upon the resource, not whether the effect is beneficial or adverse.

Figure 4.10-4 Network Effects Diagram for Watering Facility.



Note: Effects are qualified with a plus (+) or minus (-). These symbols indicate only an increase (+) or a decrease (-) in the effect upon the resource, not whether the effect is beneficial or adverse.

Figure 4.10-5 Network Effects Diagram for Irrigation Reservoir.



V. COST ESTIMATES

V. COST ESTIMATES

Conceptual-level costs have been developed for each of the alternative potential projects identified and described in Chapter 4. The bases for these costs are described in the following subsections for each of the overall project categories. Cost estimates presented represent 2015 dollars. NRCS Fiscal Year (2015) Practice Payment Rates for EQIP Program costs cost data were used where feasible for typical design items. These values represent the amount of money typically paid to individuals for EQIP projects and not necessarily the actual cost of construction. Consequently, in order to best represent actual construction costs, the EQIP Payment Rates were inflated 25% for livestock projects and 33% for irrigation projects to better reflect actual construction costs; not reimbursement values.

5.1 Irrigation System Components

Costs associated with irrigation system components of the watershed management plan were estimated based upon current itemized unit costs for individual improvements. NRCS Fiscal Year (2015) Practice Payment Rates for EQIP Program costs cost data were used where feasible for typical design items. In Table 5.1-1 summarizes conceptual cost estimates for irrigation system components of the watershed management plan. Where feasible, NRCS EQIP components are itemized for most structures.

5.2 Upland Wildlife/Livestock Water Components

The anticipated costs associated with these components of the watershed management plan were based upon previous experience completing similar projects in the study area, current NRCS EQIP cost tables, and current costs of various other system components obtained from reliable sources.

Table 5.2-1 presents the estimated costs associated with each of the upland wildlife / livestock water source components of the watershed management plan. The following components are common to most of the systems and are itemized below for general reference.

Spring Developments: Typical costs range from $1,000 to $5,000 depending on size and yield of the spring. For the purposes of this Level I investigation a cost of $3,600 was used because site-specific information was not available.

Wells*:* Well construction costs were assumed to be approximately $100 per foot of depth. This value was determined based upon input from local stakeholders, conservation districts, and the NRCS.

Solar Pump Facility*:* A cost of $8,500 per solar pump facility was used. This cost was assumed to include the pump, solar arrays, and requisite controls and regulators. Actual price would vary based upon depth to water.

Table 5.1-1 Conceptual Cost Estimates: Irrigation System Components.

		Watershed Component IRR-001	Watershed Component IRR-002	Watershed Component IRR-003	Watershed Component IRR-004	Watershed Component IRR-005	Watershed Component IRR-006	Watershed Component IRR-007	Watershed Component IRR-008	Watershed Component IRR-009	Watershed Component IRR-010	Watershed Component IRR-011	Watershed Component IRR-012
Project Name:		Brush Creek Users	Brush Creek Users	Brush Creek Users	Brush Creek Users	Brush Creek Users	Brush Creek Users	Brush Creek Users	Brush Creek Users	Brush Creek Users	Brush Creek Users	Brush Creek Users	Brush Creek Users
Mobilization		$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Pipeline	< 12 inches												
	> 12 inches												
Water Control Structures	Extra Small								1				
	Small				1		1	1		1			
	Medium	1	1	1		1					0.5	1.5	
	Large												1
Other Components	Structural Concrete												
	Rock Riprap		115	40									
	Embankment with drain												
Construction Subtotal		$12,750	$34,600	$24,350	$9,468	$12,750	$9,468	$9,468	$6,402	$9,468	$7,875	$17,625	$21,834
Engineering (10%)		$1,275	$3,460	$2,435	$947	$1,275	$947	$947	$640	$947	$788	$1,763	$2,183
Constuction and Engineering Subtotal		$14,025	$38,060	$26,785	$10,415	$14,025	$10,415	$10,415	$7,042	$10,415	$8,663	$19,388	$24,017
Contingency (15%)		$2,104	$5,709	$4,018	$1,562	$2,104	$1,562	$1,562	$1,056	$1,562	$1,299	$2,908	$3,603
Total Construction Cost		$16,129	$43,769	$30,803	$11,977	$16,129	$11,977	$11,977	$8,099	$11,977	$9,962	$22,296	$27,620
Final Plans and Specs		$4,000	$4,000	$4,000	$2,000	$4,000	$2,000	$2,000	$1,000	$2,000	$2,000	$5,000	$5,000
Additional		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Permitting / Legal Fees / Access and		$500	$1,500	$1,500	$500	$1,500	$500	$500	$500	$500	$1,500	$1,500	$500
Total Project Cost		**$20,629**	**$49,269**	**$36,303**	**$14,477**	**$21,629**	**$14,477**	**$14,477**	**$9,599**	**$14,477**	**$13,462**	**$28,796**	**$33,120**

Table 5.1-1 Conceptual Cost Estimates: Irrigation System Components (continued).

		Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component
		IRR-013	**IRR-014**	**IRR-015**	**IRR-016**	**IRR-017**	**IRR-018**	**IRR-019**	**IRR-020**	**IRR-021**	**IRR-022**	**IRR-023**	**IRR-024**
Project Name:		**Brush Creek Users**	**Brush Creek Users**	**Brush Creek Users**	**Brush Creek Users**	**Brush Creek Users**	**Brush Creek Users**	**Brush Creek Users**	**Brush Creek Users**	**ID Ranch**	**ID Ranch**	**ID Ranch**	**ID Ranch**
Mobilization		$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Pipeline	< 12 inches												
	> 12 inches												
Water Control Structures	Extra Small				1					1	1	1	
	Small		1	2		1		1	1				
	Medium					1	2	1	2				
	Large	2											
Other Components	Structural Concrete	63											
	Rock Riprap												
	Embankment with drain												1
Construction Subtotal		$135,168	$9,468	$15,936	$6,402	$19,218	$22,500	$19,218	$29,000	$6,402	$6,402	$7,800	$14,664
Engineering (10%)		$13,517	$947	$1,594	$640	$1,922	$2,250	$1,922	$2,900	$640	$640	$780	$1,466
Constuction and Engineering Subtotal		$148,685	$10,415	$17,530	$7,042	$21,140	$24,750	$21,140	$31,900	$7,042	$7,042	$8,580	$16,130
Contingency (15%)		$22,303	$1,562	$2,629	$1,056	$3,171	$3,713	$3,171	$4,785	$1,056	$1,056	$1,287	$2,420
Total Construction Cost		$170,988	$11,977	$20,159	$8,099	$24,311	$28,463	$24,311	$36,685	$8,099	$8,099	$9,867	$18,550
Final Plans and Specs		$10,000	$2,000	$3,000	$1,000	$4,000	$4,000	$4,000	$4,000	$1,000	$1,000	$1,000	$2,000
Additional		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Permitting / Legal Fees / Access and		$3,000	$500	$500	$500	$1,500	$500	$1,500	$1,500	$500	$500	$500	$500
Total Project Cost		**$183,988**	**$14,477**	**$23,659**	**$9,599**	**$29,811**	**$32,963**	**$29,811**	**$42,185**	**$9,599**	**$9,599**	**$11,367**	**$21,050**

Table 5.1-1 Conceptual Cost Estimates: Irrigation System Components (continued).

		Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component
		IRR-025	**IRR-026**	**IRR-027**	**IRR-028**	**IRR-029**	**IRR-030**	**IRR-031**	**IRR-032**	**IRR-033**	**IRR-034**	**IRR-035**	**IRR-036**
Project Name:		**ID Ranch**	**ID Ranch**	**Mark Condict**	**Monte Munroe**	**wyco club dam**	**One Pine Ranch**	**One Pine Ranch**	**One Pine Ranch**	**One Pine Ranch**	**One Pine Ranch**	**One Pine Ranch**	**Paul Herring**
Mobilization		$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Pipeline	< 12 inches	960	550	2,000									
	> 12 inches				1,400								
Water Control Structures	Extra Small	1	1	1	1		1	1	1	1	1	1	
	Small												
	Medium												
	Large												
Other Components	Structural Concrete												
	Rock Riprap												
	Embankment with drain												1
Construction Subtotal		$14,850	$11,242	$24,000	$86,402	>$200,000	$6,402	$6,402	$6,402	$6,402	$6,402	$6,402	$19,800
Engineering (10%)		$1,485	$1,124	$2,400	$8,640		$640	$640	$640	$640	$640	$640	$1,980
Constuction and Engineering Subtotal		$16,335	$12,366	$26,400	$95,042		$7,042	$7,042	$7,042	$7,042	$7,042	$7,042	$21,780
Contingency (15%)		$2,450	$1,855	$3,960	$14,256		$1,056	$1,056	$1,056	$1,056	$1,056	$1,056	$3,267
Total Construction Cost		$18,785	$14,221	$30,360	$109,299		$8,099	$8,099	$8,099	$8,099	$8,099	$8,099	$25,047
Final Plans and Specs		$1,000	$1,000	$1,000	$1,000		$1,000	$300	$300	$300	$300	$300	$1,000
Additional		$0	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0
Permitting / Legal Fees / Access and		$500	$500	$2,000	$500		$0	$0	$0	$0	$0	$0	$1,000
Total Project Cost		**$20,285**	**$15,721**	**$33,360**	**$110,799**		**$9,099**	**$8,399**	**$8,399**	**$8,399**	**$8,399**	**$8,399**	**$27,047**

Table 5.1-1 Conceptual Cost Estimates: Irrigation System Components (continued).

		Watershed Component IRR-037	Watershed Component IRR-038	Watershed Component IRR-039	Watershed Component IRR-040	Watershed Component IRR-041	Watershed Component IRR-042	Watershed Component IRR-043	Watershed Component IRR-044	Watershed Component IRR-045	Watershed Component IRR-046
Project Name:		**Pennock Ranch**	**Pennock Ranch**	**Silver Spur siphon**		**Brush Creek Supply Ditch**	**Highline Canal No 1 Drop Structure**	**Kurtz Chatterton**	**Carroll Ditch Diversion**	**Enlarged Encampment**	**Cherokee Wagner Diversion**
Mobilization		$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Pipeline	< 12 inches										
	> 12 inches		2,000	1,200							
Water Control Structures	Extra Small		1								
	Small	1									
	Medium						1		1		
	Large										
Other Components	Structural Concrete										
	Rock Riprap										
	Embankment with drain										
Construction Subtotal		$9,468	$55,272	$74,784	TBD	>200,000	$12,750	>200,000	$12,750	>200,000	>200,000
Engineering (10%)		$947	$5,527	$7,478			$1,275		$1,275		
Constuction and Engineering Subtotal		$10,415	$60,799	$82,262			$14,025		$14,025		
Contingency (15%)		$1,562	$9,120	$12,339			$2,104		$2,104		
Total Construction Cost		$11,977	$69,919	$94,602			$16,129		$16,129		
Final Plans and Specs		$1,000	$1,000	$2,000			$4,000		$4,000		
Additional		$0	$0	$0			$0		$0		
Permitting / Legal Fees / Access and		$2,500	$1,000	$3,000			$2,000		$2,500		
Total Project Cost		**$15,477**	**$71,919**	**$99,602**			**$22,129**		**$22,629**		

Table 5.2-1 Summary of Conceptual Costs: Livestock / Wildlife Components.

		Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component
		L/W-001	L/W-002	L/W-003	L/W-004	L/W-005	L/W-006	L/W-007	L/W-008	L/W-009
Description:		**Well / Stock Tank / Pipeline Construction**	**Spring Development / Pipeline / Stock Tank Construction**	**Spring Development / Pipeline / Stock Tank Construction**	**Spring Development / Pipeline / Stock Tank Construction**	**Spring Development / Pipeline / Stock Tank Construction**	**Spring Development / Pipeline / Stock Tank Construction**	**Spring Development / Pipeline / Stock Tank Construction**	**Stock Pond Rehabilitation**	**Solar Pump / Pipeline / Stock Tank Construction**
Project Name:		**Big Creek Ranch**	**Big Creek Ranch**	**Big Creek Ranch**	**Big Creek Ranch**	**Big Creek Ranch**	**Fox Farm Cistern**	**Chicken Pete Spring**	**Carrico Pond #1**	**Carrico Well #1**
Water Source:		Proposed Well	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Rehabilitate Reservoir	Existing Well
Mobilization		$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Well Construction / Spring Development	Source:	Proposed Well	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Spring		
	Units (each)	1	1	1	1	1	1	1		
	Depth Each	250	NA	NA	NA	NA	NA	NA		
	Unit Cost ($/LF wells or $/EA springs	$38	$3,355	$3,355	$3,355	$3,355	$3,355	$3,355	NA	NA
	Well Screen (LF each well)	NA	NA	NA	NA	NA	NA	NA		
	Well Screen ($/LF)	NA	NA	NA	NA	NA	NA	NA		
	Component Subtotal	$9,613	$3,355	$3,355	$3,355	$3,355	$3,355	$3,355		
Stock Pond / Guzzler Construction / Rehabilitation	Units (each)								1	
	Earthwork (Stock Pond)								$6,100	
	Agri-Drain Installation (Stock Pond)								NA	
	Rock Stabilization (Stock Pond)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bentonite Lining (Stock Pond)								$20,580	
	Guzzler Installation (Materials and Labor)								NA	
	Pond/ Guzzler Component Subtotal								$26,680	
Pump	Units (EA)	1								1
	Type	Solar Pump	NA	NA	NA	NA	NA	NA	NA	Solar Pump
	Unit Cost (EA)	$8,500								$8,500
	Component Subtotal	$8,500								$8,500
Pipeline	Low Pressure 1 1/2 in Pipe Diameter:	1.5	1.5	1.5	1.5	1.5	1.5	1.5		1.5
	Units (LF)	1,200	200	200	200	200	2,700	2,700	NA	2,700
	Unit Cost (EA)	$3.24	$3.24	$3.24	$3.24	$3.24	$3.24	$3.24		$3.24
	Component Subtotal	$3,888	$648	$648	$648	$648	$8,748	$8,748		$8,748
Livestock / Wildlife Water Tanks	Units (EA)	2	1	1	1	1	2	2		1
	Size (gal)	1,200	1,200	1,200	1,200	1,200	1,200	1,200	NA	1,200
	Unit Cost	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000		$3,000
	Component	$6,000	$3,000	$3,000	$3,000	$3,000	$6,000	$6,000		$3,000
Miscellaneous	Item		Fencing	Fencing	Fencing	Fencing	Fencing	Fencing		
	Units (Each)	NA	500	500	500	500	500	500	NA	NA
	Unit Cost ($/ea)		$4.89	$4.89	$4.89	$4.89	$4.89	$4.89		
	Component Subtotal		$2,445.00	$2,445.00	$2,445.00	$2,445.00	$2,445.00	$2,445.00		
Construction Subtotal		$31,001	$12,448	$12,448	$12,448	$12,448	$23,548	$23,548	$29,680	$23,248
Engineering (10%)		$3,100	$1,245	$1,245	$1,245	$1,245	$2,355	$2,355	$2,968	$2,325
Constuction and Engineering Subtotal		$34,101	$13,693	$13,693	$13,693	$13,693	$25,903	$25,903	$32,648	$25,573
Contingency (15%)		$5,115	$2,054	$2,054	$2,054	$2,054	$3,885	$3,885	$4,897	$3,836
Total Construction Cost		$39,216	$15,747	$15,747	$15,747	$15,747	$29,788	$29,788	$37,545	$29,409
Final Plans and Specs		$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,500	$1,500
Additional		$0	$0	$0	$0	$0	$0	$0	$0	$0
Permitting / Legal Fees / Access and Rights of Way		$2,000	$500	$500	$500	$500	$500	$500	$1,000	$1,000
Total Project Cost		**$42,216**	**$17,247**	**$17,247**	**$17,247**	**$17,247**	**$31,288**	**$31,288**	**$40,045**	**$31,909**

Table 5.2-1 Summary of Conceptual Costs: Livestock / Wildlife Components (continued).

		Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component
		L/W-010	L/W-011	L/W-012	L/W-013	L/W-014	L/W-015	L/W-016	L/W-017	L/W-018
Description:		**Solar Pump / Pipeline / Stock Tank Construction**	**Stock Pond Construction**	**Stock Pond Construction**	**Stock Pond Construction**	**Spring Development / Pipeline / Stock Tank Construction**	**Spring Development / Pipeline / Stock Tank Construction**	**Spring Development / Pipeline / Stock Tank Construction**	**Spring Rehabilitation / Pipeline / Stock Tank Construction**	**Stock Pond Construction**
Project Name:		**Carrico Well #2**	**Stock Reservoir**	**Stock Reservoir**	**Stock Reservoir**	**Spring Development**	**Spring Development**	**Spring Development**	**Spring Development**	**Stock Reservoir**
Water Source:		Existing Well	Proposed Reservoir	Proposed Reservoir	Proposed Reservoir	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Proposed Reservoir
Mobilization		$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Well Construction / Spring Development	Source:					Existing Spring	Existing Spring	Existing Spring	Existing Spring	
	Units (each)					1	1	1	0	
	Depth Each					NA	NA	NA	NA	
	Unit Cost ($/LF wells or $/EA springs	NA	NA	NA	NA	$3,355	$3,355	$3,355	$3,355	NA
	Well Screen (LF each well)					NA	NA	NA	NA	
	Well Screen ($/LF)					NA	NA	NA	NA	
	Component Subtotal					$3,355	$3,355	$3,355	$0	
Stock Pond / Guzzler Construction / Rehabilitation	Units (each)		1	1	1					1
	Earthwork (Stock Pond)		$35,000	$19,000	$21,000					$17,000
	Agri-Drain Installation (Stock Pond)		NA	NA	$4,800					NA
	Rock Stabilization (Stock Pond)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bentonite Lining (Stock Pond)		NA	NA	$10,000					NA
	Guzzler Installation (Materials and Labor)		NA	NA	NA					NA
	Pond/ Guzzler Component Subtotal		$35,000	$19,000	$35,800					$17,000
Pump	Units (EA)	1								
	Type	Solar Pump	NA	NA	NA	NA	NA	NA	NA	NA
	Unit Cost (EA)	$8,500								
	Component Subtotal	$8,500								
Pipeline	Low Pressure 1 1/2 in Pipe Diameter:	1.5				1.5	1.5	1.5	1.5	
	Units (LF)	2,700	NA	NA	NA	2,700	300	2,700	230	NA
	Unit Cost (EA)	$3.24				$3.24	$3.24	$3.24	$3.24	
	Component Subtotal	$8,748				$8,748	$972	$8,748	$745	
Livestock / Wildlife Water Tanks	Units (EA)	1				2	1	2	1	
	Size (gal)	1,200	NA	NA	NA	1,200	1,200	1,200	1,200	NA
	Unit Cost	$3,000				$3,000	$3,000	$3,000	$3,000	
	Component	$3,000				$6,000	$3,000	$6,000	$3,000	
Miscellaneous	Item					Fencing	Fencing	Fencing	Fencing	
	Units (Each)	NA	NA	NA	NA	500	500	500	500	NA
	Unit Cost ($/ea)					$4.89	$4.89	$4.89	$4.89	
	Component Subtotal					$2,445.00	$2,445.00	$2,445.00	$2,445.00	
Construction Subtotal		$23,248	$38,000	$22,000	$38,800	$23,548	$12,772	$23,548	$9,190	$20,000
Engineering (10%)		$2,325	$3,800	$2,200	$3,880	$2,355	$1,277	$2,355	$919	$2,000
Constuction and Engineering Subtotal		$25,573	$41,800	$24,200	$42,680	$25,903	$14,049	$25,903	$10,109	$22,000
Contingency (15%)		$3,836	$6,270	$3,630	$6,402	$3,885	$2,107	$3,885	$1,516	$3,300
Total Construction Cost		$29,409	$48,070	$27,830	$49,082	$29,788	$16,157	$29,788	$11,626	$25,300
Final Plans and Specs		$1,500	$3,000	$3,000	$3,000	$1,000	$1,000	$1,000	$1,000	$3,000
Additional		$0	$0	$0	$0	$0	$0	$0	$0	$0
Permitting / Legal Fees / Access and Rights of Way		$1,000	$1,000	$1,000	$1,000	$1,000	$500	$500	$500	$1,000
Total Project Cost		**$31,909**	**$52,070**	**$31,830**	**$53,082**	**$31,788**	**$17,657**	**$31,288**	**$13,126**	**$29,300**

***Pipelines**:* A cost of approximately $3.34 / lineal foot (installed) for 1.5-inch diameter pipe was used and is based upon information provided by the NRCS for “easily” installed pipeline. Areas where installation is more difficult (i.e, rough terrain, rocky, etc.) could result in higher costs. A cost of $5.00 per linear foot for pipeline installed below the frost line was assumed. Length of pipe associated with each project was approximated within the GIS environment.

Water Tanks (Stock and Storage): A cost of $3,000 per stock tank was used for a typical rubber-tire type tank based upon a unit cost of approximately $2.46 per gallon. Cost of storage tanks were assumed to be approximately $1 per gallon of storage.

Stock Pond Construction. A cost of $16,000 per stock reservoir was used based upon summation of NRCS unit costs associated with a typical facilities:

- Assumed embankment of approximately 2,800 cy (10 ft high, 10 crest width, 250 feet crest length) applied to a unit cost of approximately $4/cy earthwork
- Agridrain outlet facility: $4,800 installed

Fencing. A cost of 2.30 per linear foot was utilized for general fencing requirements (barbed or smooth wire). For sensitive areas / protected areas, a cost of $5.00 per linear foot was used.

Stock Pond Sealant**.** Unit cost of $10,000 per acre of inundated area was used based upon information presented in previous Level I watershed studies previous. This cost assumes incorporation of bentonite at appropriate application rates.

Guzzler Installation. Based upon information obtained from BLM, a unit cost of $5,000 per installation was utilized.

Guzzlers: A cost of $10,000 was used for a 2,250 square feet catchment area feeding an 1800 gallon, BOSS brand tank.

Solar Water Pump: A total cost of $8,640 was used for a typical system.

5.3 Other Management Practices and Improvements

The costs of other potential management practices and improvements such as:

- Stream channel restoration,
- Range/grazing management,
- Prescribed burning, and
- Removal/control of invasive plants and noxious weeds are very project and site dependent.

Normally, all but some of the range/grazing management practices or improvements would be implemented by the appropriate agency (NRCS, BLM, Weed and Pest Districts, etc.).

Local staff of those agencies should be consulted regarding the costs of these practices and improvements. The cost of range/grazing practices and improvements (other than wildlife/livestock watering addressed in Section 7.2 above) mostly involve the rancher's time for planning, herding, salting, noxious weed and plant control/removal (where not otherwise covered by cooperative efforts managed by the Weed and Pest Districts), and possibly installation of local fencing in critical areas.

VI. FUNDING OPPORTUNITIES

VI. FUNDING OPPORTUNITIES

6.1 Overview

Sources of funding and financing for proposed projects within the watershed and the associated technical support and assistance are available from various local, private, state, and federal entities. The widespread opportunities described in this Level I watershed study, watershed management plan, and resulting proposed projects and alternatives make identifying and obtaining potential project funding dependent on local coordination and voluntary cooperation.

Local coordination is crucial in developing viable financing approaches that could be developed in implementing proposed projects and realizing beneficial watershed improvements. Voluntary cooperation between landowners, managers, irrigators, residents, organizations, and agencies is essential in addressing the identified land and water resource concerns within the Upper North Platte River Watershed. Land and water users and managers interested in voluntarily implementing conservation projects and programs should be aware of the partnership opportunities and program incentives available in successfully achieving their watershed improvement goals and objectives.

Local, state, and federal agencies, along with private organizations, provide technical assistance for watershed and conservation projects with a smaller amount of these entities also providing financial assistance. Private contributions, such as in-kind provisions, are vital in developing and accomplishing a successful watershed or conservation project. Agencies and organizations with technical and financial assistance programs, which could potentially assist with proposed projects and alternatives, are provided in the subsequent sections. Funding and program information for potential conservation and watershed project and program assistance was obtained primarily from the following sources:

- **Water Management and Conservation Assistance Programs Directory**, is an overview of local, state, and federal programs with associated contact information. (http://wwdc.state.wy.us/wconsprog/2014WtrMgntConsDirectory.html)

- **Catalog of Federal Funding Sources for Watershed Protection** is a searchable database of financial assistance sources (grants, loans, and cost-sharing) available to fund a variety of watershed projects. (https://ofmpub.epa.gov/apex/watershedfunding/f?p=fedfund:1)

- **Habitat Extension Bulletin No. 50 – Fisheries and Wildlife Habitat Cost Share Programs and Grants** *is* published by the Wyoming Game and Fish Department and provides a very comprehensive listing of potential funding sources for fisheries and wildlife habitat projects. The document is available at the following website: https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Extension%20Bulletins/B50-Fisheries-and-Wildlife-Habitat-Cost-Sharing-Programs-and-Grants.pdf

Additional information about potential funding sources were reviewed and incorporated from previous watershed studies completed on behalf of the WWDC and specifically included excerpts from the *Blacks Fork River Watershed Study Basinwide Watershed Management Plan* [Anderson Consulting Engineers, 2015] and the *Middle North Platte River Watershed Management Plan, Level I Watershed Study* [RESPEC, 2014]. These potential sources described in this chapter are certainly not an all-inclusive listing of the available opportunities for water management and conservation projects. Also, the available funding levels for these programs vary annually because they are subject to budget appropriations; spending authorizations; and in some instances, donation amounts for private organizations. Additionally, the contact information for these sources can and does change occasionally. Important contact information for local conservation organizations include, but are certainly not limited to, the following contacts:

- Saratoga Encampment Rawlins Conservation District (307-326-8156)
- Medicine Bow Conservation District (307-379-2221)
- Laramie Rivers Conservation District (307-721-0072)
- Little Snake River Conservation District (307-383-7860)
- Natrona County Conservation District (307-261-5436 Ext. 103)
- Saratoga NRCS Office (307-326-5657)
- Medicine Bow NRCS Office (307-379-2542)
- Bureau of Land Management/Rawlins District Office (307-328-4200)
- USFS Brush Creek/Hayden Ranger District (307-326-5258)
- WGFD Casper Regional Office (307-473-3400)
- WGFD Laramie Regional Office (307-745-4046)

6.2 Local Agencies

6.2.1 Conservation Districts

Five conservation districts cover portions of the watershed, including Saratoga Encampment Rawlins Conservation District (88 percent), Medicine Bow Conservation District (6 percent), Laramie Rivers Conservation District (4 percent), Little Snake River Conservation District (1 percent), and finally the Natrona County Conservation District (1 percent). Even though there are five districts that intersect the study area, the Saratoga Encampment Rawlins Conservation District will be the primary point of contact for information contained within this report. Conservation districts are locally led, locally elected county government entities. They function as representatives of local people with responsibility to natural resource issues. Local conservation district boards perform as a liaison between local landowners and resource users and state and federal government agencies. Conservation districts are providers of information and education at the local level. Districts also provide technical assistance as local resources, capacity, and expertise allow. They can also assist in developing and implementing program and project design and funding through assistance in proposal preparation, presentation, and pursuit of grant assistance. Conservation districts can also provide funding assistance, often through in-kind contributions such as staff time and technical aid. They can administer programs, projects, and grants on behalf of recipients of state and federal natural resource programs. Districts can assist with developing leveraged, partnered programs and projects. Additional information can be found on their website (*http://www.conservewy.com*).

6.2.2 County Weed and Pest Districts

County Weed and Pest Districts in Carbon and Albany Counties also provide technical and financial assistance to landowners within the study area. These special-purpose districts deliver a wide range of support, including weed information, treatment education, field mapping, infestation control and eradication, early detection and response, and cost-share or discounted product incentives. Local contact information for the Weed and Pest Control Districts within the study area includes the following:

- Carbon County Weed and Pest (307-324-6584)
- Albany County Weed and Pest (307-742-4469)

6.3 State Programs

6.3.1 Wyoming Department of Environmental Quality

The WDEQ WQD administers the Nonpoint Source Program, which solicits funding proposals under Section 319(h) of the Clean Water Act that address nonpoint sources of pollution within the state of Wyoming. Funded proposals usually address multiple program objectives such as BMP installation, agriculture and urban, information and education, and BMP effectiveness or water quality monitoring. Program funding depends upon federal budget appropriations and the annual fund allocation from the EPA to the state of Wyoming. Section 319 grant funds are available to local, state, and federal agencies; nongovernmental organizations; and private individuals who implement projects that reduce nonpoint source pollution and improve the quality of surface water and groundwater. Information regarding program eligibility, priorities, and applications is available at the Wyoming NPS Program website (http://deq.wyoming.gov/wqd/non-point-source)

6.3.2 Wyoming Game and Fish Department

The following summary of funding assistance available from the Wyoming Game and Fish Department (WGFD) is quoted from the Water Management & Conservation Assistance Program Directory (WWDC, 2014). The full document can be accessed here:

http://wwdc.state.wy.us/wconsprog/2014WtrMgntConsDirectory.html

"The Wyoming Game and Fish Department may offer technical and funding assistance to help landowners, conservation groups, institutions, land managers, government agencies, industry, and non-profit organizations develop or maintain water sources for fish and wildlife. Assistance may also be provided for protecting or improving riparian areas/wetlands, restoring streams, and upgrading irrigation infrastructure in a manner that provides improved fish passage or diversion screening."

Table 6.1-1 Potential Funding Sources.

Agency/Entity	Program Name	Project Type(s)	Internet Site	Telephone	Email
Local					
Saratoga Encampment Rawlins Conservation District	n/a	Liaison, in-kind administrative and technical assistance, program coordination/partnering	www.sercd.org	307-326-8156	joe.sercd@gmail.com
Medicine Bow Conservation District	n/a		www.medbowcd.org	307-379-2221	joan@medbowcd.org
Laramie Rivers Conservation District	n/a		www.LRCD.net	307-721-0072	tony.hoch@lrcd.net
Little Snake River Conservation District	n/a		http://www.carbonwy.com/index.aspx?NID=900	307-383-7860	lsrcd@yahoo.com
Natrona County Conservation District	n/a		http://www.nccdwyoming.com/	307-261-5436 Ext. 103	lisa.ogden@wy.nacdnet.net
NRCS Saratoga Office	n/a	See Federal NRCS	http://www.nrcs.usda.gov/wps/portal/nrcs/site/wy/home/	307-326-5657	mark.shirley@wy.usda.gov
NRCS Medicine Bow Office	n/a		http://www.nrcs.usda.gov/wps/portal/nrcs/site/wy/home/	307-379-2542	mark.shirley@wy.usda.gov
Carbon County Weed and Pest	n/a	Technical assistance, Cost-share programs, inspection	http://www.carboncountyweed.com/	307-320-8001	ccwpsupervisor@gmail.com
Albany County Weed and Pest	n/a		http://www.albanycountyweedandpest.com/	307-742-4469	acwpcd1@wildblue.net
State					
Wyoming Department of Environmental Quality	Nonpoint Source Implementation Grants (319 Program)	Water quality BMPs	http://deq.wyoming.gov/wqd/non-point-source/	307-777-6080	jennifer.zygmunt@wyo.gov
Wyoming Game and Fish Department	Habitat Trust Fund	improving wildlife habitat, promote human understanding and enjoyment of fish and wildlife	https://wgfd.wyo.gov/	Paul Dey (307)777-4505	paul.dey@wyo.gov
	Fish Passage Grants	create and improve upstream and downstream passage of all life stages of fish		Nick Scribner (307)332-7723 Ext 277	nick.scribner@wyo.gov
Wyoming Office of State Lands and Investments	Farm Loan Program	Projects involving most agricultural purposes	http://lands.wyo.gov/	Bridget Hill Director 307-777-6629	bridget.hill1@wyo.gov
	Irrigation Loans Program	Supports small and large agricultural water development projects			
Wyoming Water Development Commission	Wyoming Water Development Program	New development, dams and reservoirs, rehabilitation, water resources planning	http://wwdc.state.wy.us/	307-777-7626	harry.labonde@wyo.gov
	Small Water Project Program	Small reservoirs and stock ponds, wells, pipelines/conveyance, spring developments, windmills, wetland			jodie.pavlica@wyo.gov
Wyoming Wildlife and Natural Resource Trust	n/a	Aquatic and wildlife habitat improvement, including water developments, prescribed burns, invasive plant control, etc.	http://wwnrt.state.wy.us	Mike Massie (District 2) 307-742-5383	n/a
Federal					
Bureau of Land Management	Riparian Habitat Management Program	Projects to maintain, restore, improve, protect and expand riparian/wetland areas	http://www.blm.gov/wy/st/en.html	307-3328-4200 or 4256 (Rawlins FO)	Rawlins_WYMail@blm.gov
	Range Improvement Planning and Development	Reservoirs, pits, spring developments, wells, and associated distribution pipelines	http://www.blm.gov/wy/st/en/info/offices.html		
	Watershed and Water Quality Improvement	Watershed health assessments, BMP implementation			
Bureau of Reclamation	WaterSMART Grants Program	Water conservation, efficiency and marketing	http://www.usbr.gov/WaterSMART/grants.html	Carlie Ronca (Area Manager) 307-261-5671	http://www.usbr.gov/gp/contact.html
Environmental Protection Agency	Targeted Watershed Grants Program	Riparian, wetland, aquatic and upland habitat protection and	http://water.epa.gov/grants_funding/twg/twg_basic.cfm	800-227-8917 (Region 8 EPA)	r8eisc@epa.gov
Farm Service Agency	Conservation Reserve Program (CRP)	Removal of highly erobible lands from production	http://www.fsa.usda.gov/FSA/stateoffapp?mystate=wy&area=home&subject=landing&topic=landing	307-261-5231	gregor.goertz@wy.usda.gov
	Continuous Sign-Up for High Priority Conservation Practices	Riparian buffers, filter strips, grass waterways, salt tolerant vegetation, shallow water areas			
	Emergency Conservation Program (ECP)	Emergency livestock watering conservation during severe drought			
Fish and Wildlife Service	Partners for Wildlife Habitat Restoration	Various fish and wildlife habitat restoration projects	http://www.fws.gov/partners/?viewPage=home	307-332-8719	Mark_J_Hogan@fws.gov
	Wildlife and Sport Fish Restoration (WSFR) Program	provides oversight and/or administrative support for projects related to conservation, enhancing fish/wildlife habitat	http://wsfrprograms.fws.gov/home.html	303-236-4411	david_mcgillivary@fws.gov
	Cooperative Endangered Species Conservation Fund	Grants for voluntary conservation projects related to candidate,listed and proposed endangered species	http://www.fws.gov/endangered/grants/	303-236-4252	Michael_Thabault@fws.gov
	North American Wetlands Conservation Act Program	Various wetlands conservation projects	http://www.fws.gov/birds/grants/north-american-wetland-conservation-act.php	406-549-0732 (Intermountain West Joint Venture)	info@iwjv.org
	Fish and Wildlife Service's (FWS) Challenge Cost Share Program	Projects and partnerships benefitting refuges	http://www.fws.gov/refuges/policiesandbudget/challengecostshareprogram.html	Mountain-Prarie Region 303-236-8102	mountainprairie@fws.gov
Natural Resources Conservation Service	Grazing Lands Conservation Initiative (GLCI) Grants	See websites and/or local contacts for detailed information on these programs	http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/technical/?cid=nrcs143_008456	307-233-6750 (State Office) 307-326-5657 (Saratoga Office) 307-379-2542 (Medicine Bow Office)	astrid.martinez@wy.usda.gov
	Small Watershed Program - PL-566		http://www.nrcs.usda.gov/wps/portal/nrcs/detail/nd/programs/?cid=nrcs141p2_001682		
	Emergency Watershed Protection (EWP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/		
	Watershed Protection and Flood Prevention Operations Program (WFPO)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wfpo/		
	Watershed Surverys and Planning		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wsp/		
	Environmental Quality Incentives Program (EQIP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/		
	Conservation Stewardship Program (CSP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/		
	Regional Conservation Partnership Program (RCPP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmbill/rcpp/		
	Agricultural Management Assistance (AMA)		http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/ama/?cid=stelprdb1242818		
	Conservation Innovation Grants (CIG) Program		http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mo/home/?cid=stelprdb1242734		
	Agricultural Conservation Easement Program (ACEP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/acep/		
	Sage Grouse Initiative (SGI)		http://www.sagegrouseinitiative.com/	Brian Jensen WY State Biologist, 307-233-6740	brian.m.jensen@wy.usda.gov
USDA Rural Development Utilities	See website for program names	Water/Wastewater disposal facilities	http://www.rurdev.usda.gov/utilities_lp.html	Alana Cannon (WY State Director)- 307-233-6709	alana.cannon@wy.usda.gov
US Army Corps of Engineers	See website for program names	Planning, Floodplain Mangement, Flood Damage, Aquatic Ecosystem Restoration	http://www.usace.army.mil/	202-761-0011	hq-publicaffairs@usace.army.mil
Wyoming Landscape Conservation Initiative (WLCI)	See website for program names	habitat projects to improve aquatic habitats and terrain	http://www.wlci.gov/	307-352-0227	blm_wy_wlci_wymail@blm.gov
Private					
Ducks Unlimited	See website for program names	Waterfowl aquatic and upland habitat protection, restoration and enhancement	http://www.ducks.org/conservation/du-regional-offices	Great Plains Regional Office: 701-355-3500	http://www.ducks.org/about-du/contact-du-online
National Fish and Wildlife Foundation	Pulling Together Initiative	Long-term weed management projects	http://www.nfwf.org/whatwedo/grants/Pages/home.aspx	202-857-0166	info@nfwf.org
	Native Plant Conservation Initiative	Restoration of native plant communities			
	Bring Back the Natives Grant Program	Riverine habitat and aquatic species restoration projects			
	Five-Star Restoration Program	Wetland and riparian habitat restoration			
Trout Unlimited	See website for program names	Erosion control, fish habitat structures, willow and other riparian plantings, etc.	http://www.tu.org/	1-800-834-2419 (National Office)	trout@tu.org

- **Habitat Trust Fund:** Funds can be used for acquisitioning, maintaining, or improving wildlife habitat; or for promoting human understanding and enjoyment of the fish and wildlife resource (habitat or information and education projects). Funds can be used for internal projects or paid as grants to an outside entity. All proposals must have a department sponsor and be entered into a department proposal database by early January or early August annually. Project proposals will be prioritized for funding by department staff during January through March and the Wyoming Game and Fish Commission grants preliminary approval in March and final approval in July for funds available in July. No cost share is required but is strongly recommended. Projects should occur in priority habitats or watersheds. Approximately $600,000 to $1,200,000 is allocated annually to projects across Wyoming. For more information related to this fund contact Paul Dey at Wyoming Game and Fish (paul.dey@wyo.gov).

- **Fish Passage Grants:** Funds can be used for creating or improving upstream or downstream passage of all life stages of fish in Wyoming waterways and for screening diversions. Examples include developing fishways or fish ladders, assisting with the replacement of traditional push-up diversion dams with more fish-friendly options, and installing various screening technologies to keep fish from becoming entrained into irrigation ditches. All proposals must have a department sponsor and be entered into a department proposal database by early January annually. Project proposals will be prioritized for funding by department staff during January through March and the Wyoming Game and Fish Commission grants preliminary approval in March and final approval in July for funds available in July. No cost share is required but is strongly recommended. Projects should occur in priority habitats or watersheds. Approximately $25,000 to $90,000 is allocated annually to projects across Wyoming. The project information and application sheet is included with the Digital Library delivered with this report.

Additionally, during its 2014 session, the Wyoming Legislature approved the Governor's budget request to support the local sage-grouse working groups and fund conservation projects benefiting sage-grouse and their habitat. Implementation of projects consistent with local sage-grouse conservation plans will reduce the likelihood of sage-grouse being listed under the federal Endangered Species Act. Requests for Wyoming Sage Grouse Conservation funding must be made on a Project Proposal Form available at: https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Sage%20Grouse/WSGCF_PROJECTPROPOSAL_FORM.pdf. This document along with an additional Wyoming Game and Fish document detailing all available funding opportunities related to sage grouse are included in the digital library delivered with this report.

6.3.3 Wyoming Office of State Lands and Investments

The OSLI is the administrative arm of the Board of Land Commissioners and the State Loan and Investment Board. It is the statutory responsibility of the OSLI to carry out the policy directives and decisions of these two boards. The organizational structure of OSLI consists of the Office of the Director and four divisions: Administrative Services Division, Trust Land Management Division, Field Service Division, and Wyoming State Forestry. Collectively, these divisions serve the trust beneficiaries–Wyoming's school children and state institutions; numerous clients in agriculture, mineral, timber, transportation, communication, public utility, recreation, tourism and other Wyoming industries; local government entities; state and federal agencies; and the resident and nonresident general public.

- The Farm Loan Program, established in 1921, provides long-term real estate loans to Wyoming's agricultural operators. The use of this program has been expanded over the years to also include loans for the purchase of livestock and to assist beginning agricultural producers. These loans are made for a wide range of agricultural purposes, including as most applicable to the potential projects identified in Chapter 5, purchasing, constructing or installing equipment and/or improvements necessary to maintain or improve the earning capacity of the farming operation. Eligible applicants include individuals whose primary residence is in Wyoming and legal entities with a majority of the ownership meeting the individual residency requirements. More information is available at: http://lands.wyo.gov/grantsloans/loans/farm

- The Irrigation Loans Program, established in 1955, is designed to support small and large agricultural water development projects. The Legislature has allocated a total of $275 million for loans under the Farm Loan Program, and $20 million for the Irrigation Loan Program. Both programs are funded from the Wyoming Permanent Mineral Trust Fund. Joint Powers Act Loan Program was established in 1974 and the Legislature authorized the Joint Powers Act Loan Program to benefit local communities for infrastructure needs. These loans are approved from funds within the state's Permanent Mineral Trust Fund. These programs are an aid to cities, counties and special districts in providing needed government services and public facilities.

6.3.4 Wyoming Water Development Commission

The WWDC is responsible for coordinating, developing, and planning Wyoming's water and related land resources. The commission, which consists of ten members who are appointed by the governor with approval of the Senate, represents the four-state water divisions and the Wind River Reservation. Appointments are for a term of 4 years and a political split on the commission is required. Clients served by the commission include irrigation districts, conservancy districts, municipalities, water and sewer districts, joint powers boards, improvement and service districts, counties, and state agencies.

The WWDC administers and develops financing recommendations for the Wyoming Water Development Program, which was defined as the following by W.S. 41-2-112(a):

> *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.

6.3.4.1 Wyoming Water Development Program

The main Wyoming Water Development Program encompasses new development, dams and reservoirs, rehabilitation, water resources planning, and master planning. Information described below was abstracted from the Operating Criteria of the Wyoming Water Development Program (*http://wwdc.state.wy.us/opcrit/final_opcrit.pdf*) and from a form titled *Information for New Applicants* (*http://wwdc.state.wy.us/projappl/New_Ap_Info.pdf*).

The most current information on funding is important to review before submitting an application because WWDC's policies and procedures can and do change over time in response to legislative direction and/or commission action. Review of information available at the above websites and contact with the WWDC staff is recommended before beginning the application process.

- **New Development Program** – The New Development Program develops presently unused and/or unappropriated waters of Wyoming.
- **Rehabilitation Program** – The Rehabilitation Program provides funding assistance for the improvement of water projects completed and in use for at least 15 years.
- **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.
- **Water Resource Planning** – The Wyoming Water Development Commission serves as the water development planning agency for the state of Wyoming. In this capacity, the WWDC can provide the following assistance to project sponsors:
    - **Basin-Wide Plans** – The program serves to develop basin-wide plans for each of the state's major drainage basins.
    - **Master Plans** – The program provides a service to municipalities, districts, and other entities to assist in preparing planning documents that serve as master plans for future water supply systems and improvements. The plans are a framework for the entities to establish project priorities and to perform the financial planning necessary to meet those priorities. These plans can assist entities in preparing the reports necessary to achieve federal funding assistance for water development and other water-related projects.
- **Groundwater Grant Program** – The primary purpose of the program is to inventory the available groundwater resources in the state. The program also serves to assist communities in developing efficient water supplies. Municipalities and special districts that purvey drinking water are eligible

to receive up to $400,000 in grant funds if 25 percent of the total project costs will be paid by local matching funds.

New Development Program. This program provides technical assistance and funding to develop waters of the state that are currently unused and/or unappropriated. The program encompasses a wide range of projects, including the following types:

- Multiple Purpose (including among other uses, two or more of the following: agriculture, recreation, environmental, and erosion control)
- New Storage (e.g., dams and reservoirs less than 2,000 acre-feet)
- New Supply (e.g., deep wells, alluvial wells, diversion dams)
- Watershed Improvement (for components whose primary function or benefit is water development)
- Recreation.

These project types are listed above in the order of preference assigned by the WWDC when determining what projects to pursue among all of the applications received for funding.

Rehabilitation Program. The Rehabilitation Program addresses the improvement of water projects completed and in use for at least 15 years to assist in keeping existing water supplies effective and viable for the future. The Rehabilitation Program can improve existing agricultural storage facilities or conveyance systems to ensure safety, decrease operation and maintenance costs, and increase the efficiency of agricultural water use. The types of projects supported relevant to this watershed are essentially the same as listed above for the New Development Program.

On-farm improvements (e.g., gated pipe, side rolls, center pivots, and related facilities and/or equipment such as pumps and power lines) are excluded from WWDC funding under both the New Development and Rehabilitation Programs.

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. Ill [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. Ill; and a percentage (0.5 percent) of the revenues which accrue to the state’s severance tax distribution account. Legislative approval must be granted before 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 developing reservoir operating plans, recreation, environmental enhancement, flood control, erosion control and hydropower uses should be explored as secondary purposes.

Key Criteria and Procedures. An application for funding under the New Development and Rehabilitation Programs must meet the following key criteria most applicable to potential projects as identified in Chapter 4.0:

- *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 or provide other adequate security for the anticipated state construction loan.*
- *The proposed project must serve… 2,000 or more acres of irrigated cropland, or must rehabilitate watershed infrastructure, which will develop or preserve the beneficial use of water in a watershed. The watershed rehabilitation projects must possess an estimated minimum useful life span of twenty-five (25) years and demonstrate that sufficient public benefits will accrue to justify construction of the anticipated improvement.*

Important procedures, deadlines and requirements for applications to the New Development and Rehabilitation Programs include, but are not necessarily limited to, the following:

- A fee of $1,000 must be submitted with the initial project applications; the fee does not apply to projects advanced to the next level of study or to construction.
- A certified resolution passed by the governing body of the sponsoring entity must accompany an application for a Level II study or Level III construction. This requirement may be deferred if the applicant is in the process of forming a public entity.
- A public entity must be in place before a Level II study or Level III construction can commence, with certain exceptions discussed below.
- The due date for new project applications is August 15 of each year; the due date for applications for advancing to the next study level or construction funding is October 1 of each year.

Two important criteria that apply specifically to dam and reservoir projects include the following:

- *For 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, expenses associated with final engineering design and required National Environmental Policy Act reviews, including but not limited to environmental assessments and environmental Impact statements, are eligible components of a Water Development Program Level II, Phase III Study Project.*
- *For dam and reservoir projects, the Commission may waive sponsor eligibility requirements through Level II, Phase II. However, the eligible entity requirements shall be met prior to initiation of Level II, Phase III activities described herein.*

Financial Plan. The current standard terms of the Wyoming Water Development Program financial plan are summarized as follows:

- A 67 percent grant to 33 percent loan mix.
- Minimum 4 percent loan interest rate (current rate is 4 percent, but legislature may increase the rate).
- Maximum 50-year term of loans; term shall not exceed the economic life of project.
- Payment of loan interest and principal may be deferred up to 5 years after substantial completion at WWDC's discretion under special circumstances.

In the document titled *Information for New Applicants*, the following additional relevant information is provided regarding financial terms:

- *The best available project financial terms include a grant for Level I and Level II expenses, a grand of 75% of the Level III costs, a loan of 25% of the Level III costs with an interest rate of four percent (4%) and a term equal to the economic life of the project/improvements or fifty (50) years, whichever is less. Principal and interest payments may be deferred for five (5) years after project completion. However, these favorable terms will be granted when a project is essential and the project sponsor has a very limited ability to pay.*
- *Those sponsors who feel more favorable terms are warranted due to a limited ability to pay must make a formal presentation to the Commission documenting their case. Sponsors electing to pursue this option should be aware that the Commission is reluctant to deviate from this standard and such requests will be denied unless they are clearly documented and justified.*

The commission will evaluate whether or not a project will be funded for Level III construction following review of the results of Level II studies. If the commission determines that the project should not advance because of high repayment costs (as determined by an analysis of the sponsor's ability to pay and after other funding sources have been considered), the sponsor has the option of making a formal presentation to the WWDC relative to the sponsor's ability and willingness to pay. This presentation must address the need for the project, the direct and indirect benefits of the project, and any other information the sponsor believes is relevant to the commission's final decision.

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. Applicant may then know if there is a viable project before 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 2-year duration with the study being completed the first year and the sponsor forming the 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. Because evaluating the feasibility of new dams is complex, the applicant will know if the proposed reservoir is feasible before becoming a public entity. However, the applicant must be a public entity before applying for Level II, Phase III funding.

6.3.4.2 Small Water Project Program

The SWPP is intended to be compatible with the conventional WWDC program described above. Small water projects are defined as providing multiple benefits where the total estimated project costs (including construction, permitting, construction engineering, and land procurement) are less than $135,000 or where WWDC's maximum financial contribution is 50 percent of project costs or $35,000, whichever is less. SWPP funding is a "one-time" grant so that operation and maintenance costs are not included. Loans are not available under the SWPP.

Eligibility. The kinds of projects eligible for SWPP funding include, but are not necessarily limited to:

- small reservoirs and stock watering ponds (up to 20 feet high and 20 acre-feet capacity);
- wells;
- pipelines and conveyance facilities;
- spring developments;
- windmills;
- wetland developments;
- solar platforms; and
- irrigation infrastructure.

Note that at the time of this report the Wyoming Water Development Office has recommended environmental types of projects (i.e. stream channel projects) be eligible for funding through the SWPP. This recommendation is currently in draft form and is out for public comment.

Irrigation works and projects may be eligible if they are already documented in a conservation district's existing watershed plan, a resource management plan, or an environmental evaluation prepared by a state or federal agency. These types of projects are only eligible if they cannot be addressed by the Water Development Program. Benefits associated with SWPP projects may include, but are not necessarily limited to, the following:

- Improved water quality

- Habitat and water for fish and wildlife
- Improved riparian habitat
- Increased recreational opportunities.

These projects may address environmental concerns by providing water supplies to support plant and animal species and serve as instruments to improve rangeland conditions.

Funding can only be provided to eligible public entities including but not necessarily limited to conservation districts, watershed improvement districts, water conservancy districts, and irrigation districts.

Application, Evaluation and Administration. Details of the application and evaluation process and program administrative procedures are provided in the Small Water Project Program Operating Criteria available online as noted previously. Some key aspects of the process and procedures applicable to the potential projects identified in Chapter 5 include the following:

- Planning for small water projects will be generated by a WWDC watershed study or equivalent as determined by the WWDO. A watershed study will incorporate, at a minimum, available technical information that describes conditions and assessments of the watershed including hydrology, geology, geomorphology, geography, soils, vegetation, water conveyance, infrastructure, and stream system data. A plan outlining the site-specific activities that may remediate existing impairments or address opportunities beneficial to the watershed shall also be included. A watershed study may identify one or more projects that may qualify for SWPP funding. A professional engineer and/or geologist (as appropriate) shall certify any analysis submitted unless generated by a federal agency.
- Applications shall be received by January 1 of each calendar year. Applications meeting criteria requirements will be considered during the regularly scheduled WWDC meeting in March. Applications shall include a project application, sponsor project referral, project location map, project cost estimates, and any letters of authorization or commitment of participation that may be available from other funding sources.
- Projects that improve watershed condition and function, provide multiple benefits, and meet the funding criteria specified in W.S. 99-3-703(j)(vii) or W.S. 99-3-704(g)(vii), as described in B.4 herein, are eligible for consideration.
- The sponsoring entity will be required to address the WWDC and provide testimony and other additional supporting evidence that justifies SWPP funding whenever the public benefit documentation, submitted with the application, is deemed to be insufficient by the WWDC.

6.3.5 Wyoming Wildlife and Natural Resource Trust

The Wildlife and Natural Resource Trust, created in 2005, is an independent state agency governed by a nine-member citizen board appointed by the Governor. Funded by interest earned on a permanent account, donations, and legislative appropriation, the purpose of the program is to enhance and conserve wildlife habitat and natural resource values throughout the state. Any project designed to improve wildlife habitat or natural resource values is eligible for funding. The office is centrally located in Riverton, Wyoming.

Wildlife and Natural Resource Trust funding is available for a wide variety of projects throughout the state, including natural resource programs of other agencies. Some examples include the following:

- Projects that improve or maintain existing terrestrial habitat necessary to maintain optimum wildlife populations may include grassland restoration, changes in management, prescribed fire, or treatment of invasive plants.
- Preservation of open space by purchase or acquisition of development rights, contractual obligations, or other means of maintaining open space.
- Improvement and maintenance of aquatic habitats, including wetland creation or enhancement, stream restoration, water management or other methods.
- Acquisition of terrestrial or aquatic habitat when existing habitat is determined crucial/critical, or is present in minimal amounts, and acquisition presents the necessary factor in attaining or preserving preferred wildlife or fish population levels.
- Mitigation of impacts detrimental to wildlife habitat, the environment, and the multiple use of renewable natural resources, or mitigation of conflicts and reduction of potential for disease transmission between wildlife and domestic livestock.

Allowable projects under this program that are potentially relevant to this watershed management plan study include:

- Improvement and maintenance of existing aquatic habitat necessary to maintain optimum fish populations.
- Conservation, maintenance, protection and development of wildlife resources, the environment, and Wyoming's natural resource heritage.
- Participation in water enhancement projects to benefit aquatic habitat for fish populations and allow for other watershed enhancements that benefit wildlife.

Funding is by grant with no matching funds required. Non-profit and governmental organizations (including watershed improvement districts, conservation districts, etc.) are eligible for funding by WWNRT. The application form has been included in the digital library and more information on the application process is available here: https://sites.google.com/a/wyo.gov/wwnrt/how-to-apply

6.4 Federal Agencies

6.4.1 Bureau of Land Management

- **<u>BLM's Riparian Habitat Management Program</u>** offers the opportunity to coordinate with outside interests on riparian improvement projects. The goal of BLM's riparian-wetland management is to maintain, restore, improve, protect, and expand these areas so they are in proper functioning condition for their productivity, biological diversity, and sustainability. The overall objective is to achieve an advanced ecological status, except where resource management objectives, including proper functioning condition, would require an earlier successional stage. The goal includes aggressive riparian-wetland information, inventory, training, and research programs as well as improving the partnerships and cooperative management processes.

  Partnerships have been available for riparian improvement projects and for research into riparian issues. Funding is available on an annual basis subject to budget allocations from Congress. All submitted cooperative projects compete for the funds available in the riparian program.

- **<u>Range Improvement Planning and Development</u>** is a cooperative effort not only with the livestock operator but also with other outside interests including the various environmental/conservation groups. Water development, whether it be for better livestock distribution or improved wetland habitats for wildlife, is key to healthy rangelands and biodiversity. Before actual range improvement development occurs, an approved management plan must be in place. These plans outline a management strategy for an area and identify the type of range improvements needed to accommodate that management. Examples of these plans are Coordinated Resource Plans, Allotment Management Plans, and Wildlife Habitat Management Plans.

  All rangeland improvement projects on lands administered by the Bureau of Land Management require the execution of a Permit. Although there are a couple of methods for authorizing range improvements on the public lands, Cooperative Agreement for Range Improvements form 4120-6 is the method most commonly used. This applies equally to range improvement projects involving water such as reservoirs, pits, springs, and wells including any associated pipelines for distribution. The major funding source for the Bureau of Land Management's share comes from the range improvement fund which is generated from the grazing fees collected. There, too, is a limited amount of funding from the general rangeland management appropriations. If the cooperator is a livestock operator, their contributions come generally in the form of labor. There are times they also provide some of the material costs as well. Contributions from the conservation/environmental interests is monetary and often come in the form of grants. They also contribute labor on occasion.

- **<u>BLM's Watershed and Water Quality Improvement</u>** efforts are undertaken in a cooperative approach with the State of Wyoming, Conservation Districts, livestock operators and various conservation groups. Wyoming's BLM is partnering in the implementation of several Section 319 watershed plans state-wide.

  It is anticipated that as the Wyoming Department of Environmental Quality (WDEQ) continues the inventory of waters of the State and the identification of Impaired and/or Threatened water bodies, BLM will be partnering with the WDEQ to improve water quality in water bodies on Public Lands. In the course of developing watershed plans or TMDL's for these watersheds, BLM will be routinely involved in watershed health assessments, planning, project implementation and Best Management Practice (BMP) monitoring.

  Now, and in the future, the goals of cooperative watershed projects will typically be the restoration and maintenance of healthy watershed function. These goals will typically be accomplished through approved BMP's, e.g. prescribe burns, vegetation treatments, instream structures, too enhance vegetation cover, control accelerated soil erosion, increase water infiltration and enhance stream flows and water quality.

  Currently, in response to the Clean Water and Watershed Restoration initiative and associated funding increases, BLM is expanding its efforts to address water quality and environmental concerns associated with abandoned mines. This work will also be accomplished, in cooperation with the State Abandoned Mine Lands Division, on a priority watershed basis and will employ appropriate BMP's to address identified acid mine drainage and runoff problems from mine tailings and waste rock piles.

6.4.2 Bureau of Reclamation

The USBR mission is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the public. The USBR has a major responsibility, in partnership with states, water users, and other interested parties, to help improve water resources and the water use efficiency in the western United States. After more than 100 years, USBR's primary role has evolved from one of water resource development to one of water resource management. More efficient water use is a key component of USBR's water resource management strategy.

The Sustain and Manage America's Resources for Tomorrow (WaterSMART) Program establishes a framework to provide federal leadership and assistance on the efficient use of water, integrating water and energy policies to support the sustainable use of all natural resources, and coordinating the water conservation activities of various department bureaus and offices. Through the WaterSMART Program, the department is working to achieve a sustainable water management strategy to meet the nation's water needs through projects that conserve and use water more efficiently, increase the use of renewable energy and improve energy efficiency, protect endangered and threatened species, facilitate water markets, or carry out other activities to address climate-related impacts on water or prevent any water-related crisis or conflict.

A major component of WaterSMART is the Water and Energy Efficiency Grant Program, through which USBR provides funding in two funding groups. In Funding Group I, up to $300,000 in federal funding is available per project, for smaller on-the-ground projects that can be completed within 2 years. In Funding Group II, up to $1 million in funding is available for larger, phased, on-the-ground projects that may take up to 3 years to complete. Water and Energy Efficiency Grants are awarded through a west-wide competitive process that requires a minimum 50 percent cost share by the recipient.

The Water Conservation Field Services Program (WCFSP), by contrast, provides smaller amounts of funding ($100,000 per project maximum) through local competitions within a region or area. The projects funded are generally smaller in scope than Water and Energy Efficiency Grant projects and are focused on fundamental conservation improvements as identified in water conservation plans developed by water users. Financial assistance provided through the WCFSP also requires a minimum 50 percent cost share by the recipient. Funding opportunity announcements for WaterSMART grants and the WCFSP can be found at http://www.grants.gov/.

6.4.3 Environmental Protection Agency

Established in 2003, the Targeted Watersheds Grant Program is designed to encourage successful community-based approaches and management techniques to protect and restore the nation's watersheds. The Targeted Watersheds Grant program is a competitive grant program based on the fundamental principles of environmental improvement: collaboration, new technologies, market incentives, and results-oriented strategies. The Targeted Watersheds Grant Program focuses on multi-faceted plans for protecting and restoring water resources that are developed using partnership efforts of diverse stakeholders (http://water.epa.gov/grants_funding/twg/twg_basic.cfm). Organizations eligible for funding include nonprofits, tribes, and local governments. The assistance provided consists of grants for up to 75 percent of the total project costs. A match of at least 25 percent is required. The typical median amount awarded is $700,000 with a typical range of $300,000 to $900,000. It is important to note that application must be made by the governor, and that the competition for these grants is keen.

6.4.4 Farm Service Agency

The FSA administers three different programs that may be applicable to some of the alternative projects identified in Chapter 5. Each of these three programs is briefly discussed below. The FSA is a member agency of the USDA. Programs administered through the FSA are offered through local county committees. Technical assistance needed for implementing FSA programs is provided through the NRCS. FSA programs available are the Conservation Reserve Program, the Emergency Conservation Program, and the Continuous Sign-up for High Priority Conservation Practices.

- **Conservation Reserve Program (CRP)** offers agricultural producers annual rental payments to remove highly erodible cropland from production. Farmers and ranchers establish long-term conservation practices on erodible and environmentally sensitive land. In exchange, they receive 10–15 years of annual rental payments and cost-share assistance. CRP is a voluntary program specifically for highly erodible lands currently in active production planted two of the five most recent crop years. Land offered for CRP is ranked according to environmental benefit for wildlife habitat, erosion control, water quality, and air quality.

- **Emergency Conservation Program (ECP)** provides emergency funding and technical assistance for farmers and ranchers to rehabilitate farmland damaged by natural disasters and for carrying out emergency water conservation measures for livestock during periods of severe drought. Participants receive cost-share assistance of up to 75 percent of the cost to implement approved emergency conservation practices, as determined by county FSA committees. Some of the conservation practices included are removing debris, restoring fences and conservation structures, and providing water for livestock in drought situations.

- **Continuous Sign-Up for High Priority Conservation Practices** provides management flexibility to farmers and ranchers to implement certain high priority conservation practices on eligible land. Land must meet the requirements of CRP and be determined by the NRCS to be eligible and suitable for the following:

Riparian buffers	Shelter belts	Salt tolerant vegetation
Filter strips	Living snow fences	Shallow water areas for wildlife
Grass waterways	Contour grass strips	

  This is a cost-share program that offers rental rates based on the average value of dryland cash rent with an additional financial incentive of up to 20 percent of the soil rental rate for field windbreaks, grass waterways, filter strips and riparian buffers. An additional 10 percent may be added if the land is located in an EPA-designated wellhead protection area. A provision for cost share of up to 50 percent of the cost of establishing permanent cover is available.

6.4.5 Fish and Wildlife Service

Technical and financial assistance are available to private landowners, profit or nonprofit entities, public agencies and public-private partnerships under several programs addressing the management, conservation, restoration or enhancement of wildlife and aquatic habitat (including riparian areas, streams, wetlands and grasslands). These programs include, but are not necessarily limited to:

- **Partners for Fish and Wildlife Program** serves as the primary tool for conservation delivery on privately owned land for the USFWS. The program provides technical and financial assistance to private landowners and tribes on a voluntary basis to help meet the habitat needs of federal trust species and conservation partner-designated species of interest. The program targets habitats that are in need of restoration or enhancement such as riparian areas, streams, wetlands, and grassland. Field biologists work one-on-one with landowners and partners to plan and implement a variety of projects, including grazing lands management, sage steppe enhancement, stream habitat improvement and fish passage, invasive species removal, and wetland establishment.

- **Wildlife and Sport Fish Restoration (WSFR) Program** works with states, insular areas, and the District of Columbia to conserve, protect, and enhance fish, wildlife, their habitats, and the hunting, sport fishing, and recreational boating opportunities they provide. The WSFR Program provides oversight and/or administrative support for the following grant programs: Wildlife Restoration Grant Program, Sport Fish Restoration Grant Program, Boating Infrastructure Grant Program, State Wildlife Grant Program, Tribal Wildlife Grant Program, and Tribal Landowner Incentive Grant Program.
- **Cooperative Endangered Species Conservation Fund** (Section 6 of the ESA) provides grants to states and territories to participate in a wide array of voluntary conservation projects for candidate, proposed, and listed species. The program provides funding to states and territories for species and habitat conservation actions on nonfederal lands. States and territories must contribute a minimum nonfederal match of 25 percent of the estimated program costs of approved projects, or 10 percent when two or more states or territories implement a joint project.
- **North American Wetlands Conservation Act (NAWCA) Grant Program** promotes long-term conservation of wetlands ecosystems and the waterfowl, migratory birds, fish and wildlife that depend upon such habitat. Conservation actions supported are acquisitioning, enhancing, and restoring wetlands and wetlands-associated habitat. This program encourages voluntary, public-private partnerships. Public or private, profit or nonprofit entities, or individuals establishing public/private sector partnerships are eligible. Cost-share partners must at least match grant funds with nonfederal monies.
- **Fish and Wildlife Service's (FWS) Challenge Cost Share Program** started in 1988 as a way to enhance partnerships with state and local governments, individuals, and public and private groups. The program enables the FWS to manage cooperatively its natural and cultural resources and fulfill stewardship responsibilities to fish and wildlife management. Under this program, projects must occur on a refuge or directly benefit a refuge. The program encourages refuge managers to form partnerships and leverage allocated funds to complete the projects. Appropriated funds may be used to pay for no more than 50 percent of the cost of a project. Nonfederal sources, including state/local governments, private individuals/ organizations, business enterprises, and philanthropic and charitable groups provide the matching 50 percent cost share. The cooperator share may be a nonmonetary contribution. Cooperative agreements are signed with the cost-share partners

More information regarding these programs and others is available at: http://www.fws.gov/grants/programs.html

6.4.6 Forest Service

A number of federal laws direct or authorize watershed management on National Forest Service lands. Some of these laws provide broad authority while others deal more narrowly with specific watershed management activities. The objectives of the Forest Service watershed management program are to protect and enhance soil productivity, water quality, water quantity, and timing of water flows and to maintain favorable conditions of stream flow and continuous production of resources from National Forest System watersheds. The policy of the Forest Service is to implement watershed management activities on National Forest System lands in accordance with general objectives of multiple use and the specific objectives in the forest land management plans for the area involved. It is also the intent to design management activities of other resources to minimize short-term impacts on soil and water resources and to maintain or enhance long-term productivity, water quality, and water quantity.

The Clean Water Action Plan provides broad water quality direction for the Forest Service. Specific direction for water quality is contained in the Land and Resource Management Plan for each national forest. The forests in Wyoming are in the process of completing the Inland West Water Reconnaissance that will provide a classification of watersheds and stream reach conditions. Forest service water quality programs are coordinated with the WDEQ and other appropriate agencies. The Forest Service also has a water rights program that is coordinated with the Wyoming SEO. The Forest Service, in conjunction with other federal, state, and local agencies, provides watershed management and condition training. T-WALK and Proper Functioning Condition surveys are field methods used to assess stream reach and other waterbody conditions.

6.4.7 Natural Resources Conservation Service

The NRCS administers a number of funding and technical assistance programs applicable to many of the alternative projects. These programs are briefly described below. The NRCS provides leadership in a partnership effort to help people voluntarily conserve, improve, and sustain natural resources on private lands. The purpose and mission of the agency is to help landowners treat every acre of their private property according to its needs and within its capability. The treatment includes a balance between the land use for economic return and protecting its ability to be productive from generation to generation.

Conservation planning is key to successful land stewardship as NRCS employees and landowners work together to tailor-make voluntary conservation plans that meet the specific needs of individual customers. The NRCS workforce has the technical expertise and field experience to help land users solve their natural resource challenges and maintain and improve their ability to thrive economically. They are highly skilled in many scientific and technical specialties, including soil science, soil conservation, range conservation, engineering, agronomy, biology, geology, hydrology, forestry, cultural resources, GIS, and economics. The NRCS conducts natural resource inventories and assessments to indicate status, conditions and trends of natural resources on private lands. This resource information and technology include science-based technical tools, technical guides, and performance specifications and standards that ensure quality and consistency of conservation planning and application across the nation.

Technical and cost-share assistance is available through the NRCS. This assistance includes designs, specifications, construction, and management and financial help for practice and system installation. Local people, individually and collectively, decide how to use NRCS capabilities in the natural resource conservation planning and application process. The role of NRCS is to support and facilitate these individual and local decisions based on good resource information, whether that is a grazing management plan or layout for an irrigation system.

The NRCS provides technical assistance for the following programs in Wyoming:

- **Grazing Lands Conservation Initiative (GLCI):** Accelerated range management technical assistance is available to producers in every county to support this initiative.
- **Small Watershed Program (PL-566):** NRCS works through local government sponsors to help solve natural resource and related economic problems on specific watersheds.
- **Snow, Water and Climate Services:** Snow survey crews collect information on snowpack conditions to provide Wyoming water users with forecasts of seasonal water supplies. This helps determine available water to meet agricultural, industrial, recreational, and urban area needs.
- **Soil Surveys:** Soil surveys provide a field-based scientific inventory of soil resources and information on the potentials and limitations of each soil. This information assists in determining the best uses of the land based on soil type.
- **Plant Materials:** Wyoming NRCS is serviced by the Plant Materials Center (PMC) at Bridger, Montana. The Plant Materials Program identifies, selects, and releases superior performing plant collections for a variety of conservation uses.

NRCS administers the following Landscape Planning Programs:

- **Emergency Watershed Protection (EWP) Program** assists in implementing emergency measures, including the purchase of flood plain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed.
- **Watershed Protection and Flood Prevention Operations (WFPO) Program** provides technical and financial assistance to entities of state and local governments and tribes (project sponsors) for planning and installing watershed projects.
- **Watershed Surveys and Planning (WSP)** authorizes the NRCS to cooperate with federal, state, and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater, sediment and to conserve and develop water and land resources.

NRCS administers the following 2014 Farm Bill programs:

- **EQIP:** Through EQIP, technical assistance, cost share, and incentive payments are available to agricultural producers to implement conservation practices that improve water quality, enhance grazing lands, and/or increase water conservation.
- **Conservation Stewardship Program (CSP)** encourages land stewards to improve their conservation performance by installing and adopting additional activities, and improving, maintaining, and managing existing activities on agricultural land and nonindustrial private forest land.
- The **Regional Conservation Partnership Program (RCPP)** promotes coordination between the NRCS and its partners to deliver conservation assistance to producers and landowners. The NRCS provides assistance to producers through partnership agreements and through program contracts or easement agreements. Assistance is delivered in accordance with the rules of EQIP, CSP, Agricultural Conservation Easement Program (ACEP) and HFRP, and in certain areas the Watershed Operations and Flood Prevention Program.
- The **Agricultural Management Assistance (AMA)** provides financial assistance to agricultural producers to address resource issues such as water management, water quality, invasive species control, and erosion control by incorporating conservation into their farming or ranching operations. The purpose of the AMA is to assist producers in reducing risk to their operation.
- **Conservation Innovation Grants (CIG) Program** is intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging federal investment in environmental enhancement and protection, in conjunction with agricultural production. Under CIG, EQIP funds are used to award competitive grants to nonfederal governmental or nongovernmental organizations, tribes, or individuals.
- The **ACEP** provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements (ALE) component, NRCS helps tribes, state and local governments and nongovernmental organizations protect working agricultural lands and limit nonagricultural uses of the land. Under the Wetlands Reserve Easements (WRE) component, the NRCS helps to restore, protect and enhance enrolled wetlands.
- **Partners** NRCS collaborates with many local, state, and federal agency partners to provide the maximum technical assistance to people who work the land and to leverage the federal contributions to natural resource conservation on private lands. The state's 34 conservation districts take a special place in the partnership and the natural resource conservation delivery system. Units of local government, conservation districts operate on the premise that local people know the most about local natural resource needs. Conservation districts link the NRCS to local communities and to local priorities for natural resource conservation.
- **Sage Grouse Initiative** is an organization of public and private entities conserving at-risk wildlife through voluntary cooperation, incentives, and community support. The Natural Resources Conservation Service launched SGI in 2010, applying the power of the Farm Bill to target lands where habitats are intact and sage grouse numbers are highest – covering 78 million acres across 11 western states. While private lands are the primary focus, the Initiative serves as a catalyst for public land enhancements. The Sage Grouse Initiative applies Farm Bill dollars and certifies conservation projects in the core areas for sage grouse with a dual goal of sustaining rangelands

and sage grouse. In addition to directing dollars to private lands where 40 percent of sage grouse live, SGI dollars can be applied on public lands where ranchers have grazing leases. For more details related to funding opportunities please contact your local NRCS office. Detailed information related to the Sage Grouse Initiative can be found at the following website: http://www.sagegrouseinitiative.com/

Information on all NRCS programs is available from the local contacts listed Table 6.1-1.

6.4.8 US Army Corps of Engineers

The Army Corps of Engineers has civil responsibilities for flood damage reduction, hydroelectric power generation and navigational improvement as well as other water and land resource problems and needs including environmental preservation and enhancement, ecosystem management and comprehensive flood plain management. The Corps is responsible for a worldwide military construction program, an extensive environmental program and a broad national civil works program.

The Corps of Engineers is authorized to provide technical assistance to local communities, States and federally recognized Indian Tribes in support of their efforts to alleviate flooding impacts, reduce erosion and otherwise plan for the wise and prudent use of the nation’s water and related land resources. They also have authority to construct certain water resources related projects and respond to water resource needs.

- **Planning Assistance to States.** This program provides for assistance in preparation of plans for the development, utilization and conservation of water and related land resources. The Corps provide technical planning assistance in all areas related to water resources development such as bank stabilization, sedimentation, water conservation, ecosystem and watershed planning and water quality. Assistance is limited to $500,000 per state and studies are cost-shared on a 50-50 basis with a non-federal sponsor such as a state, public entity or an Indian Tribe.
- **Floodplain Management Services.** This program provides technical services and planning guidance for support and promotion of effective flood plain management. Flood and flood plain data are developed and interpreted with assistance and guidance provided in the form of “Special Studies” on all aspects of flood plain management planning. All services are provided free of charge to local, regional, state or non-federal public agencies. Federal agencies and private entities have to cover 100% of costs.
- **Flood Damage Reduction Projects.** This program provides structural and non-structural projects to reduce damages caused by flooding and focuses on solving local flood problems in urban areas, towns and villages. The Corps works with the project sponsor to define the flood problem, evaluate solutions, select a plan, develop the design and construct a project. A feasibility study is conducted to identify potential projects with the first $100,000 of the cost Federal. Any cost above this amount is cost-shared 50-50 with the sponsor in the form of cash and in-kind services. Construction lands, easements, rights-of-way, relocations and disposal and 5% of the projects

costs are the sponsor's responsibility. Operation and maintenance and a maximum of 50% of total project cost are the sponsor's responsibility.

- **Project Modification for Improvement of Environment.** The purpose of this program is to modify structures or operation of previously constructed water resources projects to improve environmental quality, especially fish and wildlife values. A study, at federal expense, is initiated followed by a feasibility plan that is cost-shared 25% by the sponsor.
- **Aquatic Ecosystem Restoration.** This effort is for restoration of historic habitat conditions to benefit fish and wildlife resources. This is primarily to provide structural or operational changes to improve the environment such river channel reconnection, wetland creation or improving water quality. Conditions are similar to the Project Modification program with sponsor cost-share being 35%.
- **Water Resources Projects.** The purpose of this program is to construct larger projects for flood damage reduction and to provide technical assistance in resolving more complex water resource problems. It is used to evaluate projects costing more than $10 million that include purposes of flood control, water supplies, water quality, environmental protection and restoration, sedimentation or recreation. This would include reservoirs, diversions, levees, channels or flood plain parks as examples. The Corps works with a non-federal sponsor to define the flood or water resource related problem or opportunity, evaluate flood control or solutions, select a plan, develop a design and construct a project. This requires special authorization and funding from Congress with a reconnaissance study being federal cost. A feasibility study to establish solutions is cost-shared 50% by the non-federal sponsor with 35 to 50% of construction cost the responsibility of the sponsor.
- **Support for Others Program.** This program provides for environmental protection and restoration or facilities and infrastructure. This includes Environmental Planning and Compliance, Economic and Financial Analyses, Flood Plain Management, Cultural Resources and General Planning. All costs for these programs are provided by the customer agency.
- **Regulatory Authority/Responsibility.** The Corps of Engineers has regulatory authority under the Clean Water Act and the River and Harbor Act. The purpose of these laws is to restore and maintain the chemical, physical and biological integrity of waters of the United States. Section 404 of the Clean Water Act authorizes the Corps to regulate the discharge of dredged or fill material into waters. This would include dams and dikes, levees, riprap, bank stabilization and development fill. There are three kinds of permits issued by the USACE: Individual, Nationwide and Regional General.

6.4.9 Rural Utilities Service

The USDA Rural Development's utilities program is authorized to provide financial assistance for water and waste disposal facilities in rural areas and towns of up to 10,000 people. This program is intended for non-profit corporations and public bodies such as municipalities, counties, and special purpose districts and authorities.

Funding may be obtained through Rural Development only when the applicant is unable to secure funding from other sources at reasonable rates and terms. The applicant must have legal capacity to borrow and repay loans, to pledge security for loans and to operate and maintain the facilities. The applicant must be financially sound and able to manage the facility effectively as well as have a financially sound facility based upon taxes, assessments, revenues, fees or other satisfactory sources of income to pay costs of operating, debt service and reserve. Grants are also available and are used to supplement loans to reduce debt service where necessary to achieve reasonable user rates. Assistance is also available on how to assemble information concerning engineering, financing and management of proposed improvements.

Loans and grants may be used to construct, repair, improve, expand or modify rural water supplies and distribution facilities such as reservoirs, pipelines, wells and pumping stations, waste collection, pumping, treatment or other disposal facilities. This assistance may also be used to acquire a water supply or water right or finance facilities in conjunction with funds from other agencies or those provided by the applicant. These funds can be used to pay legal and engineering fees connected with the development of a facility or pay other costs related to development including rights-of-way or easements and relocation of roads or utilities. Loan terms are a maximum of 40 years, State Statute, or the useful life, whichever is less with interest rates based on current market yields for municipal obligations.

USDA Rural Development also guarantees loans to eligible commercial lenders to improve, develop or finance water or waste disposal facilities in rural areas. This guarantee is a warrant to protect the lender and may cover up to 90% of the principal advanced. The guarantee fee is 1% of the loan amount multiplied by the percent of the guarantee. Interest rates will be negotiated between the lender and the borrower.

6.4.10 Wyoming Landscape Conservation Initiative (WLCI) (FROM WLCI WEBSITE)

The WLCI is a long-term science based effort to assess and enhance aquatic and terrestrial habitats at a landscape scale in southwest Wyoming, while facilitating responsible development through local collaboration and partnerships. The WLCI is composed of numerous committees and teams made up of representatives from the participating agencies. These agencies include: BLM, USGS, US Fish and Wildlife Service, US Forest Service, Wyoming Game and Fish Department, Wyoming Department of Agriculture, Southwest Wyoming County Commissions, Southwest Wyoming Conservation Districts, US National Park Service, NRCS, University of Wyoming, and the US Bureau of Reclamation.

Information gathered through scientific inventory and assessment of species and habitat is combined with local input and knowledge to develop and implement conservation projects. The WLCI conducts regular Local Project Development Team meetings, where public participation is needed and expected. If you have ideas for projects, they can be presented at these meetings or sent to the WLCI Coordination Team through the BLM High Desert District Office at (307) 352-0256 or WLCI_WYMail@blm.gov.

The project application form, project tracking and project ranking score sheet are available from the following website, and have been included in the digital library delivered with this report (http://www.wlci.gov/lpdt-resources).

6.5 Non-Profit and Other Organizations

6.5.1 Ducks Unlimited

Ducks Unlimited, Inc. (DU) is a potential funding source for wetlands and waterfowl restoration projects. Although direct grant funding is limited (to the extent that there is generally about $20,000 to $30,000 available annually statewide), in-kind assistance may be available from the local chapter of DU. Additional information on DU's funding programs and opportunities is available in the Water Management & Conservation Assistance Program Directory referenced previously.

DU offers a waterfowl habitat development and protection program called Matching Aid to Restore States Habitat (MARSH). This is a reimbursement program that provides matching funds for restoring, protecting, or enhancing wetlands. The financial extent of this program is dependent on DU's income within the state. MARSH projects must significantly benefit waterfowl. Projects receiving funding support must be on lands that can demonstrate at least a 30-year project life at a minimum. Groups requesting assistance must be able to demonstrate capacity to execute long-term habitat agreements, deliver and manage projects, and be willing to assume project liability. DU's goal is to match MARSH funds equally with private, state, or federal sources. Their objective is to obtain maximum leverage possible to maximize benefit to waterfowl. Therefore, leveraged projects have a greater likelihood of being approved. Specifics for proposal submission, budget preparation, project development, and receipt of funding can be further explained by the DU local coordinator. The local coordinator can provide additional information relating to the program and provide partner contact opportunities at a local level.

6.5.2 National Fish and Wildlife Foundation

The National Fish and Wildlife Foundation (NFWF) is a private, non-profit, tax exempt organization chartered by Congress in 1984 to sustain, restore and enhance the Nation's fish, wildlife, plants and habitats. NFWF provides grant funding on a competitive basis through their Keystone Initiative Grants and Special Grant Program. Some of the grants/programs that may be applicable to potential projects in the Blacks Fork Watershed Study Area include, but are not limited to the following:

- **Pulling Together Initiative** - provides support on a competitive basis for the formation of local Weed Management Area (WMA) partnerships that engage federal resource agencies, state and local governments, private landowners, and other interested parties in developing long-term weed management projects within the scope of an integrated pest management strategy; minimum 1:1 nonfederal match is required.
- **Native Plant Conservation Initiative** – funding preference for "on-the-ground" projects that involve local communities and citizen volunteers in the restoration of native plant communities.
- **Bring Back the Natives Grant Program** – funds to restore damaged or degraded riverine habitats and their native aquatic species provided by BLM, Bureau of Reclamation, FWS, Forest Service, and NFWF; minimum 2:1 nonfederal match required.

- **Five-Star Restoration Program** - provides modest financial assistance on a competitive basis to support community-based wetland, riparian, and coastal habitat restoration projects that build diverse partnerships and foster local natural resource stewardship through education, outreach and training activities; average grant is $13,000.

Information about all of these and other NFWF grants/programs is available at their website: http://nfwf.org/.

6.5.3 Trout Unlimited

The mission of the Wyoming Council of Trout Unlimited is to conserve, protect, and restore Wyoming's cold-water (trout) fisheries and their watersheds. The Council is made up of 16 chapters located throughout the state. While a majority of Trout Unlimited members are indeed enthusiastic anglers, their focus is not only on maintaining fisheries for the purpose of angling. Healthy trout fisheries are indicative of well-functioning, sound ecosystems and that the work we do toward restoring good trout habitat will ultimately benefit the overall environment.

Of special concern are Wyoming's four subspecies of native cutthroat trout that currently inhabit a tiny fraction of their historic range. Working with federal and state agencies, local officials and landowners, Wyoming Trout Unlimited is actively engaged in a battle to keep these fish from being listed under the Endangered Species Act. Trout Unlimited provides funding and volunteer labor for a variety of stream and watershed projects such as erosion control and fish habitat structures, willow and other riparian plantings, and stream protection fencing. Embrace-A-Stream grants are available for up to $10,000 per project. Partnerships are encouraged and can include local conservation districts and state and federal agencies. Those interested should contact the Council office.

VII. PERMITS

VII. PERMITS

The following discussion presents the results of an early regulatory process analysis for the types of alternative projects that have been identified in Chapter 4. The purpose of this analysis is to characterize the known and likely environmental processes, permits and related requirements and conditions associated with the alternative projects, including identification of environmental documentation, permits, agency clearances and approvals, and agency coordination steps that would be required for implementation of the proposed actions and alternatives.

Many of the potential projects described in this plan will be subject to the National Environmental Policy Act (NEPA) and other federal environmental regulations administered by federal agencies such as the EPA, Bureau of Land Management (BLM), Army Corps of Engineers (COE), and/or the U.S. Fish and Wildlife Service (FWS). The Wyoming agencies which may have environmental, land use, and other regulatory approval requirements include, but are not necessarily limited to the Department of Environmental Quality (WDEQ), State Engineer's Office (WSEO), State Historic Preservation Office (SHPO), Board of Land Commissioners through the State Lands and Investments Board (SLIB), and Game and Fish Department (WGFD).

Much of the following text was extracted from previous watershed investigations conducted on behalf of the Wyoming Water Development Commission (WWDC) in which Anderson Consulting Engineers (ACE) participated. Specifically, the Middle North Platte River Basin Watershed Management Plan (RESPEC, 2014) and the Blacks Fork River Watershed Study (Anderson Consulting Engineers, 2015) are referenced here as sources of permitting information. The previously prepared descriptions of the permitting process were revised to reflect conditions anticipated within the Upper North Platte River Watershed.

7.1 NEPA Compliance and Documentation

NEPA applies to any of the proposed actions for which the project site is located on federal land, federal funds may be used, and/or when formal federal agency actions are necessary for the project to move forward. One of the primary intentions of the NEPA process is to avoid, minimize and mitigate adverse environmental consequences of federal actions. NEPA requires analysis and documentation of potential adverse and beneficial effects of a proposed action and alternatives and an open public involvement process.

For this project, it is likely that BLM would be the lead federal agency for implementation of the NEPA process for projects on lands under their administration. The COE would presumably be the lead federal agency otherwise where wetlands may be impacted. It is also possible that these agencies may work out a shared lead under a Memorandum of Understanding (MOU) if there are significant issues best led by both agencies for a given project.

7.1.1 NEPA Process Upland Project Types

The applicability of NEPA to projects other than major (non-stock pond) reservoir storage and typical of those incorporated in the watershed management plan, must be determined on a case-by-case basis. For example, proposed new wildlife/livestock watering developments, including especially tank/pipeline systems that cross and/or serve federal or state rangeland will require that an appropriate NEPA process be followed. In this case, and for many of the lesser potential impact projects (e.g., a well, stock/wildlife pond, guzzler, etc.), it is possible if not likely that an EA process will be found appropriate rather than a full EIS (see related discussion in Section 5.1 above).

BLM. Under current practice, NEPA evaluations and processes for projects on BLM lands, reservoir storage projects and other types of projects that may be proposed where BLM is the lead federal agency will be performed by BLM staff or qualified, independent third party experts responsible to BLM. These experts may include specialists from other federal and/or state agencies working under memoranda of understanding (MOU) or other appropriate arrangement(s). Compliance with NEPA will be guided in large part by the Rawlins Resource Management Plan (approved 2008).

Other Local/State/Federal Agencies. Depending on the specific circumstances of a particular project, it is possible that another state or federal agency may lead the NEPA process. For example, a project proposed within the Medicine Bow National Forest would presumably be led by the U.S. Forest Service. All of the relevant state and federal land management agencies have management plans developed from NEPA-compliant processes where appropriate. As discussed above for BLM, these plans will guide these agencies' NEPA process for any applicable proposed projects or improvements.

Watershed-Wide Environmental Analysis. Given the significant number of planned and potential wildlife/livestock and irrigation water development projects and the opportunity for larger-scale, cooperative projects as discussed identified Chapter 4, it is recommended that serious consideration be given to the potential benefits of conducting a comprehensive "watershed-wide" environmental analysis for these and other potential water-resources related improvement projects. A key benefit of this approach would be developing a single baseline characterization and impacts assessment of the relevant environmental issues associated with these types of projects rather than repetitively for many similar individual projects. This should, in turn, substantially reduce the overall resources and time necessary to conduct the required environmental permitting (including especially NEPA compliance) for these projects. If necessary, the overall environmental analysis could be supplemented on a case-by-case basis for a particular issue in a focused, time and resource efficient manner.

7.1.2 NEPA Process for Reservoir Storage Projects

The following discussion characterizes the basic steps of the NEPA process applicable to a reservoir storage project.

Prepare a Purpose and Need Statement for the Project. It is important to develop an accurate and defensible Purpose and Need statement for the project as one of the first steps in the NEPA process. The Purpose and Need statement provides an overall or basic purpose for the proposed action and presents details supporting various needs for the project. The Purpose and Need statement should provide enough information to develop and support a "reasonable range" of alternatives. More specifically, the Purpose and Need statement guides the alternative development and screening process. With the COE as the lead agency, the Purpose and Need would include a reference to finding the "least damaging practicable alternative." This reference relates to the Clean Water Act Section 404 requirements that are under the jurisdiction of the COE and is an important part of the NEPA process for a reservoir storage project. Additional details about the Section 404 process are provided in Section 7.2. The NEPA process requires analysis of the No Action alternative and a reasonable range of alternatives that fully address the project's purpose and need. The reasonable range of alternatives may include one or more "build" alternatives, depending on the nature and extent of anticipated project impacts and level of NEPA documentation to be provided.

For new, expanded or reconstructed reservoir storage projects, key issues associated with alternative development will or may include:

- loss of wetland and riparian habitat from direct inundation by a new, expanded or reconstructed reservoir;
- potential impacts on threatened and endangered species;
- potential impacts on fish and other aquatic species; and
- potential impacts on other wildlife (e.g., sage grouse; big game).

Given these issues and risk management considerations, the project team anticipates that an EIS will likely be the appropriate NEPA documentation for reservoir storage projects. An EIS involves analysis of more than one build alternative and typically takes up to several years to complete. An Environmental Assessment (EA) may or may not involve analysis of more than one build alternative and can typically be completed in less than 18 months. The outcome of an EA is either a Finding of No Significant Impact (FONSI) or a recommendation to prepare an EIS. If an EA is prepared, there is a possibility that the outcome might be that an EIS is needed. This could occur as a result of "significant impact findings" or as a result of substantial public controversy over the project's effects. If this occurs at the end of the EA process, the EIS process would need to start from the beginning, wasting a considerable amount of time and money. At this time, it appears it would be prudent to assume that an EIS process would be applicable, while leaving the option open for an EA/FONSI, rather than to proceed with an EA and take the risk that an EIS will ultimately be needed. This decision should be reviewed during a Level II study (should the project advance) when more detailed information is available on a preferred proposed action and its appropriate alternatives.

Conduct a Proactive Public Involvement Program. The NEPA process begins with public and agency outreach and related input focused on alternatives and potential impacts. Education about the project's purpose and need, project details and issues is provided and input is solicited in various ways. It is very important that the public have a clear understanding of the benefits and potential adverse impacts of the proposed action and alternatives. Public involvement is continuous throughout the project and can influence alternative development, alternative screening, issues addressed, mitigation measures, the level of NEPA documentation to be prepared (EA or EIS), and the selection of the preferred alternative.

Collect and Analyze Environmental Baseline Data. It is important to carefully identify environmental constraints and considerations early and incorporate them into alternative development efforts as a means of avoiding and minimizing potential impacts. Early field investigations and agency consultation and coordination efforts help to focus this effort and streamline subsequent analysis methods, schedule needs, and budget requirements. Creating "self-mitigating" alternatives is highly advantageous and fully consistent with the intent of NEPA.

Many NEPA analyses relate to compliance with various laws and regulations. Integrating the NEPA, National Historic Preservation Act, Endangered Species Act and other compliance processes will reduce overall permitting timeframes and costs, and streamline agency decision-making. These issues are discussed in Section 7.2.

Prepare the Draft and Final Environmental Impact Statement. The Draft EIS would be prepared in two versions. A Preliminary Draft EIS would be prepared for internal review. The Draft EIS would respond to comments on the Preliminary Draft EIS. The Draft EIS would be circulated for public review and would be the subject of a public hearing. The Final EIS would also be prepared in two versions. A Preliminary Final EIS would be prepared for internal review. The Final EIS would respond to comments on the Preliminary Final EIS. The Final EIS would be circulated for public review and would be the subject of a public hearing. A Record of Decision would be prepared to complete the NEPA process.

7.2 Permitting/Clearances/Approvals

7.2.1 Dam and Reservoir Construction

In addition to the U.S. Army Corps of Engineers (COE) Section 404 Permit, there are numerous other permits and/or approvals required for new dam and reservoir construction. Presented below are the primary additional permits and/or approvals that would be required for any of the alternative projects under consideration.

Section 404 Permit. Like all water development projects, any dam and reservoir storage project in the watershed will face environmental permitting issues. Typically the most significant environmental permit to be secured is a Section 404 Dredge and Fill permit from the COE, Omaha District. Even when impacts are anticipated to be modest, the process of obtaining a Section 404 permit for new storage projects may take several years from initiation of the NEPA process.

The primary guidance in embarking on the permitting process for a new dam and reservoir storage project is the development of a defensible Purpose and Need for the project. The NEPA process dictates that the least environmentally damaging practical alternative that addresses the purpose and need be pursued. This is the alternative most likely to be successfully permitted.

Endangered Species Act (Section 7 Consultation). The lead agency would prepare a biological assessment to determine project effects on threatened and endangered plant and animal species listed or proposed for listing (candidate species) under the Endangered Species Act (16 U.S.C. § 1531 et seq.). U.S. Fish and Wildlife Service (FWS) would then issue an opinion on whether federal actions are likely to jeopardize the continued existence of a threatened or endangered species, or destroy or adversely modify critical habitat. FWS must approve the preparation of a biological assessment to comply with the Endangered Species Act in order to render its decision. If FWS determines that the preferred alternative would jeopardize the continued existence of a species, it may offer a reasonable and prudent alternative.

Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act requires federal agencies involved in actions that will result in the control or structural modification of any natural stream or body of water for any purpose to take action to protect the fish and wildlife resources which may be affected by the action. It requires federal agencies or applicants to first consult with state and federal wildlife agencies to prevent, mitigate and compensate for project-caused losses of wildlife resources, as well as to enhance those resources.

Laws and Regulations Addressing Cultural Resources. Because federal approvals are likely involved with any of the identified alternatives, a consideration of effects on cultural resources must be undertaken (Section 106 consultation), as required under the following laws and regulations: the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. § 470 et seq.); the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C., § 4321); the Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. § 470aa et seq.); the National Park Services (NPS) procedures concerning the National Register of Historic Places (NR) (36 CFR Part 60); the Advisory Council on Historic Preservation's Procedures for the Protection of Cultural Properties (36 CFR Part 800); the Treatment of Archaeological Properties of 1980: Determination of Eligibility for Inclusion in the NR (36 CFR 63); the Secretary of Interior's Standards and Guidelines for Archaeological Historical Preservation of 1983; Reservoir Salvage Act of 1960; and the l974 Amendment to the Reservoir Salvage Act of 1960. The State of Wyoming Historic Preservation Office (SHPO) coordinates with federal agencies in determining the significance of cultural resources potentially affected by ground disturbing activities.

In addition, consultation with relevant Native American groups concerning traditional cultural properties is required under the American Indian Religious Freedom Act of 1978 (AIRFA, P.L. 95-341.42 U.S.C. § 1996) and Section 4 of ARPA of 1979. Guidelines for evaluation of traditional cultural properties are contained in Bulletin 38 issued by the National Park Service.

Wyoming Board of Land Commissioners. The Wyoming Board of Land Commissioners through the State Lands and Investments Board (SLIB) is responsible for regulating all activities on state lands, including granting of rights-of-way. Any facility, utility, road, railroad, ditch or reservoir to be constructed on state or school lands must have a right-of-way, as required in the "Rules and Regulations Governing the Issuance of Rights Of Way" (W.S. 36-20 and W.S. 36-202).

Wyoming State Engineer's Office Surface Water Storage Permit. The State Engineer's Office administers the water rights system of appropriation within the state. The Applicant must obtain the necessary water rights permits from the State of Wyoming for the diversion and storage of the State's surface water.

Wyoming State Engineer's Office Permit to Construct/Dam Safety Review. The Wyoming Dam Safety Law (W.S. 41-3) requires that any persons, public company, government entity or private company who proposes to construct a dam which is greater than 20 feet high or which will impound more than 50 acre-feet of water, or a diversion system which will carry more than 50 cubic feet of water per second, must obtain approval for construction of the dam or ditch from the Wyoming State Engineer's Office. The approval by the State Engineer's Office of a dam's construction is contingent upon the Office's review and approval of all dam plans and specifications, which must be prepared by a registered professional engineer licensed in Wyoming. Design, construction, and operation of jurisdictional dams must also comply with dam safety regulations promulgated pursuant to the Dam Safety Act.

Wyoming State Engineer's Office Ditch Enlargement Permit. In addition to the permits and clearances that will be required for reservoir construction, existing irrigation ditches may require enlargement to convey water to off-channel reservoirs. If so, this effort would require an enlargement filing with the Wyoming SEO. Even if physical enlargement of the existing ditch was found to not be required, the enlargement filing would be a legal formality as a water right requirement.

Wyoming Department of Environmental Quality – National Pollution Discharge Elimination System (NPDES) permit and Section 401 Certification. The federal Clean Water Act is administered in Wyoming by the Department of Environmental Quality (WDEQ), Water Quality Division (WQD) consistent with the Wyoming Environmental Quality Act. The Section 401 Certification is the State's approval to ensure that the activities authorized under Section 404 meet state water quality standards and do not degrade water quality. Any discharge of pollutants into the broadly defined "waters of the state" requires application to and permit issuance by WQD in accord with WQD's Rules and Regulations. This body of regulations sets forth classification of surface and groundwater uses and establishes water quality standards (Wyoming Water Quality Standards). The WQD administers the NPDES permit system including storm water permits and construction-related, short-term discharge permits.

Implementation of any of the action alternatives would require application for and compliance with the provisions of the statewide general NPDES Construction Storm Water Discharge Permit (WYR10-000). Construction activities associated with dam construction or enlargement often result in the requirement to temporarily discharge pumped water. These discharges are provided for in a general permit. Upon acceptance of the application by DEQ, the temporary discharge must be in compliance with the terms of the general permit and any stipulations applied as a result of the application's review.

EPA has oversight responsibility for federal Clean Water Act programs delegated to and administered by the State Water Quality Division. EPA also may intervene to resolve interstate disputes where discharges of pollutants in an upstream state may affect water quality in a downstream state.

Mining Permit. A Wyoming mining permit is not required for development of an aggregate and/or borrow material source solely for use in construction of one of the various reservoir alternatives and whose product is not for commercial sale. Commercial sources of aggregate, rock, or other mined materials are responsible for obtaining and maintaining all required permits and clearances for their operations.

Special Use Permits/Rights-of-Way/Easements. Special use permits, rights-of-way (ROW) or easements will be required wherever access across the lands of others (private, state or federal) is needed for construction and/or operation of the project facilities. These may be temporary (e.g., access to a temporary borrow area or quarry site to be closed and reclaimed; construction of a new haul road; etc.) or permanent (e.g., construction of a wildlife/livestock pipeline alignment). Usually privately owned lands that will be rendered permanently unavailable (such as the dam and reservoir footprint of a storage project) would be purchased unless the owner desired (and the sponsoring entity agreed) to a permanent easement. Permanent use of BLM lands would most likely be administered under a grant with an appropriate term issued under their ROW process; the U.S. Forest Service would use their equivalent special use process. An easement or ROW from the Wyoming Department of Transportation (WYDOT), Uinta County, Lincoln County or Sweetwater County may also be required. The specific requirements for rights-of-way, special use permits and easements vary widely and should be determined as part of the early stages of planning for a specific proposed project. This will help to avoid the potential for significant project delay, higher costs, or required changes in location/alignment or design during project development and implementation.

Other. In addition to the above, there may be other permits and clearances required for a given dam and reservoir project. These might include permits typically required to be provided by the construction contractor (e.g., air quality permit; trash/slash burning permit; etc.).

7.2.2 Other Project Types

Permits, clearances and approvals for projects other than major dams and storage reservoirs will depend on the specific nature and location of the project. Various permits and clearances discussed above in Section 7.2.1 may also apply to other types of projects. The specific permits and clearances necessary for a particular project should be determined early in the planning stages of the project to ensure compliance with applicable laws and regulations, and to avoid possible delays, increased costs and possibly re-design later during project implementation.

7.3 Environmental Considerations

Proposed, Threatened and Endangered Species. The following species have the potential to occur within the proposed project areas within the watershed:

Endangered:	Black-footed Ferret (*Mustela nigripes)*
Threatened:	Canada Lynx (*Lynx canadensis*)
	Grizzly Bear (*Ursus arctos arctos*)
	Piping Plover (*Charadrius melodus*)
	Greenback Cutthroat Trout (*Oncorhynchus clarkii stomias*)
Petition	Eastern Clade Western Toad (*Anaxyrus boreas - Eastern Clade*)
Under	White-tailed Ptarmigan (*Lagopus leucura*)
Review:	Monarch Butterfly (*Danaus plexippus plexippus*)
	Little Brown Myotis (*Myotis lucifugus*)
	White-tailed Prairie Dog (*Cynomys leucurus)*
	(Wyoming Natural Diversity Database [WYNDD], 2015)

The Wyoming Natural Diversity Database (WYNDD) lists several other species of concern and species of potential concern existing within the study area. This list was presented and discussed in Chapter 3 of this report and contained 5 amphibians, 79 birds, 1 crustacean, 5 Fern and Fern Ally, 3 Fish, 5 Insects, 34 Mammals, 5 Mulloscs, 8 Reptiles, and 53 flowering plants.

The potential exists for some of these species to occur within appropriate habitats within the watershed. Although none of these species receive federal or state protection, sage grouse are identified as a sensitive species/species of concern and merit special attention as discussed in some detail in the following paragraphs.

The greater sage grouse (Centrocercus urophasianus) is a native species to the area and is almost totally dependent on open sagebrush plain. The males will gather in the early spring to lek (breeding ground) locations to start their elaborate courtship rituals (strutting). They are considered omnivores, eating insects, sagebrush and seeds; but are most reliant upon sagebrush for both cover from predators and for food.

The greater sage grouse is listed as a sensitive species by the BLM, and a species of concern by WGFD. The BLM definition of a sensitive species is as follows: species that could easily become endangered or extinct in the state, including: (a) species under status review by the FWS/National Marine and Fisheries Service; (b) species whose numbers are declining so rapidly that Federal listing may become necessary; (c) species with typically small or fragmented populations; and (d) species inhabiting specialized refugia or other unique habitats. WGFD lists the greater sage grouse as: species that are widely distributed, with population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance. The sage grouse are not listed as a Threatened or Endangered species and does not receive any protections from the

Endangered Species Act; however, BLM and WGFD have developed restrictions/recommendations to help protect the sage grouse.

It is recommended that coordination with BLM and WGFD occur regarding any proposed or alternative project that has the potential to impact sage grouse habitat. Note that providing water to areas where water is limited may create a beneficial impact for sage grouse and should be considered when evaluating the net potential impacts to this species.

Please note that the information above is current as of the time of this report. Updated information regarding status of sage grouse may be obtained from the WGF.

Rare Plant Species of Concern. The WYNDD has 53 known sensitive plant species of concern located in the watershed as discussed in Chapter 3 of this report. Of the 53 sensitive species only one is listed as endangered and therefore receives protection.

Big Game. The Upper North Platte River watershed contains portions of crucial big game habitat for antelope, big horn sheep, mule deer, elk managed by the Wyoming Game and Fish Department (WGFD) and parturition (birthing) sites for big horn sheep and elk. The WGFD maps the seasonal ranges by herd unit for each big game species and makes special note of areas listed as crucial habitat. Crucial habitat or range is defined as those seasonal ranges or habitats (mostly winter range) that have been documented as the determining factor in a population's ability to maintain itself at a certain level over a long period of time.

Fisheries. Most of the alternative reservoir sites are located on tributaries that are considered perennial and contain viable fisheries resources. Impacts to the various streams and associated fishery resources will occur with any of the alternative dam and reservoir storage alternatives and should be considered during further environmental evaluation of these sites.

Wetland Resources. Formal wetland delineation in accordance with the Corps of Engineers guidelines was beyond the scope of this Level I study and was not conducted. GIS digital mapping from the National Wetland Inventory (NWI) was acquired to preliminarily identify wetland habitats in the study area. Likewise, LANDFIRE data were obtained and evaluated as presented in Chapter 3. The various locations identified as potential alternative reservoir storage sites are all located on what are considered intermittent to perennial riverine systems. These systems are associated with streambeds and their associated wetland/riparian habitat. Riparian habitats are considered to be valuable habitat for both mammals and birds, along with assisting in reducing flooding. The creation of a reservoir on the drainage would inundate the basin bottoms changing the landscape/habitat.

Some of the areas identified on the NWI maps and within the LANDFIRE datasets as wetlands or other riparian system categories, may in fact not qualify as jurisdictional wetlands upon subsequent detailed examination in the field. This is due to inherent limitations in the aerial photography or satellite imagery-based methodologies used to prepare the NWI maps. In general, our previous experience suggests that estimates of wetland acreage based on the NWI maps or within LANDFIRE datasets tend to be conservatively high and actual acreage of jurisdictional wetlands may be less.

Formal wetlands delineation would be necessary prior to construction at any proposed reservoir storage site, and in any other areas of proposed disturbance (e.g., at spring development sites and along associated pipeline alignments) to determine the level of impacts to wetlands located in the alternative project area and to identify and quantify any necessary mitigation of those impacts.

7.4 Mitigation

Based on prior experience, mitigation could be required at any of the identified alternative dam and reservoir sites to address impacts to wetlands, riparian vegetation, stream channel habitat, cultural resources, fish and game resources, and possibly threatened or endangered species. It is preferred to avoid the need for mitigation of a potentially significant impact by relocation and/or "self-mitigating" design if technically and economically feasible.

Detailed mitigation plans would need to be prepared and approved to replace any lost wetlands identified and quantified by formal wetlands delineation, and riparian vegetation communities. However, given the relatively small acreages of wetlands at the alternative dam and reservoir sites (ranging from less than 1 to 12.2 acres), it is anticipated that mitigation of this resource will be possible at any of the sites by constructing additional wetlands nearby, ideally in the same mainstem stream and/or in a close-by tributary.

Mitigation of potential raptor and big game impacts would generally involve control of certain construction activities during sensitive time periods, and avoidance of direct disturbance of the subject species. Mitigation of potential sage grouse lek impacts will be given special consideration as discussed previously. If any T&E species were encountered at a given site special studies would be required to determine if appropriate mitigation could be implemented. In general, any such impacts would be avoided to the greatest extent possible by relocation of site facilities.

Additional cultural and historic resource fieldwork would need to be completed to identify and document any such resources that would be inundated or otherwise impacted as a result of constructing any one (or more) of the alternative dams and reservoirs or other potential projects described in Chapter 5. This would include, in turn, a class I (literature search) survey, a Class II (reconnaissance inventory) survey, and if needed, a class III (intensive inventory) survey. Ultimately, a mitigation plan for cultural resources would be developed which would culminate in a Memorandum of Agreement (MOA) between the Wyoming SHPO and the lead federal agency with concurrence by the project sponsor(s), and possibly affected Native American tribes. The agreement would require approval from the Advisory Council on Historic Preservation.

7.5 Land Ownership and Property Owners

Where applicable, permission must be negotiated for easement/right-of-access for all construction activities associated with the project.

VIII. CONCLUSIONS AND RECOMMENDATIONS

VIII. CONCLUSIONS AND RECOMMENDATIONS

A multidisciplinary inventory of the Upper North Platte River watershed was conducted in an effort to identify and evaluate key resource issues and concerns. A comprehensive Geographic Information System (GIS) was completed in conjunction with the inventory. The GIS incorporates the data collected and results generated during the study and collates it with information collected from a wide variety of sources. The GIS will be a valuable resource for the community and future studies which will likely be conducted in the watershed.

8.1 Conclusions

Upon completion of the watershed inventory phase of the project, the project team developed the watershed management plan. The plan was developed based upon findings of the inventory phase, a series of public meetings, questionnaires, and interaction with the project steering committee. In previous chapters, the key issues and problems were identified and ultimately, project goals and objectives were formulated to address them. Specifically, plans were developed to address issues associated with the following broad categories:

- *Irrigation System Conservation and Rehabilitation,*
- *Livestock/Wildlife Upland Watering Opportunities,*
- *Surface Water Storage Opportunities,*
- *Stream Channel Condition and Stability,*
- *Grazing Management Opportunities, and*
- *Other Upland Management Opportunities.*

In summary, the following conclusions are provided.

8.1.1 Irrigation System Components

1. Potential solutions to the primary issues and problems associated with irrigation system infrastructure were identified. Consequently, forty six (46) individual projects were incorporated into the watershed management plan. Conceptual level cost estimates were completed for the recommended improvements.

2. Individual improvements range from installation of measurement devices on ditches where there currently are no means of measuring flows at a cost of approximately $5000 to construction of new diversion structures and headgates. These projects would be much more extensive with respect to costs, permitting, and construction.

3. The recommended improvements to each irrigation system can be implemented individually, in combination, or as a complete package depending on the needs, preferences and financial ability

of the owner. Funding assistance is available from a number of sources, especially the WWDC Small Water Project Program and various programs administered by the NRCS.

4. Partnering opportunities may exist for construction of in-stream structures diversion. For example, Trout Unlimited (TU) is currently providing partial funding for projects within the study area in an effort to minimize their impacts upon fisheries and fish passage.

5. Many of the proposed irrigation system improvements would require minor involvement or permitting from regulatory agencies to be completed. However, work completed within stream channels (waters of the US) would require coordination with the USACE. Rehabilitation activities would likely be exempted from Section 404 permitting due to the USACE's exclusion of irrigation system maintenance efforts. Construction of new facilities would likely require Section 404 permitting.

8.1.2 Livestock/Wildlife Upland Watering Opportunities

1. There appears to be numerous opportunities to improve range and riparian conditions by means of increasing the availability of upland water sources for wildlife and livestock use.

2. Opportunities to improve range and riparian conditions require installing and operating well-distributed, reliable upland water sources and watering facilities for wildlife and livestock. Installing pipelines and stock tanks is the foundation of effective grazing management and can be an economical way to improve rangeland conditions.

3. Pipeline/tank systems appear to offer the most efficient and cost-effective means to provide adequate watering to large areas of rangeland. Water sources for these systems will depend on the location of the rangeland to be served and the available alternative sources. The most likely sources are wells or spring developments.

4. Through discussion with local landowners and stakeholders, a total of 18 potential livestock / wildlife water supply projects were identified. Conceptual plans and conceptual level cost estimates were prepared for each project. Projects ranged from installation of stock tanks to well and pipeline construction.

5. Many of the livestock / wildlife projects could be completed entirely on private lands. Consequently permitting issues are greatly simplified. However, many would involve coordination with the Bureau of Land Management (BLM) through the Rawlins Office. BLM consultation will be necessary in order to obtain the requisite permits and cultural clearances.

6. Because of the existing regulatory environment and involvement of third-party interests, the proposed projects with portions of federal lands could be difficult and require additional review and planning efforts.

7. Several proposed projects and pipeline components could be rerouted or redesigned to involve only private or state lands, these might result in increased materials and construction costs but could avoid project delays and permitting issues.

8. Any such improvements and practices must be fully implemented and maintained by the landowner to gain the maximum overall benefits to the watershed.

8.1.3 Surface Water Storage Opportunities

1. Construction of new reservoirs within the project study area are controlled by two legal documents:
   a. The Modified North Platte Decree (MNPD) and,
   b. The Platte River Recovery and Implementation Program (PRRIP).

2. The two documents define constraints upon development of new storage facilities, however they do not prohibit them.

3. Construction of new surface water storage facilities or enlargement of existing facilities were not identified as vital components of the watershed management plan. Through the project Scoping Meeting and public outreach efforts, only one recommendation was brought to the project team.

4. The storage project recommended for inclusion in the plan (Beaver Meadow Reservoir) had originally been initiated by the Town of Encampment as a source of municipal water. Original water rights were cancelled by the WSEO because work on the proposed reservoir was not completed.

8.1.4 Stream Channel Condition and Stability

1. Based on the geomorphic assessment and input from the project Sponsor, impaired channel reaches were identified within the watershed. The categories of impairments identified include, but are not limited to degradation of riparian vegetation and degradation of riparian condition in the form of stream bank erosion and channel degradation.

2. Site-specific solutions should be developed to mitigate the channel impairment and ultimately included in the watershed management rehabilitation plan.

3. Community-sponsored stream channel and habitat improvement projects could provide numerous benefits to the watershed. Potential projects would include efforts such as bank stabilization efforts using techniques such as willow plantings. In addition to providing direct benefits to the specific stream, ancillary benefits include education and community involvement.

8.1.5 Grazing Management Opportunities

1. Construction and operation of reliable water supply projects must be developed and implemented in areas with inadequate water sources before adjustments or alternatives in grazing management could be made on a particular area or allotment.

2. Development of reliable water sources and associated watering facilities can aid in distribution, timing, and frequency of grazing animals. However, additional measures such as cross-fencing, low-stress herding, mineral/salting, and grazing density should be evaluated as part of the site-specific, grazing management inventory and plan.

3. Available tools such as the ESD and the STM can be used by landowners and managers to become aware of the growth potential of desirable vegetation and predicted responses on a particular range site.

4. These tools could be used in developing appropriate rangeland treatments and grazing practices to begin the transition from an undesirable to a desirable plant community

8.2 Recommendations

Based upon the information presented throughout this report and the conclusions presented above, the recommendations listed below are presented for consideration:

1. Many of the irrigation rehabilitation alternatives and the livestock / wildlife upland watering alternatives fall within the constraints for funding eligibility of the WWDC's Small Water Project Program (SWPP).These projects should be reviewed and selected alternatives should be implemented as soon as is practical. Completion of one or more of these projects in the near future would serve to benefit those directly involved in the project and increase interest and awareness of the benefits associated with the watershed planning process**.**

   Funding through the SWPP does not require formation of a district. Consequently, individuals can seek funding through this program by applying through a conservation district as their sponsor. As discussed in Chapter 6, projects providing multiple benefits and for which total project cost are less than $135,000 are eligible for funding under this program. Grants are available for up to 50 percent of the total project cost or $35,000, whichever is less.

   Several alternative sources exist for funding of improvements within the watershed including on-farm improvements, irrigation rehabilitation projects, stream enhancements/restoration projects, and conservation and flood control projects. Creative strategies for funding/financing of projects should be more fully investigated following identification of projects worthy of additional evaluation and potential implementation. As an example, replacement of a failing ditch headgate and diversion which are also identified by WGFD as a barriers to fish passage, could potentially be eligible for funding through SWPP (if total project cost meets SWPP criteria). Additional funding could also be attained through WGFD, Trout Unlimited, and other sources because of the fisheries and stream habitat benefits achievable with completion of the project. *By combining funding sources, the owner could conceivably obtain grants for most, if not all, of the project costs.*

2. Several of the irrigation projects identified involved costly repairs or replacement of existing facilities and would not be eligible for funding through the SWPP. For the projects listed below, landowners and ditch owners should consider district formation (where applicable) and application to the WWDC for level II evaluation and potential project funding:

    a. IRR-029: Encampment Platte Valley Ditch Diversion
    b. IRR-041: South Brush Creek Supply Ditch
    c. IRR-043: Kurtz-Chatterton Ditch
    d. IRR-045: Enlarged Encampment Range Ditch (Billie Creek Ditch)
    e. IRR-046: Wagoner Cherokee Ditch Diversion

3. Landowners or managers seeking to participate in the SWPP should consult and coordinate with the SERCD, which is the eligible sponsor of SWPP applications and project agreements.

4. The study's GIS and digital library should be used as a tool in planning and developing potential projects and should be updated as necessary from available information sources.

5. Potential funding opportunities exist for proposed and future improvement projects within the watershed including ranch and farm improvements, irrigation system rehabilitation, riparian/wetland enhancements, river corridor and stream channel restoration, and urban drainage and flood control projects. For example, the SERCD has been granted funding through the USDA ***Regional Conservation Partnership Program (RCPP)***. The funding is intended for achieving resource management goals from improving water quality and wildlife habitat to streambank restoration. Where appropriate, partnering SWPP funding with RCPP funded projects could provide multiple benefits.

6. Innovative strategies for coordinated project funding and financing should be investigated and focus on local, collaborative endeavors that integrate more than one watershed issue or concern that could potentially result in achievement of multiple benefits.

7. Every effort was made to provide information within this document to support the application for SWPP funding from the WWDC with SERCD sponsorship. Project narratives, conceptual designs, cost estimates, and discussion of project benefits can all be incorporated directly into the SWPP application by the SERCD.

8. The public outreach portion of this project attempted to accommodate all interested parties. To the best of the project team's knowledge, all who expressed interested in participating were contacted. However, our experience has shown that additional "new" individuals will come forward wishing to participate after this Level I study is completed. These individuals must be made aware that they are eligible to apply for SWPP funding if they are within the geographic boundaries of the study area. They simply have not had the benefit of having met with the project team and having a portion of their application needs provided to them. They would be subject to the same application requirements and deadlines as those who did participate.

9. The Upper North Platte River Watershed Management plan was completed based primarily upon input obtained from the SERCD and participating landowners/stakeholders. The majority of the project recommendations involved rehabilitation or replacement of irrigation structures (IRR components) with a total of forty six (46) projects. Forty of these would be eligible for Small Water Project Program Funding as their total costs would be less than $135,000 each. Construction of all project eligible for SWPP funding would require approximately $1,179,000. The remaining four projects would like require Level II investigations and would potentially add over $1,000,000 to complete.

   A total of eighteen (18) livestock and wildlife water supply projects (L/W components) were included in the plan. Construction of all projects would require approximately $538,000 to complete and included the following itemized features:

• Spring Developments	10
• Well Construction / Rehabilitation	3
• Solar Pumps / Generators	3
• Stock Tanks	18
• Pipeline (ft)	18,730
• Fencing (ft)	5,000
• Stock Reservoir Rehabilitation	1
• Stock Reservoir Construction	3

IX. REFERENCES

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APPENDIX 3A

UPPER NORTH PLATTE RIVER WATERSHED: RESERVOIR ANALYSIS

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
1	Reservoir	Far East Stock Reservoir	ACE Mapscan	wet in at least two years of photography	Existing	Yes		USFS	41.01	-106.46	Spring Creek-Big Creek	BIG CR	12N	81W	14
2	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.00	-106.59	North Fork Big Creek		12N	82W	15
3	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.01	-106.59	North Fork Big Creek		12N	82W	15
4	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.01	-106.17	Pelton Creek	BOSWELL	12N	78W	17
5	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		USFS	41.01	-106.53	South Fork Big Creek	BIG CR	12N	81W	18
6	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	41.01	-106.58	North Fork Big Creek		12N	82W	14
7	Reservoir		ACE Mapscan	wet in 2009, 2011 & 2012	Existing	Yes		Private	41.01	-106.58	North Fork Big Creek		12N	82W	14
8	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	41.01	-106.59	North Fork Big Creek		12N	82W	15
9	Reservoir		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		Private	41.01	-106.59	North Fork Big Creek	BEAVER CR	12N	82W	15
10	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	41.01	-106.59	North Fork Big Creek		12N	82W	15
11	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	41.01	-106.59	North Fork Big Creek		12N	82W	15
12	Reservoir		ACE Mapscan	Dry in 3 years of photography	Existing	No		Private	41.01	-106.59	North Fork Big Creek		12N	82W	15
13	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	41.01	-106.60	North Fork Big Creek		12N	82W	15
14	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.02	-106.45	Spring Creek-Big Creek	A BAR A RANCH	12N	81W	12
15	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		State of Wyoming	41.01	-106.84	Hog Park Creek		12N	84W	16
16	Reservoir		ACE Mapscan	wet in 2009, 2011 & 2012	Existing	Yes		Private	41.02	-106.45	Spring Creek-Big Creek	A BAR A RANCH	12N	81W	12
17	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.02	-106.61	North Fork Big Creek		12N	82W	9
18	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.02	-106.61	North Fork Big Creek		12N	82W	9
19	Reservoir		ACE Mapscan	wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.02	-106.58	North Fork Big Creek	BIG CR	12N	82W	11
20	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.03	-106.45	Spring Creek-Big Creek	A BAR A RANCH	12N	81W	12
21	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.03	-106.47	Spring Creek-Big Creek	SKYLINE	12N	81W	10
22	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.02	-106.60	North Fork Big Creek		12N	82W	10
23	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.02	-106.61	North Fork Big Creek		12N	82W	10
24	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.02	-106.60	North Fork Big Creek		12N	82W	10
25	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.02	-106.60	North Fork Big Creek		12N	82W	10
26	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012, Hog Park Reservoir	Existing	Yes		USFS	41.02	-106.86	Hog Park Creek	HOG PARK	12N	84W	8
27	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.04	-106.61	North Fork Big Creek	BEAVER CR	12N	82W	4
28	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.04	-106.46	Spring Creek-Big Creek	A BAR A RANCH	12N	81W	2
29	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.04	-106.50	Spring Creek-Big Creek	SKYLINE	12N	81W	4
30	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.05	-106.49	Spring Creek-Big Creek	SKYLINE	13N	81W	33
31	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.06	-106.18	Pelton Creek	BOSWELL	13N	78W	32
32	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.07	-106.48	Spring Creek-Big Creek	A BAR A RANCH	13N	81W	27
33	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.07	-106.47	Spring Creek-Big Creek	A BAR A RANCH	13N	81W	26
34	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.07	-106.48	Spring Creek-Big Creek	A BAR A RANCH	13N	81W	27
35	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.07	-106.63	North Fork Big Creek	BEAVER CR	13N	82W	29
36	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925856	BLM	41.07	-106.43	Spring Creek-Big Creek	PROSPECT MTN.	13N	80W	19
37	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.08	-106.48	Spring Creek-Big Creek	A BAR A RANCH	13N	81W	22
38	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.08	-106.44	Spring Creek-Big Creek	PROSPECT MTN.	13N	81W	24
39	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.08	-106.44	Spring Creek-Big Creek	PROSPECT MTN.	13N	81W	24
40	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.09	-106.45	Spring Creek-Big Creek	PROSPECT MTN.	13N	81W	24
41	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.09	-106.45	Spring Creek-Big Creek	PROSPECT MTN.	13N	81W	13
42	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.09	-106.44	Spring Creek-Big Creek	PROSPECT MTN.	13N	81W	13
43	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.10	-106.54	Bear Creek-Big Creek	A BAR A RANCH	13N	81W	18
44	Reservoir		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		USFS	41.10	-106.95	North Fork Encampment River	ENCAMPMENT	13N	85W	16
45	Pond		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		USFS	41.11	-106.96	North Fork Encampment River	ENCAMPMENT	13N	85W	9
46	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.11	-106.47	Big Creek-North Platte River	PROSPECT MTN.	13N	81W	11
47	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.11	-106.48	Big Creek-North Platte River	PROSPECT MTN.	13N	81W	10
48	Reservoir		BLM-Rawlins	moved to reservoir on imagery	Existing	Yes	0	BLM	41.12	-106.49	Big Creek-North Platte River	PROSPECT MTN.	13N	81W	10
49	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.12	-106.48	Big Creek-North Platte River	PROSPECT MTN.	13N	81W	10
50	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.12	-106.48	Big Creek-North Platte River	PROSPECT MTN.	13N	81W	3
51	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	921014	BLM	41.12	-106.46	North Platte River-Cottonwood Creek	PROSPECT MTN.	13N	81W	2
52	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.12	-106.55	Bear Creek-Big Creek	A BAR A RANCH	13N	81W	6
53	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Private	41.12	-106.61	Beaver Creek-North Platte River		13N	82W	4
54	Pond		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		USFS	41.13	-106.26	Upper Douglas Creek	PLATTE RIVER	13N	79W	3
55	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.12	-106.62	Beaver Creek-North Platte River		13N	82W	4
56	Pond		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		USFS	41.13	-106.43	North Platte River-Cottonwood Creek	PLATTE RIVER	13N	80W	6
57	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.13	-106.49	Big Creek-North Platte River	PROSPECT MTN.	13N	81W	3
58	Pond		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		USFS	41.12	-107.01	North Fork Encampment River	ENCAMPMENT	13N	86W	1
59	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.60	Beaver Creek-North Platte River		13N	82W	3
60	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.13	-106.74	Encampment River- Billie Creek	WOOD MOUNTAIN	13N	83W	5

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
61	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.52	Big Creek-North Platte River	PLATT MINE	13N	81W	5
62	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.52	Big Creek-North Platte River	PLATT MINE	13N	81W	5
63	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.82	Miner Creek	COW CAMP	13N	84W	3
64	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925854	BLM	41.13	-106.48	Big Creek-North Platte River	A BAR A RANCH	14N	81W	34
65	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.51	Big Creek-North Platte River	PLATT MINE	14N	81W	32
66	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.52	Big Creek-North Platte River	PLATT MINE	14N	81W	32
67	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.51	Big Creek-North Platte River	PLATT MINE	14N	81W	32
68	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.52	Big Creek-North Platte River	PLATT MINE	14N	81W	32
69	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.51	Big Creek-North Platte River	PLATT MINE	14N	81W	32
70	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.51	Big Creek-North Platte River	PLATT MINE	14N	81W	32
71	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.57	Big Creek-North Platte River	GOLDEN CLOVER MINE	14N	82W	35
72	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.51	Big Creek-North Platte River	PLATT MINE	14N	81W	32
73	Reservoir		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		USFS	41.13	-107.00	North Fork Encampment River	ENCAMPMENT	13N	85W	6
74	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.13	-106.63	Beaver Creek-North Platte River		14N	82W	32
75	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.14	-106.51	Big Creek-North Platte River	PLATT MINE	14N	81W	32
76	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.13	-106.79	Encampment River- Billie Creek	MINER CEEK	14N	84W	36
77	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.14	-106.25	Upper Douglas Creek	FOXPARK	14N	79W	34
78	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.14	-106.60	Beaver Creek-North Platte River		14N	82W	34
79	Pond		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.14	-106.60	Beaver Creek-North Platte River		14N	82W	34
80	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.14	-106.60	Beaver Creek-North Platte River		14N	82W	34
81	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.14	-106.88	Miner Creek	ENCAMPMENT	14N	84W	31
82	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.14	-106.87	Miner Creek	ENCAMPMENT	14N	84W	31
83	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.60	Beaver Creek-North Platte River		14N	82W	27
84	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.55	Big Creek-North Platte River	A BAR A RANCH	14N	82W	25
85	Pond		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		USFS	41.15	-106.14	Middle Douglas Creek	FOXPARK	14N	78W	27
86	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.15	-106.89	North Fork Encampment River	ENCAMPMENT	14N	84W	31
87	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.59	Beaver Creek-North Platte River		14N	82W	27
88	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.60	Beaver Creek-North Platte River		14N	82W	27
89	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.60	Beaver Creek-North Platte River		14N	82W	27
90	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.15	-106.37	Lower Douglas Creek	PLATTE RIVER	14N	80W	27
91	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.63	Beaver Creek-North Platte River		14N	82W	29
92	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.16	-106.33	Lower Douglas Creek	PLATTE RIVER	14N	80W	25
93	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.61	Beaver Creek-North Platte River		14N	82W	28
94	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.16	-106.33	Lower Douglas Creek	PLATTE RIVER	14N	80W	25
95	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.61	Beaver Creek-North Platte River		14N	82W	28
96	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.56	Big Creek-North Platte River	A BAR A RANCH	14N	82W	25
97	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.16	-106.33	Lower Douglas Creek	PLATTE RIVER	14N	80W	25
98	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.55	Big Creek-North Platte River	A BAR A RANCH	14N	82W	25
99	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.15	-106.65	Beaver Creek-North Platte River		14N	82W	30
100	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.15	-106.93	North Fork Encampment River	ENCAMPMENT	14N	85W	27
101	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.15	-106.93	North Fork Encampment River	ENCAMPMENT	14N	85W	27
102	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.61	Beaver Creek-North Platte River		14N	82W	28
103	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.16	-106.62	Beaver Creek-North Platte River		14N	82W	28
104	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.15	-106.89	North Fork Encampment River	ENCAMPMENT	14N	84W	30
105	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.15	-106.90	North Fork Encampment River	ENCAMPMENT	14N	85W	25
106	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.16	-106.34	Lower Douglas Creek	PLATTE RIVER	14N	80W	24
107	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.15	-106.88	North Fork Encampment River	ENCAMPMENT	14N	84W	30
108	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.16	-106.61	Beaver Creek-North Platte River		14N	82W	28
109	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.15	-106.96	Calf Creek	ENCAMPMENT	14N	85W	28
110	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.15	-106.89	North Fork Encampment River	ENCAMPMENT	14N	84W	30
111	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.16	-106.66	Beaver Creek-North Platte River		14N	82W	30
112	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.16	-106.61	Beaver Creek-North Platte River		14N	82W	21
113	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.16	-106.71	Beaver Creek-North Platte River	COTTON RESERVOIR	14N	83W	22
114	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.17	-106.56	North Platte River-North Cottonwood Creek	A BAR A RANCH	14N	82W	24
115	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		USFS	41.17	-106.19	Middle Douglas Creek	FOXPARK	14N	78W	19
116	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.16	-106.67	Beaver Creek-North Platte River		14N	83W	24
117	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.17	-106.56	North Platte River-North Cottonwood Creek	A BAR A RANCH	14N	82W	24
118	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.17	-106.64	Beaver Creek-North Platte River		14N	82W	20
119	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.17	-106.63	Beaver Creek-North Platte River		14N	82W	20
120	Reservoir		ACE Mapscan	Wet in 2009 & 2011, completely dry in 2012 migh need investigation	Existing	Yes		Private	41.17	-106.66	Beaver Creek-North Platte River		14N	82W	19

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
121	Reservoir		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		Private	41.17	-106.62	Beaver Creek-North Platte River		14N	82W	21
122	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.17	-106.70	Beaver Creek-North Platte River	COTTON RESERVOIR	14N	83W	23
123	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925837	BLM	41.17	-106.71	Beaver Creek-North Platte River	COTTON RESERVOIR	14N	83W	22
124	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.17	-106.67	Beaver Creek-North Platte River		14N	83W	24
125	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.17	-106.84	North Fork Encampment River	NORTH FORK	14N	84W	21
126	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.17	-106.76	Encampment River-West Cottonwood Creek	COTTONWOOD	14N	83W	19
127	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.18	-106.61	Beaver Creek-North Platte River	BIG HOLLOW	14N	82W	21
128	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.17	-106.88	North Fork Encampment River	ENCAMPMENT	14N	84W	19
129	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925835	BLM	41.18	-106.71	Encampment River-West Cottonwood Creek	COTTON RESERVOIR	14N	83W	15
130	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.18	-106.86	North Fork Encampment River	TENNANT CREEK	14N	84W	17
131	Reservoir		ACE Mapscan	Rob Roy Reservoir	Existing	Yes		Private	41.20	-106.26	Upper Douglas Creek	CINNABAR PARK	14N	79W	10
132	Reservoir		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		USFS	41.19	-107.01	Calf Creek	COW CREEK	14N	86W	13
133	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.20	-106.72	Encampment River-West Cottonwood Creek	Brownlee Reservoir	14N	83W	9
134	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.20	-106.50	North Platte River-Cottonwood Creek	A CROSS RANCH	14N	81W	4
135	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.20	-106.66	Beaver Creek-North Platte River		14N	82W	6
136	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.21	-106.57	North Platte River-North Cottonwood Creek	A CROSS RANCH	14N	82W	1
137	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.20	-106.81	Encampment River-West Cottonwood Creek		14N	84W	11
138	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.20	-106.80	Encampment River-West Cottonwood Creek		14N	84W	2
139	Reservoir		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		USFS	41.20	-107.06	Upper Spring Creek-North Platte River	JACK CREEK	14N	86W	10
140	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.21	-106.72	Encampment River-West Cottonwood Creek	Brownlee Reservoir	14N	83W	3
141	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.21	-106.74	Encampment River-West Cottonwood Creek		14N	83W	4
142	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	926179	BLM	41.21	-106.73	Encampment River-West Cottonwood Creek	Brownlee Reservoir	14N	83W	4
143	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.21	-106.65	Beaver Creek-North Platte River		14N	82W	5
144	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.21	-107.03	South Spring Creek	SPRING CREEK	14N	86W	2
145	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.22	-106.57	North Platte River-North Cottonwood Creek	A CROSS RANCH	14N	82W	2
146	Reservoir		ACE Mapscan	Mine reclamation? Wet in 2011	Existing	No		Private	41.22	-106.28	Upper Douglas Creek	ELK CREEK	15N	79W	33
147	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.21	-106.79	Encampment River-West Cottonwood Creek		14N	84W	1
148	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.22	-106.79	Encampment River-West Cottonwood Creek		14N	84W	1
149	Reservoir		ACE Mapscan	Small - Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.22	-106.81	Encampment River-West Cottonwood Creek		14N	84W	2
150	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.21	-107.07	Upper Spring Creek-North Platte River	JACK CREEK	14N	86W	4
151	Reservoir		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		Private	41.21	-107.09	Upper Jack Creek	JACK CREEK	14N	86W	5
152	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.22	-106.87	Calf Creek		14N	84W	5
153	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.22	-106.49	French Creek-North Platte River	PLATTE RIVER	15N	81W	34
154	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.22	-106.83	Encampment River-West Cottonwood Creek		15N	84W	34
155	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.22	-106.77	Encampment River-West Cottonwood Creek		15N	83W	31
156	Pond		ACE Mapscan	Industrial?	Existing	No		Private	41.22	-106.78	Encampment River-West Cottonwood Creek		15N	84W	36
157	Pond		ACE Mapscan	Industrial?	Existing	No		Private	41.22	-106.78	Encampment River-West Cottonwood Creek		15N	84W	36
158	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.22	-106.83	Encampment River-West Cottonwood Creek		15N	84W	34
159	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.23	-106.48	French Creek-North Platte River		15N	81W	34
160	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.22	-106.75	Encampment River-West Cottonwood Creek		15N	83W	32
161	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.22	-106.83	Encampment River-West Cottonwood Creek		15N	84W	34
162	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.23	-106.71	Encampment River-West Cottonwood Creek		15N	83W	34
163	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.23	-106.77	Encampment River-West Cottonwood Creek		15N	83W	31
164	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.23	-106.77	Encampment River-West Cottonwood Creek		15N	83W	31
165	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.23	-106.60	North Platte River-North Cottonwood Creek	A CROSS RANCH	15N	82W	34
166	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.23	-106.76	Encampment River-West Cottonwood Creek		15N	83W	31
167	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.23	-106.84	Calf Creek		15N	84W	33
168	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.23	-106.73	Encampment River-West Cottonwood Creek		15N	83W	28
169	Reservoir		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		USFS	41.23	-107.09	Upper Jack Creek	JACK CREEK	15N	86W	32
170	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.24	-106.79	Encampment River-West Cottonwood Creek		15N	84W	25
171	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	924028	BLM	41.25	-106.55	North Platte River-North Cottonwood Creek	COTTONWOODCORRAL CR.	15N	81W	19
172	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924715	Private	41.25	-106.56	North Platte River-North Cottonwood Creek	A CROSS RANCH	15N	82W	25
173	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.24	-106.83	Calf Creek		15N	84W	27
174	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.24	-106.79	Encampment River-West Cottonwood Creek	HERRING RANCH PASTURE	15N	84W	25
175	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.25	-106.82	Calf Creek		15N	84W	22
176	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.25	-106.83	Calf Creek		15N	84W	22
177	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.25	-106.77	Encampment River-West Cottonwood Creek		15N	83W	19
178	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.26	-106.84	Calf Creek		15N	84W	21
179	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.26	-106.83	Calf Creek		15N	84W	22
180	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.26	-106.87	Calf Creek	SILVER SPUR	15N	84W	20

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
181	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.26	-106.83	Calf Creek		15N	84W	22
182	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.26	-106.64	North Platte River-North Cottonwood Creek		15N	82W	17
183	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.26	-106.87	Calf Creek	SILVER SPUR	15N	84W	20
184	Reservoir		ACE Mapscan	series of reservoirs	Existing	Yes		Private	41.26	-106.97	South Spring Creek	SIERRA MADRE RANCH	15N	85W	21
185	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.26	-106.84	Calf Creek		15N	84W	16
186	Pond		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Private	41.27	-106.80	Encampment River-West Cottonwood Creek	SILVER SPUR	15N	84W	14
187	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.27	-106.73	Encampment River-West Cottonwood Creek		15N	83W	16
188	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.27	-106.92	South Spring Creek	HEATHER CR LAND CO	15N	85W	14
189	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.28	-106.88	Calf Creek	HEATHER CR LAND CO	15N	84W	18
190	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.28	-106.69	North Platte River-North Cottonwood Creek		15N	83W	11
191	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.28	-106.88	Calf Creek	HEATHER CR LAND CO	15N	84W	7
192	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.28	-106.88	Calf Creek	HEATHER CR LAND CO	15N	84W	7
193	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.28	-106.57	North Platte River-North Cottonwood Creek		15N	82W	11
194	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.28	-106.83	Calf Creek		15N	84W	10
195	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.28	-106.76	Encampment River-West Cottonwood Creek		15N	83W	7
196	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.28	-106.62	Brush Creek		15N	82W	9
197	Reservoir		ACE Mapscan	Breached between 2011 and 2012	Existing	No		Private	41.28	-106.82	Calf Creek		15N	84W	10
198	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.28	-106.87	Calf Creek	SILVER SPUR	15N	84W	8
199	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.28	-106.85	Calf Creek	SILVER SPUR	15N	84W	9
200	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.28	-106.89	South Spring Creek	OWL CREEK	15N	85W	12
201	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.29	-106.91	South Spring Creek	OWL CREEK	15N	85W	12
202	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.29	-106.77	North Platte River-Elk Hollow Creek		15N	83W	7
203	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.29	-106.85	Calf Creek	SILVER SPUR	15N	84W	9
204	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.29	-106.90	South Spring Creek		15N	85W	1
205	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.30	-106.59	Brush Creek	LITTLE BEAVER CREEK	15N	82W	3
206	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.30	-106.36	French Creek-North Platte River	SNOWY RANGE S&G	16N	80W	34
207	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.30	-106.74	North Platte River-Elk Hollow Creek	SILVER SPUR	15N	83W	5
208	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.30	-106.74	North Platte River-Elk Hollow Creek	SILVER SPUR	15N	83W	4
209	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.30	-106.74	North Platte River-Elk Hollow Creek	SILVER SPUR	15N	83W	4
210	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.30	-106.64	North Platte River-North Cottonwood Creek		15N	82W	5
211	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.31	-106.36	French Creek-North Platte River	SNOWY RANGE S&G	16N	80W	35
212	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.31	-106.33	French Creek-North Platte River	SNOWY RANGE S&G	16N	80W	36
213	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.30	-106.89	South Spring Creek		16N	84W	31
214	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.31	-106.89	South Spring Creek		16N	85W	36
215	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.32	-106.37	French Creek-North Platte River	SNOWY RANGE S&G	16N	80W	34
216	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.32	-106.36	French Creek-North Platte River	SNOWY RANGE S&G	16N	80W	34
217	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.31	-106.78	Calf Creek	PIERSON	16N	83W	31
218	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.32	-106.37	French Creek-North Platte River	SNOWY RANGE S&G	16N	80W	27
219	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.32	-106.37	French Creek-North Platte River	SNOWY RANGE S&G	16N	80W	27
220	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.32	-106.49	Brush Creek	BARRETT RIDGE	16N	81W	27
221	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.32	-106.75	Calf Creek		16N	83W	29
222	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.33	-106.29	French Creek-North Platte River	SNOWY RANGE S&G	16N	79W	20
223	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.33	-106.35	French Creek-North Platte River	SNOWY RANGE S&G	16N	80W	26
224	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		USFS	41.33	-106.36	French Creek-North Platte River	SNOWY RANGE S&G	16N	80W	22
225	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012, lake marie	Existing	Yes		USFS	41.34	-106.32	French Creek-North Platte River	SNOWY RANGE S&G	16N	79W	19
226	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.33	-106.74	Calf Creek		16N	83W	29
227	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.33	-106.61	Brush Creek		16N	82W	21
228	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.34	-106.35	French Creek-North Platte River	SNOWY RANGE S&G	16N	80W	23
229	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012, mirror lake	Existing	Yes		USFS	41.34	-106.32	French Creek-North Platte River	SNOWY RANGE S&G	16N	79W	19
230	Reservoir		BLM-Rawlins	Sediment	Existing	No	923526	BLM	41.33	-106.84	North Platte River-Elk Hollow Creek	STANDARD	16N	84W	28
231	Reservoir		BLM-Rawlins	Breached, major erosion	Existing	No	923525	BLM	41.33	-106.81	North Platte River-Elk Hollow Creek	STANDARD	16N	84W	26
232	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.34	-106.60	Brush Creek		16N	82W	22
233	Reservoir		ACE Mapscan	Large body of water, but still a water source	Existing	Yes		USFS	41.34	-106.32	French Creek-North Platte River	SNOWY RANGE S&G	16N	79W	19
234	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.34	-106.56	Brush Creek		16N	82W	24
235	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924115	BLM	41.33	-106.95	Lower Spring Creek	SNOW CREEK	16N	85W	22
236	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.34	-106.36	South Brush Creek	SNOWY RANGE S&G	16N	80W	23
237	Reservoir		BLM-Rawlins	Sediment	Existing	No	0	Private	41.34	-106.79	North Platte River-Elk Hollow Creek	SILVER SPUR NORTH	16N	84W	24
238	Reservoir		ACE Mapscan	Large body of water, but still a water source	Existing	Yes		USFS	41.35	-106.32	French Creek-North Platte River	SNOWY RANGE S&G	16N	79W	19
239	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.35	-106.36	South Brush Creek	SNOWY RANGE S&G	16N	80W	22
240	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.34	-106.92	Lower Spring Creek	SNOW CREEK	16N	85W	23

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241	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.35	-106.35	South Brush Creek	SNOWY RANGE S&G	16N	80W	14
242	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.35	-106.35	South Brush Creek	SNOWY RANGE S&G	16N	80W	14
243	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.34	-106.90	Lower Spring Creek	SNOW CREEK	16N	85W	24
244	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.35	-106.38	South Brush Creek	LINCOLN CREEK	16N	80W	16
245	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	923524	BLM	41.34	-106.80	North Platte River-Elk Hollow Creek	STANDARD	16N	84W	23
246	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		USFS	41.35	-106.36	South Brush Creek	SNOWY RANGE S&G	16N	80W	14
247	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.35	-106.39	South Brush Creek	LINCOLN CREEK	16N	80W	16
248	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	923527	BLM	41.35	-106.84	South Spring Creek	STANDARD	16N	84W	21
249	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.35	-106.31	French Creek-North Platte River	SNOWY RANGE S&G	16N	79W	18
250	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.35	-106.54	South Brush Creek		16N	81W	18
251	Pond		ACE Mapscan	Wet in 2009 & 2012	Existing	Yes		USFS	41.35	-106.32	French Creek-North Platte River	SNOWY RANGE S&G	16N	79W	18
252	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.35	-106.31	French Creek-North Platte River	SNOWY RANGE S&G	16N	79W	18
253	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.35	-106.38	South Brush Creek	LINCOLN CREEK	16N	80W	15
254	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.35	-106.36	South Brush Creek	SNOWY RANGE S&G	16N	80W	14
255	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.35	-106.37	South Brush Creek	SNOWY RANGE S&G	16N	80W	15
256	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.31	French Creek-North Platte River	SNOWY RANGE S&G	16N	79W	18
257	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.35	-106.58	Brush Creek		16N	82W	14
258	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.35	-106.72	North Platte River-Elk Hollow Creek		16N	83W	15
259	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.35	-106.96	Upper Spring Creek-North Platte River	CHEROKEE CREEK	16N	85W	21
260	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.38	South Brush Creek	LINCOLN CREEK	16N	80W	15
261	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.34	South Brush Creek	SNOWY RANGE S&G	16N	80W	13
262	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.35	-106.95	Lower Spring Creek	CUSHING	16N	85W	15
263	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.36	South Brush Creek	SNOWY RANGE S&G	16N	80W	15
264	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.37	South Brush Creek	SNOWY RANGE S&G	16N	80W	15
265	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.39	South Brush Creek	LINCOLN CREEK	16N	80W	16
266	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.36	South Brush Creek	SNOWY RANGE S&G	16N	80W	14
267	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.34	South Brush Creek	SNOWY RANGE S&G	16N	80W	14
268	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.35	South Brush Creek	SNOWY RANGE S&G	16N	80W	14
269	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.35	-107.15	Little Jack Creek		16N	87W	23
270	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		USFS	41.36	-106.35	South Brush Creek	SNOWY RANGE S&G	16N	80W	14
271	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.37	South Brush Creek	LINCOLN CREEK	16N	80W	10
272	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.38	South Brush Creek	LINCOLN CREEK	16N	80W	9
273	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.36	-106.35	South Brush Creek	SNOWY RANGE S&G	16N	80W	11
274	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.36	-106.92	Lower Spring Creek	CUSHING	16N	85W	14
275	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.37	-106.35	South Brush Creek	SNOWY RANGE S&G	16N	80W	11
276	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.37	-106.34	South Brush Creek	SNOWY RANGE S&G	16N	80W	11
277	Reservoir		BLM-Rawlins	Breached	Existing	No	923528	BLM	41.36	-106.83	South Spring Creek	STANDARD	16N	84W	15
278	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	921266	BLM	41.36	-106.99	Upper Spring Creek-North Platte River	ANTELOPE	16N	85W	18
279	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.37	-106.37	South Brush Creek	LINCOLN CREEK	16N	80W	10
280	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.37	-106.36	South Brush Creek	LINCOLN CREEK	16N	80W	10
281	Reservoir		BLM-Rawlins	Breached, around spillway	Existing	No	923523	BLM	41.37	-106.76	North Platte River-Elk Hollow Creek	STANDARD	16N	83W	7
282	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.36	-107.02	Upper Jack Creek	METHODIST	16N	86W	13
283	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.36	-107.15	Little Jack Creek	TWIN GROVES	16N	87W	14
284	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.37	-107.02	Upper Jack Creek	METHODIST	16N	86W	12
285	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.38	-106.87	Lower Spring Creek	CUSHING	16N	84W	8
286	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.38	-106.35	North Brush Creek	SNOWY RANGE S&G	16N	80W	2
287	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.38	-107.00	Upper Jack Creek	METHODIST	16N	85W	7
288	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	920433	BLM	41.38	-106.95	Lower Spring Creek	CUSHING	16N	85W	9
289	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920432	BLM	41.38	-106.92	Lower Spring Creek	CUSHING	16N	85W	2
290	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.38	-107.14	Little Jack Creek	TWIN GROVES	16N	87W	12
291	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	921300	Private	41.38	-107.02	Upper Jack Creek	JACK CREEK	16N	86W	12
292	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.39	-106.36	North Brush Creek	LINCOLN CREEK	16N	80W	3
293	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.38	-107.15	Little Jack Creek	TWIN GROVES	16N	87W	11
294	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	923522	BLM	41.39	-106.78	North Platte River- Saratoga Lake	STANDARD	16N	83W	6
295	Reservoir		BLM-Rawlins	Sediment	Existing	No	921298	BLM	41.39	-106.93	Lower Spring Creek	CUSHING	16N	85W	2
296	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.40	-106.37	North Brush Creek	NORTH BRUSH CREEK	17N	80W	34
297	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.39	-106.96	Lower Spring Creek	DISH	16N	85W	4
298	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.39	-107.00	Upper Jack Creek	JACK CREEK	16N	85W	6
299	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.39	-107.13	Little Jack Creek	TWIN GROVES	16N	87W	1
300	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	920389	BLM	41.40	-106.92	Lower Spring Creek	DISH	17N	85W	35

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301	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.40	-107.11	Little Jack Creek	BODEN	17N	86W	32
302	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.40	-107.11	Little Jack Creek	BODEN	17N	86W	32
303	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		State of Wyoming	41.40	-107.13	Little Jack Creek	LITTLE JACK CREEK	17N	86W	31
304	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.41	-106.72	North Platte River-Elk Hollow Creek		17N	83W	27
305	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.41	-106.88	North Platte River- Saratoga Lake	RICH	17N	84W	30
306	Pond		ACE Mapscan	Industrial?	Existing	No		BLM	41.41	-106.79	North Platte River- Saratoga Lake	STANDARD	17N	84W	25
307	Reservoir		BLM-Rawlins	Sediment	Existing	No	0	BLM	41.41	-107.09	Little Jack Creek	BODEN	17N	86W	33
308	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925976	BLM	41.41	-107.33	Upper Sage Creek-North Platte River	SAGE CREEK	17N	88W	32
309	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.42	-106.75	North Draw		17N	83W	29
310	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.42	-106.75	North Draw		17N	83W	29
311	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.42	-106.68	North Draw	WIANT	17N	83W	25
312	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.42	-106.42	North Brush Creek	NORTH BRUSH CREEK	17N	80W	30
313	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.41	-107.10	Little Jack Creek	DISH	17N	86W	29
314	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920436	BLM	41.42	-106.95	Lower Jack Creek	DISH	17N	85W	27
315	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.43	-106.59	North Draw		17N	82W	23
316	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.42	-107.28	Upper Sage Creek-North Platte River	SAGE CREEK	17N	88W	26
317	Reservoir		BLM-Rawlins	Sediment	Existing	No	920386	BLM	41.43	-106.90	Lower Jack Creek	WINDMILL	17N	85W	24
318	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.43	-106.75	North Platte River- Saratoga Lake		17N	83W	20
319	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.42	-107.32	Upper Sage Creek-North Platte River	SAGE CREEK	17N	88W	29
320	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	925447	BLM	41.43	-106.96	Lower Jack Creek	DISH	17N	85W	21
321	Reservoir		ACE Mapscan	wet in 2009, 2011 & 2012	Existing	Yes		Private	41.43	-106.73	North Draw		17N	83W	22
322	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.43	-107.23	Upper Sage Creek-North Platte River	SAGE CREEK	17N	87W	19
323	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.44	-106.69	North Draw	V U	17N	83W	13
324	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.44	-106.76	North Platte River- Saratoga Lake		17N	83W	20
325	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.44	-106.75	North Platte River- Saratoga Lake		17N	83W	17
326	Reservoir		ACE Mapscan	Breach around spillway by high flows	Existing	No		Private	41.43	-107.24	Upper Sage Creek-North Platte River	SAGE CREEK	17N	87W	19
327	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		USFS	41.45	-106.41	Pass Creek-Lee Creek	PASS CREEK	17N	80W	17
328	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.43	-107.27	Upper Sage Creek-North Platte River	SAGE CREEK	17N	88W	23
329	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.44	-106.75	North Platte River- Saratoga Lake		17N	83W	17
330	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.44	-106.80	Lower Spring Creek		17N	84W	13
331	Reservoir		BLM-Rawlins	Breached	Existing	No	925427	BLM	41.44	-107.03	Lower Jack Creek	DISH	17N	86W	13
332	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.44	-107.25	Upper Sage Creek-North Platte River	SAGE CREEK	17N	88W	24
333	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.44	-107.26	Upper Sage Creek-North Platte River	SAGE CREEK	17N	88W	24
334	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.44	-107.29	Upper Sage Creek-North Platte River	SAGE CREEK	17N	88W	22
335	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.45	-106.78	North Platte River- Saratoga Lake		17N	83W	18
336	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.44	-107.01	Lower Jack Creek	DISH	17N	85W	18
337	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924728	BLM	41.45	-106.65	Lake Creek-North Platte River		17N	82W	18
338	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		BLM	41.45	-106.67	Lake Creek-North Platte River	V U	17N	83W	13
339	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	State of Wyoming	41.45	-107.07	Little Jack Creek	DISH	17N	86W	15
340	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.44	-107.27	Upper Sage Creek-North Platte River	SAGE CREEK	17N	88W	14
341	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	State of Wyoming	41.45	-107.06	Little Jack Creek	DISH	17N	86W	15
342	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.46	-106.83	North Platte River- Saratoga Lake		17N	84W	10
343	Pond		ACE Mapscan	Industrial?	Existing	No		State of Wyoming	41.46	-106.80	North Platte River- Saratoga Lake		17N	84W	12
344	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.46	-106.89	Lower Jack Creek		17N	84W	7
345	Reservoir		ACE Mapscan	Wet in 2009 & 2011, spillway damage evident	Existing	Yes		BLM	41.46	-106.97	Lower Jack Creek	PLATTE RIVER	17N	85W	9
346	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.46	-106.89	Lower Jack Creek		17N	84W	7
347	Reservoir		BLM-Rawlins	Sediment	Existing	No	924251	BLM	41.45	-107.12	Upper Sage Creek-North Platte River	MIDDLEWOOD HILL	17N	86W	18
348	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.46	-106.89	Lower Jack Creek		17N	84W	7
349	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.46	-106.82	North Platte River- Saratoga Lake		17N	84W	11
350	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.46	-106.89	Lower Jack Creek		17N	84W	7
351	Reservoir		ACE Mapscan	wet in 2009, 2011	Existing	Yes		Private	41.46	-106.87	Lower Jack Creek		17N	84W	8
352	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924253	BLM	41.46	-107.14	Upper Sage Creek-North Platte River	MIDDLEWOOD HILL	17N	87W	12
353	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920390	BLM	41.46	-107.09	Little Jack Creek	MIDDLEWOOD HILL	17N	86W	9
354	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.47	-106.86	Lower Jack Creek		17N	84W	9
355	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	State of Wyoming	41.47	-107.06	Little Jack Creek	DISH	17N	86W	10
356	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924256	BLM	41.46	-107.10	Upper Sage Creek-North Platte River	MIDDLEWOOD HILL	17N	86W	8
357	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924117	BLM	41.47	-107.03	Lower Jack Creek	COYOTE DRAW	17N	86W	12
358	Reservoir		BLM-Rawlins	Sediment	Existing	No	924116	BLM	41.47	-106.94	Lower Jack Creek	PLATTE RIVER	17N	85W	10
359	Pond		ACE Mapscan	Industrial?	Existing	No		State of Wyoming	41.47	-106.80	North Platte River- Saratoga Lake		17N	84W	1
360	Pond		ACE Mapscan	Industrial?	Existing	No		State of Wyoming	41.47	-106.80	North Platte River- Saratoga Lake		17N	84W	1

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
361	Pond		ACE Mapscan	Industrial?	Existing	No		State of Wyoming	41.47	-106.80	North Platte River- Saratoga Lake		17N	84W	1
362	Pond		ACE Mapscan	Industrial?	Existing	No		State of Wyoming	41.47	-106.80	North Platte River- Saratoga Lake		17N	84W	1
363	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926283	BLM	41.47	-107.06	Little Jack Creek	MIDDLEWOOD HILL	17N	86W	3
364	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.48	-106.79	North Platte River- Saratoga Lake		17N	84W	1
365	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920387	BLM	41.48	-106.99	North Platte River-First Cottonwood Draw	COYOTE DRAW	17N	85W	5
366	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.48	-106.92	North Platte River-First Cottonwood Draw	PLATTE RIVER	17N	85W	1
367	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924118	BLM	41.48	-107.03	North Platte River-First Cottonwood Draw	COYOTE DRAW	17N	86W	1
368	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.48	-106.77	Lake Creek-North Platte River		18N	83W	31
369	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924250	BLM	41.48	-107.14	Upper Sage Creek-North Platte River	MIDDLEWOOD HILL	17N	87W	1
370	Reservoir		BLM-Rawlins	Sediment	Existing	No	924255	BLM	41.48	-107.09	Lower Sage Creek-Upper North Platte River	MIDDLEWOOD HILL	17N	86W	5
371	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920493	BLM	41.48	-106.96	North Platte River-First Cottonwood Draw	PLATTE RIVER	17N	85W	3
372	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.48	-106.95	North Platte River-First Cottonwood Draw	PLATTE RIVER	17N	85W	3
373	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925423	BLM	41.48	-107.05	North Platte River-First Cottonwood Draw	COTTONWOOD DRAW	18N	86W	35
374	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.49	-106.91	North Platte River-First Cottonwood Draw	PLATTE RIVER	18N	85W	36
375	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924254	BLM	41.48	-107.12	Upper Sage Creek-North Platte River	MIDDLEWOOD HILL	17N	86W	6
376	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924249	BLM	41.48	-107.14	Upper Sage Creek-North Platte River	MIDDLEWOOD HILL	17N	87W	1
377	Reservoir		BLM-Rawlins	breached, or by passed	Existing	No	920082	BLM	41.48	-107.16	Upper Sage Creek-North Platte River	MIDDLEWOOD HILL	17N	87W	2
378	Reservoir		BLM-Rawlins	Sediment	Existing	No	924252	BLM	41.49	-107.07	Lower Sage Creek-Upper North Platte River	MIDDLEWOOD HILL	18N	86W	34
379	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	State of Wyoming	41.49	-107.02	North Platte River-First Cottonwood Draw	COTTONWOOD DRAW	18N	86W	36
380	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920513	BLM	41.49	-107.32	Rasmussen Creek	PINE GROVE/BOLTEN	18N	88W	32
381	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.50	-106.53	Pass Creek-Lee Creek	BASIN RANCH	18N	81W	29
382	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.50	-106.80	Lake Creek-North Platte River		18N	84W	25
383	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.50	-106.80	Lake Creek-North Platte River		18N	84W	25
384	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.50	-106.98	North Platte River-First Cottonwood Draw	COTTONWOOD DRAW	18N	85W	29
385	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.51	-106.68	South Fork Lake Creek	COAD MOUNTAIN	18N	83W	25
386	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.50	-107.12	Upper Sage Creek-North Platte River	PINE GROVE/BOLTEN	18N	86W	30
387	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		BLM	41.50	-107.04	Lower Sage Creek-Upper North Platte River	PINE GROVE/BOLTEN	18N	86W	26
388	Reservoir		ACE Mapscan	Sediment - Wet in 2011	Existing	Potential		Private	41.51	-106.72	South Fork Lake Creek	COAD MOUNTAIN	18N	83W	27
389	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.51	-106.78	Lake Creek-North Platte River		18N	83W	19
390	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.51	-106.64	South Fork Lake Creek	COAD MOUNTAIN	18N	82W	20
391	Reservoir		ACE Mapscan	Sediment	Existing	No		State of Wyoming	41.51	-106.69	South Fork Lake Creek	COAD MOUNTAIN	18N	83W	24
392	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.51	-107.10	Lower Sage Creek-Upper North Platte River	PINE GROVE/BOLTEN	18N	86W	29
393	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.52	-106.53	Pass Creek-Lee Creek		18N	81W	20
394	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Private	41.52	-106.78	Lake Creek-North Platte River		18N	83W	19
395	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.51	-107.29	Rasmussen Creek	PINE GROVE/BOLTEN	18N	88W	27
396	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.52	-106.65	South Fork Lake Creek	COAD MOUNTAIN	18N	82W	20
397	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.51	-107.29	Rasmussen Creek	PINE GROVE/BOLTEN	18N	88W	27
398	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.52	-106.79	Lake Creek-North Platte River		18N	84W	24
399	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.52	-106.90	North Platte River-First Cottonwood Draw	OLSON RANCH PASTURE	18N	85W	24
400	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.52	-106.77	Lake Creek-North Platte River		18N	83W	19
401	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.52	-106.78	Lake Creek-North Platte River		18N	83W	19
402	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.51	-107.04	Lower Sage Creek-Upper North Platte River	PINE GROVE/BOLTEN	18N	86W	23
403	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.51	-107.19	Rasmussen Creek	PINE GROVE/BOLTEN	18N	87W	27
404	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.52	-106.99	North Platte River-First Cottonwood Draw	PINE GROVE/BOLTEN	18N	85W	20
405	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.52	-106.89	North Platte River-First Cottonwood Draw	OLSON RANCH PASTURE	18N	84W	19
406	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.52	-106.89	North Platte River-First Cottonwood Draw	OLSON RANCH PASTURE	18N	84W	19
407	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.52	-106.69	South Fork Lake Creek	COAD MOUNTAIN	18N	83W	23
408	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Private	41.52	-107.23	Rasmussen Creek	PINE GROVE/BOLTEN	18N	87W	19
409	Reservoir		BLM-Rawlins	breached, by passed	Existing	No	0	BLM	41.53	-106.69	South Fork Lake Creek	COAD MOUNTAIN	18N	83W	14
410	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.53	-106.55	Pass Creek-Lee Creek		18N	81W	18
411	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.53	-106.47	Pass Creek-Lee Creek	BASIN RANCH	18N	81W	14
412	Reservoir		ACE Mapscan	Sediment - Wet in 2011	Existing	Potential		Private	41.53	-106.97	North Platte River-First Cottonwood Draw	PLATTE RIVER	18N	85W	21
413	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926752	BLM	41.52	-107.29	Rasmussen Creek	PINE GROVE/BOLTEN	18N	88W	22
414	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.53	-106.89	North Platte River-First Cottonwood Draw		18N	84W	18
415	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.53	-106.73	South Fork Lake Creek	LAKE CREEK	18N	83W	16
416	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.54	-106.46	Pass Creek-Lee Creek	BASIN RANCH	18N	81W	13
417	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.54	-106.44	Pass Creek-Little Pass Creek	BASIN RANCH	18N	80W	7
418	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.54	-106.44	Pass Creek-Little Pass Creek	BASIN RANCH	18N	80W	7
419	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.54	-106.54	Pass Creek-Lee Creek		18N	81W	7
420	Reservoir		BLM-Rawlins	Sediment, water bypasses reservoir	Existing	No	920988	BLM	41.53	-107.24	Miller Creek	PINE GROVE/BOLTEN	18N	87W	18

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421	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926169	BLM	41.55	-106.69	South Fork Lake Creek	COAD MOUNTAIN	18N	83W	12
422	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.55	-106.54	Pass Creek-Lee Creek		18N	81W	7
423	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925336	BLM	41.54	-107.28	Miller Creek	PINE GROVE/BOLTEN	18N	88W	14
424	Reservoir		BLM-Rawlins	breached	Existing	No	924787	BLM	41.55	-106.95	North Platte River-First Cottonwood Draw	PLATTE RIVER	18N	85W	10
425	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		State of Wyoming	41.56	-106.44	Pass Creek-Little Pass Creek		18N	80W	6
426	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.56	-106.61	Pass Creek-Hat Creek	COAD MOUNTAIN	18N	82W	4
427	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920504	BLM	41.55	-107.41	Upper Little Sage Creek	PINE GROVE/BOLTEN	18N	89W	10
428	Reservoir		BLM-Rawlins	Sediment	Existing	No	924119	BLM	41.56	-106.90	North Platte River-First Cottonwood Draw	PLATTE RIVER	18N	84W	6
429	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	921291	BLM	41.55	-107.33	Miller Creek	PINE GROVE/BOLTEN	18N	88W	8
430	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.57	-106.64	South Fork Lake Creek	COAD MOUNTAIN	18N	82W	5
431	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	41.57	-106.56	Pass Creek-Little Pass Creek	EAST COAD MTN ALLOT	18N	82W	1
432	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925333	BLM	41.55	-107.40	Upper Little Sage Creek	PINE GROVE/BOLTEN	18N	89W	10
433	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.57	-106.53	Pass Creek-Little Pass Creek		19N	81W	32
434	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.57	-106.46	Pass Creek-Little Pass Creek		19N	81W	36
435	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925327	BLM	41.55	-107.43	Upper Little Sage Creek	FILLMORE	18N	89W	8
436	Reservoir		BLM-Rawlins	Sediment	Existing	No	924120	BLM	41.57	-106.90	North Platte River-First Cottonwood Draw	PLATTE RIVER	18N	84W	6
437	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.56	-107.39	Upper Little Sage Creek	PINE GROVE/BOLTEN	18N	89W	2
438	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.56	-107.39	Upper Little Sage Creek	PINE GROVE/BOLTEN	18N	89W	2
439	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.56	-107.39	Upper Little Sage Creek	PINE GROVE/BOLTEN	18N	89W	2
440	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.57	-106.49	Pass Creek-Little Pass Creek		19N	81W	34
441	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.57	-107.04	Lower Sage Creek-Upper North Platte River	PINE GROVE/BOLTEN	18N	86W	2
442	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.57	-106.51	Pass Creek-Little Pass Creek		19N	81W	33
443	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.56	-107.18	Miller Creek	PINE GROVE/BOLTEN	18N	87W	3
444	Reservoir		BLM-Rawlins	Sediment	Existing	No	924121	BLM	41.57	-106.92	North Platte River-First Cottonwood Draw	PLATTE RIVER	18N	85W	2
445	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.57	-106.66	South Fork Lake Creek	COAD MOUNTAIN	19N	82W	31
446	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.56	-107.34	Miller Creek	EMIGRANT	18N	88W	5
447	Reservoir		ACE Mapscan	breached	Existing	No		BLM	41.56	-107.42	Upper Little Sage Creek	DOOLITTLE	18N	89W	4
448	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.58	-106.71	Pass Creek-Hat Creek		19N	83W	34
449	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.58	-106.50	Pass Creek-Little Pass Creek		19N	81W	33
450	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.58	-106.67	Pass Creek-Hat Creek		19N	83W	36
451	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.57	-107.35	Upper Little Sage Creek	EMIGRANT	18N	88W	6
452	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		State of Wyoming	41.57	-107.38	Upper Little Sage Creek	PINE GROVE/BOLTEN	18N	89W	2
453	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.58	-106.49	Pass Creek-Little Pass Creek		19N	81W	27
454	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.57	-107.40	Upper Little Sage Creek	PINE GROVE/BOLTEN	18N	89W	3
455	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.58	-106.56	Pass Creek-Little Pass Creek		19N	82W	25
456	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925329	BLM	41.57	-107.30	Miller Creek	EMIGRANT	19N	88W	34
457	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.58	-106.74	Pass Creek-Hat Creek	T.A.RANCH	19N	83W	28
458	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		State of Wyoming	41.59	-106.47	Pass Creek-Little Pass Creek	U.L.ALLOTMENT	19N	81W	26
459	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.59	-106.52	Pass Creek-Little Pass Creek		19N	81W	29
460	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.58	-107.08	Lower Little Sage Creek	PINE GROVE/BOLTEN	19N	86W	33
461	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.58	-107.08	Lower Little Sage Creek	PINE GROVE/BOLTEN	19N	86W	33
462	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.59	-106.50	Pass Creek-Little Pass Creek		19N	81W	28
463	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.59	-106.53	Pass Creek-Little Pass Creek		19N	81W	29
464	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.59	-106.49	Pass Creek-Little Pass Creek	U.L.ALLOTMENT	19N	81W	27
465	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	921210	BLM	41.58	-107.40	Upper Little Sage Creek	PINE GROVE/BOLTEN	19N	89W	34
466	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.60	-106.52	Pass Creek-Little Pass Creek		19N	81W	29
467	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		State of Wyoming	41.59	-106.74	Pass Creek-Hat Creek	T.A.RANCH	19N	83W	28
468	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.58	-107.35	Upper Little Sage Creek	EMIGRANT	19N	88W	31
469	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.58	-107.39	Upper Little Sage Creek	PINE GROVE/BOLTEN	19N	89W	35
470	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.58	-107.31	Upper Little Sage Creek	EMIGRANT	19N	88W	33
471	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.58	-107.38	Upper Little Sage Creek	PINE GROVE/BOLTEN	19N	89W	35
472	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.60	-106.60	Pass Creek-Little Pass Creek	WEST ELK MOUNTAIN	19N	82W	22
473	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.59	-107.33	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	29
474	Reservoir		ACE Mapscan	sediment	Existing	No		BLM	41.59	-107.32	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	28
475	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.59	-107.35	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	30
476	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.59	-107.35	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	30
477	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925317	BLM	41.59	-107.39	Upper Little Sage Creek	SIXTEEN MILE	19N	89W	26
478	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.59	-107.37	Upper Little Sage Creek	SIXTEEN MILE	19N	89W	25
479	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.59	-107.30	Upper Little Sage Creek	EMIGRANT	19N	88W	27
480	Reservoir		BLM-Rawlins	Sediment	Existing	No	921215	BLM	41.59	-107.31	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	28

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481	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		BLM	41.59	-107.35	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	30
482	Reservoir		ACE Mapscan	small storage pool	Existing	Yes		State of Wyoming	41.61	-106.67	Pass Creek-Hat Creek		19N	83W	24
483	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926305	BLM	41.60	-107.03	North Platte River-Coal Mine Draw	PINE GROVE/BOLTEN	19N	86W	24
484	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	921213	BLM	41.60	-107.29	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	22
485	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.60	-107.37	Upper Little Sage Creek	SIXTEEN MILE	19N	89W	25
486	Reservoir		BLM-Rawlins	Breached	Existing	No	921214	BLM	41.60	-107.32	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	20
487	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	921059	BLM	41.60	-107.26	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	24
488	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.61	-106.91	North Platte River-Coal Mine Draw	PINE GROVE/BOLTEN	19N	85W	24
489	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924093	BLM	41.60	-107.30	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	22
490	Reservoir		BLM-Rawlins	Sediment	Existing	No	921146	BLM	41.61	-107.29	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	22
491	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.62	-106.83	Pass Creek-Stage Station Springs	LAKE CREEK FLATS	19N	84W	15
492	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.61	-107.36	Upper Little Sage Creek	SIXTEEN MILE	19N	89W	24
493	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.61	-107.37	Upper Little Sage Creek	SIXTEEN MILE	19N	89W	24
494	Reservoir		BLM-Rawlins	Sediment	Existing	No	921147	BLM	41.61	-107.30	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	22
495	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.61	-107.37	Upper Little Sage Creek	SIXTEEN MILE	19N	89W	24
496	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.62	-107.37	Upper Little Sage Creek	SIXTEEN MILE	19N	89W	13
497	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	921145	BLM	41.62	-107.32	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	16
498	Reservoir		ACE Mapscan	sediment	Existing	No		State of Wyoming	41.63	-106.97	North Platte River-Coal Mine Draw	PINE GROVE/BOLTEN	19N	85W	16
499	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	923574	BLM	41.62	-107.28	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	14
500	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	925431	BLM	41.62	-107.05	North Platte River-Coal Mine Draw	PINE GROVE/BOLTEN	19N	86W	14
501	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.62	-107.33	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	17
502	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.63	-107.36	Upper Little Sage Creek	SIXTEEN MILE	19N	89W	13
503	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.64	-106.77	Pass Creek-Rattlesnake Creek	T.A.RANCH	19N	83W	7
504	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925318	BLM	41.63	-107.32	Upper Little Sage Creek	SIXTEEN MILE	19N	88W	16
505	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.63	-107.36	Upper Little Sage Creek	SIXTEEN MILE	19N	89W	13
506	Reservoir		BLM-Rawlins	Sediment	Existing	No	925429	BLM	41.63	-107.11	Iron Springs Draw	PINE GROVE/BOLTEN	19N	86W	8
507	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.64	-106.72	Pass Creek-Hat Creek		19N	83W	10
508	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.64	-106.72	Pass Creek-Hat Creek		19N	83W	10
509	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.63	-107.39	Upper Sugar Creek	SIXTEEN MILE	19N	89W	11
510	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.64	-106.75	Pass Creek-Hat Creek		19N	83W	4
511	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.64	-106.74	Pass Creek-Hat Creek		19N	83W	4
512	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.64	-106.74	Pass Creek-Hat Creek		19N	83W	4
513	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	0	Private	41.64	-106.83	Pass Creek-Stage Station Springs	LAKE CREEK FLATS	19N	84W	3
514	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.65	-106.72	Pass Creek-Hat Creek		19N	83W	3
515	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	925430	BLM	41.64	-107.08	Iron Springs Draw	PINE GROVE/BOLTEN	19N	86W	4
516	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.65	-107.10	Iron Springs Draw	PINE GROVE/BOLTEN	19N	86W	5
517	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926295	BLM	41.64	-107.37	Upper Sugar Creek	SIXTEEN MILE	19N	89W	12
518	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.65	-106.83	Pass Creek-Stage Station Springs	LAKE CREEK FLATS	19N	84W	3
519	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.65	-107.36	Upper Sugar Creek	SIXTEEN MILE	19N	89W	1
520	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.65	-107.34	Upper Sugar Creek	SIXTEEN MILE	19N	88W	5
521	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926508	Private	41.65	-107.20	Hugus Draw	PINE GROVE/BOLTEN	19N	87W	4
522	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.65	-107.41	Upper Sugar Creek	SIXTEEN MILE	19N	89W	3
523	Pond		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.66	-107.27	Middle Sugar Creek	SIXTEEN MILE	20N	88W	35
524	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.66	-107.35	Upper Sugar Creek	BULL CANYON	19N	88W	6
525	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.67	-106.84	Pass Creek-Stage Station Springs	LAKE CREEK FLATS	20N	84W	34
526	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.66	-107.44	Upper Sugar Creek	SIXTEEN MILE	19N	89W	5
527	Pond		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.67	-106.71	Pass Creek-Hat Creek		20N	83W	27
528	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.67	-107.05	Iron Springs Draw	PINE GROVE/BOLTEN	20N	86W	35
529	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925433	BLM	41.66	-107.21	Hugus Draw	PINE GROVE/BOLTEN	20N	87W	32
530	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.67	-107.16	Hugus Draw	PINE GROVE/BOLTEN	20N	87W	35
531	Reservoir		BLM-Rawlins	Potential breach around spillway	Existing	No	926533	BLM	41.67	-107.27	Middle Sugar Creek	PINE GROVE/BOLTEN	20N	88W	36
532	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.68	-106.70	Pass Creek-Hat Creek		20N	83W	26
533	Reservoir		BLM-Rawlins	breach around spillway	Existing	No	925434	BLM	41.67	-107.13	Hugus Draw	PINE GROVE/BOLTEN	20N	86W	30
534	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	926083	Private	41.67	-107.34	Upper Sugar Creek	BULL CANYON	20N	88W	32
535	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.67	-107.38	Upper Sugar Creek	SIXTEEN MILE	20N	89W	35
536	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		BLM	41.67	-107.29	Middle Sugar Creek	SIXTEEN MILE	20N	88W	34
537	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	0	Private	41.68	-106.84	Pass Creek-Stage Station Springs	South Walcott	20N	84W	27
538	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926546	BLM	41.67	-107.40	Upper Sugar Creek	SIXTEEN MILE	20N	89W	34
539	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	41.67	-107.36	Upper Sugar Creek	SIXTEEN MILE	20N	89W	36
540	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.68	-107.02	Iron Springs Draw	PINE GROVE/BOLTEN	20N	85W	30

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
541	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926082	BLM	41.68	-107.31	Middle Sugar Creek	BULL CANYON	20N	88W	28
542	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.68	-107.35	Upper Sugar Creek	BULL CANYON	20N	88W	30
543	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.69	-106.97	Iron Springs Draw	PINE GROVE/BOLTEN	20N	85W	21
544	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.68	-107.20	Hugus Draw	PINE GROVE/BOLTEN	20N	87W	28
545	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925321	BLM	41.68	-107.39	Upper Sugar Creek	BULL CANYON	20N	89W	26
546	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Private	41.68	-107.29	Middle Sugar Creek	SIXTEEN MILE	20N	88W	27
547	Reservoir		ACE Mapscan	breached, holds water	Existing	No		Private	41.68	-107.37	Upper Sugar Creek	BULL CANYON	20N	89W	25
548	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	0	BLM	41.70	-106.68	Pass Creek-Rattlesnake Creek	PASS CREEK RIDGE	20N	83W	24
549	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.69	-107.34	Upper Sugar Creek	BULL CANYON	20N	88W	29
550	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925320	BLM	41.69	-107.34	Upper Sugar Creek	BULL CANYON	20N	88W	20
551	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		BLM	41.69	-107.29	Middle Sugar Creek	SIXTEEN MILE	20N	88W	22
552	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	0	Private	41.70	-106.69	Pass Creek-Rattlesnake Creek		20N	83W	23
553	Reservoir		BLM-Rawlins	Sediment	Existing	No	926724	BLM	41.69	-107.27	Middle Sugar Creek	PINE GROVE/BOLTEN	20N	88W	24
554	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.70	-106.73	Pass Creek-Rattlesnake Creek		20N	83W	22
555	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926362	BLM	41.70	-106.95	Iron Springs Draw	PINE GROVE/BOLTEN	20N	85W	22
556	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.69	-107.28	Middle Sugar Creek	SIXTEEN MILE	20N	88W	23
557	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.70	-107.00	Hugus Draw	PINE GROVE/BOLTEN	20N	85W	20
558	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.70	-106.77	Pass Creek-Stage Station Springs		20N	83W	18
559	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.69	-107.35	Upper Sugar Creek	BULL CANYON	20N	88W	19
560	Reservoir		BLM-Rawlins	breached	Existing	No	0	Private	41.71	-106.68	Pass Creek-Rattlesnake Creek	PASS CREEK RIDGE	20N	83W	13
561	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.70	-107.29	Middle Sugar Creek	SIXTEEN MILE	20N	88W	22
562	Reservoir		BLM-Rawlins	Sediment	Existing	No	923573	BLM	41.70	-107.27	Middle Sugar Creek	SIXTEEN MILE	20N	88W	14
563	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.70	-107.29	Middle Sugar Creek	SIXTEEN MILE	20N	88W	15
564	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.72	-106.76	Pass Creek-Stage Station Springs		20N	83W	8
565	Reservoir		BLM-Rawlins	Industrial? only wet in one year of photography	Existing	No	0	BLM	41.71	-107.27	Middle Sugar Creek	SIXTEEN MILE	20N	88W	14
566	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	925848	BLM	41.72	-106.83	Pass Creek-Stage Station Springs	South Walcott	20N	84W	10
567	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.73	-106.77	Pass Creek-Stage Station Springs		20N	83W	7
568	Reservoir		ACE Mapscan	Wet in 2009 & 2011 &2012	Existing	Yes		Private	41.73	-106.76	Pass Creek-Stage Station Springs		20N	83W	8
569	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.73	-106.77	Pass Creek-Stage Station Springs		20N	83W	7
570	Reservoir		BLM-Rawlins	breached	Existing	No	0	BLM	41.72	-107.22	1.018E+11	PINE GROVE/BOLTEN	20N	87W	8
571	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.73	-107.00	Hugus Draw	PINE GROVE/BOLTEN	20N	85W	8
572	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.74	-106.60	Upper Saint Mary's Creek	PASS CREEK RIDGE	20N	82W	3
573	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.73	-106.77	Pass Creek-Stage Station Springs		20N	83W	6
574	Reservoir		BLM-Rawlins	wet in two years of photography	Existing	Yes	0	Private	41.73	-106.84	Pass Creek-Stage Station Springs	South Walcott	20N	84W	3
575	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.73	-106.77	Pass Creek-Stage Station Springs		20N	83W	6
576	Reservoir		ACE Mapscan	Wet in 2009 & 2011 & 2012	Existing	Yes		Private	41.73	-106.78	Pass Creek-Stage Station Springs		20N	83W	6
577	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	41.74	-106.55	Upper Saint Mary's Creek	HOME RANCH	21N	81W	32
578	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.74	-106.77	Pass Creek-Stage Station Springs	PASS CREEK RIDGE	21N	83W	33
579	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.74	-107.36	Upper Sugar Creek	SIXTEEN MILE	20N	89W	1
580	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.75	-106.95	North Platte River-Lost Springs Draw	PINE GROVE/BOLTEN	21N	85W	35
581	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.75	-106.94	North Platte River-Lost Springs Draw	PINE GROVE/BOLTEN	21N	85W	36
582	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.76	-106.48	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	25
583	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.75	-107.01	Grenville Dome	PINE GROVE/BOLTEN	21N	85W	32
584	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.74	-107.26	Middle Sugar Creek	PINE GROVE/BOLTEN	21N	87W	31
585	Pond		ACE Mapscan	Industrial	Existing	No		Private	41.75	-107.26	Middle Sugar Creek	PINE GROVE/BOLTEN	21N	87W	31
586	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.75	-106.91	North Platte River-Lost Springs Draw	FT STEELE BREAKS	21N	84W	31
587	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.76	-106.45	Upper Saint Mary's Creek		21N	80W	30
588	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920164	BLM	41.76	-106.52	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	28
589	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.75	-107.26	Middle Sugar Creek		21N	87W	31
590	Reservoir		ACE Mapscan	breached or bypassed	Existing	No		Private	41.75	-107.23	Middle Sugar Creek	PINE GROVE/BOLTEN	21N	87W	33
591	Reservoir		ACE Mapscan	Sediment - wet in 2011	Existing	Potential		Private	41.75	-107.31	Upper Sugar Creek	SIXTEEN MILE	21N	88W	35
592	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.76	-106.94	North Platte River-Lost Springs Draw	PINE GROVE/BOLTEN	21N	85W	25
593	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.76	-107.10	Grenville Dome	PINE GROVE/BOLTEN	21N	86W	27
594	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.76	-106.62	Upper Saint Mary's Creek	PASS CREEK RIDGE	21N	82W	27
595	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.76	-106.94	North Platte River-Lost Springs Draw	PINE GROVE/BOLTEN	21N	85W	25
596	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.75	-107.34	Upper Sugar Creek	SIXTEEN MILE	21N	88W	33
597	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		BLM	41.77	-106.52	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	28
598	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.76	-106.74	Pass Creek-Stage Station Springs	PASS CREEK RIDGE	21N	83W	27
599	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.77	-106.49	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	23
600	Reservoir		ACE Mapscan	Sediment	Existing	No		State of Wyoming	41.76	-106.85	Lower Saint Mary's Creek	FT STEELE BREAKS	21N	84W	26

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
601	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.76	-106.95	North Platte River-Lost Springs Draw	PINE GROVE/BOLTEN	21N	85W	26
602	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.77	-106.47	Upper Saint Mary's Creek		21N	81W	24
603	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		BLM	41.77	-106.56	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	20
604	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.77	-106.85	Lower Saint Mary's Creek	FT STEELE BREAKS	21N	84W	26
605	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.77	-106.59	Upper Saint Mary's Creek	WILSON PASTURE	21N	82W	24
606	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	920247	State of Wyoming	41.76	-107.21	1.018E+11	PINE GROVE/BOLTEN	21N	87W	27
607	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.77	-106.49	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	23
608	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.77	-106.48	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	23
609	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.78	-106.49	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	23
610	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.78	-106.48	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	23
611	Reservoir		BLM-Rawlins	breached or by passed	Existing	No	920160	BLM	41.78	-106.50	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	22
612	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.78	-106.53	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	21
613	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.77	-106.94	North Platte River-Lost Springs Draw	FT STEELE BREAKS	21N	85W	24
614	Reservoir		BLM-Rawlins	wet in two years of photography	Existing	Yes	0	Private	41.77	-106.84	Lower Saint Mary's Creek	FT STEELE BREAKS	21N	84W	23
615	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.77	-107.28	Upper Sugar Creek	SIXTEEN MILE	21N	88W	25
616	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.78	-106.57	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	19
617	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.78	-106.65	Middle Saint Mary's Creek	PASS CREEK RIDGE	21N	82W	21
618	Reservoir		BLM-Rawlins	Sediment	Existing	No	926507	BLM	41.78	-106.75	Lower Saint Mary's Creek	PASS CREEK RIDGE	21N	83W	22
619	Pond		ACE Mapscan	Industrial	Existing	No		Private	41.77	-107.09	Lower Sugar Creek		21N	86W	22
620	Pond		ACE Mapscan	Industrial	Existing	No		Private	41.77	-107.18	Middle Sugar Creek	PINE GROVE/BOLTEN	21N	87W	23
621	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	0	Private	41.78	-106.87	Lower Saint Mary's Creek	FT STEELE BREAKS	21N	84W	21
622	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.79	-106.44	Upper Saint Mary's Creek	CHACE BLOCK	21N	80W	17
623	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.79	-106.47	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	13
624	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.79	-106.66	Middle Saint Mary's Creek	PASS CREEK RIDGE	21N	82W	17
625	Pond		ACE Mapscan	Industrial	Existing	No		Private	41.78	-107.18	Middle Sugar Creek	PINE GROVE/BOLTEN	21N	87W	23
626	Pond		ACE Mapscan	Industrial	Existing	No		Private	41.78	-107.10	Lower Sugar Creek		21N	86W	21
627	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	State of Wyoming	41.79	-106.75	Lower Saint Mary's Creek	PASS CREEK RIDGE	21N	83W	16
628	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.79	-106.44	Upper Saint Mary's Creek	CHACE BLOCK	21N	80W	18
629	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.78	-107.03	Grenville Dome	EAST SINCLAIR	21N	85W	19
630	Reservoir		BLM-Rawlins	Sediment	Existing	No	0	Private	41.78	-107.01	Grenville Dome	EAST SINCLAIR	21N	85W	17
631	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.79	-106.57	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	18
632	Pond		ACE Mapscan	Industrial	Existing	No		Private	41.78	-107.31	Upper Sugar Creek		21N	88W	23
633	Pond		ACE Mapscan	Industrial	Existing	No		Private	41.78	-107.31	Upper Sugar Creek		21N	88W	23
634	Pond		ACE Mapscan	Industrial	Existing	No		Private	41.78	-107.31	Upper Sugar Creek		21N	88W	23
635	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.79	-106.81	Lower Saint Mary's Creek	FT STEELE BREAKS	21N	84W	13
636	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.78	-107.20	Middle Sugar Creek	THAYER	21N	87W	22
637	Reservoir		ACE Mapscan	Industrial Pits	Existing	No		Private	41.79	-107.04	Grenville Dome		21N	86W	13
638	Reservoir		ACE Mapscan	Industrial Pits	Existing	No		Private	41.79	-107.07	Lower Sugar Creek		21N	86W	14
639	Reservoir		ACE Mapscan	Industrial Pits	Existing	No		Private	41.79	-107.08	Lower Sugar Creek		21N	86W	15
640	Reservoir		ACE Mapscan	golf course	Existing	No		Private	41.79	-107.18	Lower Sugar Creek		21N	87W	14
641	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.80	-106.48	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	12
642	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.80	-106.66	Middle Saint Mary's Creek	PASS CREEK RIDGE	21N	82W	17
643	Reservoir		ACE Mapscan	Industrial Pits	Existing	No		Private	41.79	-107.04	Lower Sugar Creek		21N	86W	13
644	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.80	-106.68	Middle Saint Mary's Creek	PASS CREEK RIDGE	21N	82W	7
645	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.80	-106.70	Middle Saint Mary's Creek	PASS CREEK RIDGE	21N	83W	12
646	Reservoir		ACE Mapscan	golf course	Existing	No		Private	41.79	-107.19	Lower Sugar Creek		21N	87W	14
647	Reservoir		BLM-Rawlins	wet in two years of photography	Existing	Yes	0	BLM	41.80	-106.82	Lower Saint Mary's Creek	FT STEELE BREAKS	21N	84W	12
648	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.80	-106.54	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	8
649	Reservoir		BLM-Rawlins	Sediment, moved upstream	Existing	No	0	Private	41.80	-106.70	Middle Saint Mary's Creek	PASS CREEK RIDGE	21N	83W	12
650	Reservoir		ACE Mapscan	golf course	Existing	No		Private	41.79	-107.19	Lower Sugar Creek		21N	87W	14
651	Reservoir		ACE Mapscan	Industrial	Existing	No		BLM	41.79	-107.30	Upper Sugar Creek	SANDSTONE	21N	88W	14
652	Reservoir		ACE Mapscan	Industrial Pits	Existing	No		Private	41.80	-107.04	Lower Sugar Creek		21N	86W	13
653	Reservoir		ACE Mapscan	golf course	Existing	No		Private	41.79	-107.19	Lower Sugar Creek		21N	87W	14
654	Reservoir		ACE Mapscan	Industrial Pits	Existing	No		Private	41.80	-107.06	Lower Sugar Creek		21N	86W	13
655	Reservoir		ACE Mapscan	Industrial Pits	Existing	No		Private	41.80	-107.05	Lower Sugar Creek		21N	86W	13
656	Reservoir		ACE Mapscan	Industrial Pits	Existing	No		Private	41.80	-107.06	Lower Sugar Creek		21N	86W	13
657	Reservoir		ACE Mapscan	golf course	Existing	No		Private	41.80	-107.19	Lower Sugar Creek		21N	87W	14
658	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.80	-106.88	Cedar Ridge	FT STEELE BREAKS	21N	84W	9
659	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		BLM	41.81	-106.66	Middle Saint Mary's Creek	PASS CREEK RIDGE	21N	82W	8
660	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.81	-106.46	Upper Saint Mary's Creek	CHACE BLOCK	21N	80W	7

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
661	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	925200	BLM	41.80	-107.35	Upper Sugar Creek	SANDSTONE	21N	88W	16
662	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926509	BLM	41.81	-106.78	Middle Saint Mary's Creek	PASS CREEK RIDGE	21N	83W	8
663	Pond		ACE Mapscan	Industrial	Existing	No		BLM	41.80	-107.12	Lower Sugar Creek	HAYSTACK	21N	86W	8
664	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.81	-106.56	Upper Saint Mary's Creek	DANA MEADOWS SOUTH	21N	81W	8
665	Pond		ACE Mapscan	Industrial	Existing	No		BLM	41.80	-107.13	Lower Sugar Creek	HAYSTACK	21N	86W	8
666	Pond		ACE Mapscan	Industrial	Existing	No		BLM	41.80	-107.12	Lower Sugar Creek	HAYSTACK	21N	86W	8
667	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.81	-106.64	Middle Saint Mary's Creek	PASS CREEK RIDGE	21N	82W	9
668	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.80	-107.29	Upper Sugar Creek	SANDSTONE	21N	88W	12
669	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.81	-106.86	Taylor Draw	FT STEELE BREAKS	21N	84W	10
670	Reservoir		BLM-Rawlins	Reservoir for overflow from tank, BlM doesn't know water source	Existing	No	0	Private	41.81	-106.96	Cedar Ridge	FT STEELE BREAKS	21N	85W	11
671	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.81	-107.03	Lower Sugar Creek	EAST SINCLAIR	21N	85W	7
672	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.81	-107.09	Lower Sugar Creek	HAYSTACK RIVER PAST	21N	86W	10
673	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.81	-107.21	Lower Sugar Creek		21N	87W	10
674	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	920929	BLM	41.82	-106.46	Upper Saint Mary's Creek	CHACE BLOCK	21N	80W	6
675	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	41.81	-107.08	Lower Sugar Creek	HAYSTACK RIVER PAST	21N	86W	2
676	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.81	-107.30	Upper Sugar Creek	SANDSTONE	21N	88W	11
677	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	5978	BLM	41.82	-107.04	Lower Sugar Creek	HAYSTACK RIVER PAST	21N	85W	6
678	Pond		ACE Mapscan	Industrial	Existing	No		Private	41.82	-107.03	North Platte River-Lost Springs Draw	HAYSTACK RIVER PAST	21N	85W	6
679	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.83	-106.67	Middle Saint Mary's Creek	PASS CREEK RIDGE	22N	82W	32
680	Reservoir		BLM-Rawlins	wet in at least two years of photography associated with well	Existing	Yes	0	Private	41.82	-107.35	Upper Sugar Creek	SANDSTONE	21N	88W	5
681	Pond		ACE Mapscan	Industrial	Existing	No		State of Wyoming	41.83	-106.59	Middle Saint Mary's Creek	DANA MEADOWS SOUTH	22N	82W	36
682	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.82	-107.11	Lower Sugar Creek	HAYSTACK	21N	86W	4
683	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	41.83	-107.31	Upper Sugar Creek	SANDSTONE	21N	88W	2
684	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	41.83	-106.97	Cedar Ridge	NORTH WALCOTT	22N	85W	34
685	Reservoir		BLM-Rawlins	Sediment	Existing	No	926514	Private	41.84	-106.68	Middle Saint Mary's Creek	DANA BLOCK NORTH	22N	82W	31
686	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.83	-107.14	Lower Sugar Creek	HAYSTACK	22N	86W	32
687	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.84	-106.71	Middle Saint Mary's Creek	QUEALEY BLOCK	22N	83W	25
688	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		BLM	41.85	-106.72	Middle Saint Mary's Creek	QUEALEY BLOCK	22N	83W	26
689	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	41.84	-107.32	Upper Sugar Creek	SANDSTONE	22N	88W	34
690	Reservoir		BLM-Rawlins	Sediment	Existing	No	926512	BLM	41.85	-106.80	Taylor Draw	QUEALEY BLOCK	22N	83W	30
691	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926510	BLM	41.85	-107.11	Lower Sugar Creek	HAYSTACK	22N	86W	28
692	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.85	-107.32	Upper Sugar Creek	SANDSTONE	22N	88W	27
693	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.86	-106.83	Taylor Draw	NORTH WALCOTT	22N	84W	23
694	Reservoir		ACE Mapscan	Wet in 2009	Existing	Potential		Private	41.85	-107.14	Lower Sugar Creek	HAYSTACK	22N	86W	29
695	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes	924214	Private	41.86	-107.16	Lower Sugar Creek	HAYSTACK	22N	87W	25
696	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924214	BLM	41.86	-107.16	Lower Sugar Creek	HAYSTACK	22N	86W	30
697	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		BLM	41.86	-106.89	Taylor Draw	NORTH WALCOTT	22N	84W	20
698	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.86	-107.28	Ninemile Hill	SANDSTONE	22N	88W	24
699	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.86	-107.28	Ninemile Hill	SANDSTONE	22N	88W	24
700	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.87	-106.88	Taylor Draw	NORTH WALCOTT	22N	84W	21
701	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	0	Private	41.88	-107.31	Ninemile Hill	SANDSTONE	22N	88W	14
702	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	0	Private	41.89	-107.26	Ninemile Hill	HAYSTACK	22N	87W	7
703	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	926511	BLM	41.90	-107.04	North Platte River-Lost Springs Draw	SEMINOE	22N	85W	6
704	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.90	-107.27	Ninemile Hill	HAYSTACK	22N	87W	7
705	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.91	-107.02	Dirtyman Draw	SEMINOE	22N	85W	5
706	Reservoir		BLM-Rawlins	Wet in only 2011 photography	Existing	Potential	924198	BLM	41.91	-106.99	Dirtyman Draw	SEMINOE	22N	85W	4
707	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.91	-107.32	Ninemile Hill	SANDSTONE	22N	88W	3
708	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	924964	BLM	41.91	-107.30	Ninemile Hill	HAYSTACK	22N	88W	2
709	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	41.91	-107.30	Ninemile Hill	HAYSTACK	22N	88W	2
710	Reservoir		ACE Mapscan	dry in 2009, 2011 & 2012	Existing	No		Private	41.93	-106.93	Upper Seminoe Reservoir	SEMINOE	23N	85W	25
711	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	41.94	-106.92	Upper Seminoe Reservoir	SEMINOE	23N	84W	19
712	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	41.94	-107.29	Ninemile Hill	HAYSTACK	23N	88W	25
713	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	923532	BLM	41.95	-107.08	Dirtyman Draw	SEMINOE	23N	86W	22
714	Reservoir		BLM-Rawlins	Sediment	Existing	No	0	BLM	41.95	-107.02	Dirtyman Draw	SEMINOE	23N	85W	20
715	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.95	-106.87	Middle Seminoe Reservoir	SEMINOE	23N	84W	21
716	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.95	-107.11	Dirtyman Draw	HAYSTACK	23N	86W	21
717	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	0	Private	41.95	-107.07	Dirtyman Draw	SEMINOE	23N	86W	23
718	Reservoir		BLM-Rawlins	Sediment	Existing	No	0	Private	41.96	-107.08	Dirtyman Draw	SEMINOE	23N	86W	15
719	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	926522	BLM	41.96	-106.99	Dirtyman Draw	SEMINOE	23N	85W	16
720	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	0	Private	41.97	-106.93	Middle Seminoe Reservoir	SEMINOE	23N	85W	13

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
721	Reservoir		BLM-Rawlins	Sediment	Existing	No	926521	BLM	41.97	-107.06	Dirtyman Draw	SEMINOE	23N	86W	14
722	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.97	-106.91	Middle Seminoe Reservoir	SEMINOE	23N	84W	17
723	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.97	-106.94	Middle Seminoe Reservoir	SEMINOE	23N	85W	13
724	Reservoir		ACE Mapscan	breached around spillway	Existing	No		Private	41.97	-106.91	Middle Seminoe Reservoir	SEMINOE	23N	84W	7
725	Reservoir		BLM-Rawlins	Sediment	Existing	No	923529	BLM	41.97	-107.04	Dirtyman Draw	SEMINOE	23N	86W	12
726	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	41.98	-106.95	Middle Seminoe Reservoir	SEMINOE	23N	85W	11
727	Reservoir		BLM-Rawlins	wet in two years of photography	Existing	Yes	0	Private	41.98	-107.03	Dirtyman Draw	SEMINOE	23N	85W	7
728	Reservoir		BLM-Rawlins	wet in two years of photography	Existing	Yes	0	Private	41.98	-106.95	Middle Seminoe Reservoir	SEMINOE	23N	85W	11
729	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.98	-107.08	Stinkhole Draw	SEMINOE	23N	86W	11
730	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.98	-106.91	Middle Seminoe Reservoir	SEMINOE	23N	84W	7
731	Reservoir		BLM-Rawlins	Sediment	Existing	No	0	Private	41.98	-107.10	O'Brien Creek	SEMINOE	23N	86W	9
732	Reservoir		ACE Mapscan	Wet in only 2011 photography	Existing	Potential		Private	41.98	-107.11	O'Brien Creek	SEMINOE	23N	86W	9
733	Reservoir		BLM-Rawlins	Breached	Existing	No	0	Private	41.98	-107.06	Stinkhole Draw	SEMINOE	23N	86W	11
734	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	41.99	-106.89	Middle Seminoe Reservoir	SEMINOE	23N	84W	5
735	Reservoir		BLM-Rawlins	Sediment	Existing	No	923531	BLM	41.99	-107.10	O'Brien Creek	SEMINOE	23N	86W	10
736	Reservoir		BLM-Rawlins	Dry in 3 years of photography	Existing	No	926523	BLM	42.00	-107.03	Stinkhole Draw	SEMINOE	23N	85W	6
737	Reservoir		BLM-Rawlins	Sediment, used as a cattle corral now? see 2011 imagery	Existing	No	0	Private	42.00	-107.06	O'Brien Creek	SEMINOE	23N	86W	2
738	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Private	42.01	-106.96	Stinkhole Draw	SEMINOE	24N	85W	35
739	Reservoir		BLM-Rawlins	Sediment	Existing	No	0	Private	42.01	-106.95	Stinkhole Draw	SEMINOE	24N	85W	35
740	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	923533	BLM	42.01	-107.12	O'Brien Creek	SEMINOE	24N	86W	32
741	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	42.01	-106.98	Stinkhole Draw	SEMINOE	24N	85W	34
742	Reservoir		ACE Mapscan	Sediment	Existing	No		BLM	42.02	-107.00	Stinkhole Draw	SEMINOE	24N	85W	28
743	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		BLM	42.02	-107.00	Stinkhole Draw	SEMINOE	24N	85W	28
744	Reservoir		BLM-Rawlins	Breached	Existing	No	0	Private	42.02	-107.08	O'Brien Creek	SEMINOE	24N	86W	26
745	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	42.02	-107.10	O'Brien Creek	SEMINOE	24N	86W	28
746	Reservoir		ACE Mapscan	Wet in 2009	Existing	Potential		BLM	42.03	-106.92	Stinkhole Draw	SEMINOE	24N	84W	30
747	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	42.03	-106.97	Stinkhole Draw	SEMINOE	24N	85W	27
748	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	42.03	-106.91	Stinkhole Draw	SEMINOE	24N	84W	30
749	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Private	42.03	-107.13	O'Brien Creek	SEMINOE	24N	86W	29
750	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	42.04	-107.01	O'Brien Creek	SEMINOE	24N	85W	20
751	Reservoir		BLM-Rawlins	wet in two years of photography	Existing	Yes	0	Private	42.04	-107.07	O'Brien Creek	SEMINOE	24N	86W	23
752	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.05	-107.04	O'Brien Creek	SEMINOE	24N	86W	13
753	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920925	BLM	42.07	-107.01	O'Brien Creek	SEMINOE	24N	85W	8
754	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		BLM	42.07	-107.01	O'Brien Creek	SEMINOE	24N	85W	8
755	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920122	BLM	42.07	-107.01	O'Brien Creek	SEMINOE	24N	85W	8
756	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	BLM	42.07	-107.05	Tapers Ranch	SEMINOE	24N	86W	12
757	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Bureau of Reclamation	42.08	-106.88	Lower Seminoe Reservoir	SEMINOE	24N	84W	4
758	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	920924	BLM	42.07	-107.06	Tapers Ranch	SEMINOE	24N	86W	1
759	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	42.08	-107.08	Tapers Ranch	TAPERS	24N	86W	2
760	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.08	-107.08	Tapers Ranch	TAPERS	24N	86W	3
761	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		State of Wyoming	42.09	-107.06	Tapers Ranch	SEMINOE	25N	86W	36
762	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Bureau of Reclamation	42.10	-106.89	Hurt Creek	SEMINOE	25N	84W	33
763	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.10	-107.03	Hurt Creek	SEMINOE	25N	85W	32
764	Reservoir		BLM-Rawlins	Breached, holding water but clearly breached	Existing	No	0	Private	42.10	-106.89	Hurt Creek	SEMINOE	25N	84W	28
765	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes	0	Private	42.10	-107.04	Hurt Creek	SEMINOE	25N	85W	30
766	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	42.11	-106.90	Hurt Creek	SEMINOE	25N	84W	29
767	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.11	-106.91	Hurt Creek	SEMINOE	25N	84W	29
768	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	42.11	-107.04	Hurt Creek	SEMINOE	25N	85W	30
769	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.11	-107.03	Hurt Creek	SEMINOE	25N	85W	29
770	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.11	-106.92	Hurt Creek	SEMINOE	25N	84W	29
771	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	42.11	-106.92	Hurt Creek	SEMINOE	25N	84W	30
772	Reservoir		ACE Mapscan	Wet in 2009	Existing	Potential		Private	42.11	-106.91	Hurt Creek	SEMINOE	25N	84W	29
773	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.11	-106.92	Hurt Creek	SEMINOE	25N	84W	29
774	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.11	-106.94	Hurt Creek	SEMINOE	25N	84W	30
775	Reservoir		BLM-Rawlins	possible spillway damage	Existing	Yes	0	Private	42.11	-107.06	Hurt Creek	SEMINOE	25N	86W	25
776	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Bureau of Reclamation	42.12	-106.88	Lower Seminoe Reservoir	SEMINOE	25N	84W	21
777	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	42.12	-107.06	Hurt Creek	SEMINOE	25N	86W	24
778	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		BLM	42.12	-107.09	Hurt Creek	SEMINOE	25N	86W	23
779	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	42.16	-107.09	Garden Creek	STONE	25N	86W	11
780	Reservoir		BLM-Rawlins	wet in at least two years of photography	Existing	Yes	0	Private	42.16	-107.08	Garden Creek	STONE	25N	86W	2

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
781	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		BLM	42.17	-107.18	Garden Creek	STONE	25N	87W	1
782	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.17	-107.17	Garden Creek	STONE	25N	86W	6
783	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.17	-107.16	Garden Creek	STONE	26N	86W	31
784	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.17	-107.17	Garden Creek	STONE	26N	86W	31
785	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Private	42.18	-107.16	Garden Creek	STONE	26N	86W	31
786	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.18	-107.16	Garden Creek	STONE	26N	86W	31
787	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		BLM	42.18	-107.16	Garden Creek	STONE	26N	86W	31
788	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.19	-107.12	Garden Creek	STONE	26N	86W	28
789	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.19	-107.17	Garden Creek	STONE	26N	86W	30
790	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.20	-107.08	Garden Creek	STONE	26N	86W	26
791	Pond		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.19	-107.17	Garden Creek	STONE	26N	86W	30
792	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.20	-107.13	Garden Creek	STONE	26N	86W	28
793	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		BLM	42.20	-107.10	Garden Creek	STONE	26N	86W	27
794	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.20	-107.18	Garden Creek	STONE	26N	87W	25
795	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.20	-107.18	Garden Creek	STONE	26N	87W	25
796	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.20	-107.14	Garden Creek	STONE	26N	86W	29
797	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.20	-107.19	Garden Creek	STONE	26N	87W	26
798	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Potential		Private	42.20	-107.18	Garden Creek	STONE	26N	87W	25
799	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		Private	42.20	-107.18	Garden Creek	STONE	26N	87W	25
800	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.20	-107.14	Garden Creek	STONE	26N	86W	29
801	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.20	-107.11	Garden Creek	STONE	26N	86W	27
802	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.20	-107.14	Garden Creek	STONE	26N	86W	29
803	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.20	-107.17	Garden Creek	STONE	26N	86W	30
804	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.20	-107.15	Garden Creek	STONE	26N	86W	29
805	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Private	42.20	-107.18	Garden Creek	STONE	26N	87W	25
806	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.20	-107.18	Garden Creek	STONE	26N	87W	25
807	Reservoir		ACE Mapscan	Sediment	Existing	No		Private	42.21	-106.91	North Platte River-Tincup Creek	LONG CREEK	26N	84W	20
808	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.20	-107.11	Garden Creek	STONE	26N	86W	22
809	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.20	-107.13	Garden Creek	STONE	26N	86W	21
810	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.21	-107.09	Garden Creek	STONE	26N	86W	23
811	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.21	-107.12	Garden Creek	STONE	26N	86W	21
812	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		State of Wyoming	42.21	-107.14	Garden Creek	STONE	26N	86W	20
813	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.21	-107.13	Garden Creek	STONE	26N	86W	21
814	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.22	-106.92	North Platte River-Tincup Creek	LONG CREEK	26N	84W	18
815	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.21	-107.18	Garden Creek	STONE	26N	87W	24
816	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	42.21	-107.11	Garden Creek	STONE	26N	86W	21
817	Reservoir		ACE Mapscan	sediment	Existing	No		Private	42.22	-107.11	Garden Creek	BUZZARD	26N	86W	15
818	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.23	-107.08	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	26N	86W	14
819	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.23	-107.07	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	26N	86W	12
820	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.23	-107.06	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	26N	86W	12
821	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.24	-106.97	North Platte River-Sunday Morning Creek		26N	85W	11
822	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		BLM	42.24	-107.06	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	26N	86W	12
823	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		State of Wyoming	42.24	-107.07	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	26N	86W	12
824	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.26	-107.05	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	31
825	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.26	-107.05	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	31
826	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	42.26	-107.04	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	31
827	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.26	-107.03	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	32
828	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		State of Wyoming	42.27	-107.00	Deweese Creek	BUZZARD	27N	85W	33
829	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		BLM	42.27	-107.03	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	32
830	Reservoir		ACE Mapscan	breach around spillway	Existing	No		Private	42.27	-107.00	Deweese Creek	BUZZARD	27N	85W	33
831	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		Private	42.27	-107.03	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	32
832	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.28	-107.09	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	26
833	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.29	-107.08	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	26
834	Reservoir		ACE Mapscan	wet in at least two years of photography Associated with North Bear Creek Well	Existing	Yes		BLM	42.29	-107.02	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	29
835	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.29	-107.08	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	23
836	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.29	-107.01	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	21
837	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.29	-107.01	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	21
838	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.29	-107.01	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	21
839	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		BLM	42.29	-107.00	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	21
840	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.29	-107.00	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	21

ACE_ID	Improvement Type	Project Name	Source	Notes	Status	Water Source	RIPS_NO	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
841	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.29	-107.01	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	21
842	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.29	-107.01	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	21
843	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		BLM	42.29	-107.06	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	24
844	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		BLM	42.29	-107.06	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	24
845	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.30	-107.01	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	21
846	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		BLM	42.30	-107.06	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	24
847	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.30	-107.09	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	23
848	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.30	-107.08	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	23
849	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Private	42.30	-107.08	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	23
850	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.30	-107.07	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	24
851	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		State of Wyoming	42.30	-107.00	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	16
852	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.30	-107.09	Sand Creek-Buzzard Ranch	BUZZARD RANCH MEADOW	27N	86W	14
853	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	42.31	-106.98	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	15
854	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	42.31	-106.98	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	14
855	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	42.31	-106.99	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	15
856	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	42.31	-106.98	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	15
857	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	42.31	-106.98	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	14
858	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	42.31	-106.98	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	14
859	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	42.31	-106.98	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	15
860	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.31	-106.97	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	14
861	Reservoir		ACE Mapscan	wet in at least two years of photography	Existing	Yes		Private	42.31	-106.98	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	14
862	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.32	-106.96	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	14
863	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		Fish & Wildlife	42.32	-106.96	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	13
864	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		BLM	42.32	-106.97	Bear Creek-North Platte River-Pathfinder Reservoir	SAND CREEK	27N	85W	14
865	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Fish & Wildlife	42.32	-106.95	Deweese Creek	BUZZARD	27N	85W	13
866	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		BLM	42.32	-107.08	Sand Creek-Buzzard Ranch	BUZZARD	27N	86W	14
867	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		BLM	42.32	-106.96	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	12
868	Reservoir		ACE Mapscan	Wet in 2009, 2011	Existing	Yes		BLM	42.32	-106.95	Bear Creek-North Platte River-Pathfinder Reservoir	BUZZARD	27N	85W	12
869	Reservoir		ACE Mapscan	Dry in 3 years of photography	Existing	No		BLM	42.33	-106.99	Pathfinder Reservoir-Sand Creek	SAND CREEK	27N	85W	10
870	Reservoir		ACE Mapscan	Dry in 3 years of photography	Existing	No		BLM	42.33	-106.99	Pathfinder Reservoir-Sand Creek	SAND CREEK	27N	85W	10
871	Reservoir		ACE Mapscan	Wet in 2011 & 2012	Existing	Yes		BLM	42.34	-107.09	Pathfinder Reservoir-Sand Creek	BUZZARD	27N	86W	2
872	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.34	-107.00	Pathfinder Reservoir-Sand Creek	SAND CR. RANCH PAST.	27N	85W	4
873	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.34	-107.00	Pathfinder Reservoir-Sand Creek	SAND CR. RANCH PAST.	27N	85W	4
874	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.34	-107.01	Pathfinder Reservoir-Sand Creek	SAND CR. RANCH PAST.	27N	85W	4
875	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.35	-107.01	Pathfinder Reservoir-Sand Creek	SAND CR. RANCH PAST.	28N	85W	33
876	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.37	-106.99	Pathfinder Reservoir-Sand Creek	SAND CR. RANCH PAST.	28N	85W	27
877	Reservoir		ACE Mapscan	Wet in 2009, 2011 & 2012	Existing	Yes		Private	42.37	-106.97	Pathfinder Reservoir-Sand Creek	BUZZARD	28N	85W	26
878	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.37	-106.97	Pathfinder Reservoir-Sand Creek	BUZZARD	28N	85W	26
879	Reservoir	Arkansas Creek Well #3	ACE Mapscan	wet in at least two years of photography Tank with overflow to Reservoir	Existing	Yes		BLM	42.37	-107.04	Pathfinder Reservoir-Sand Creek	BUZZARD	28N	85W	30
880	Reservoir		ACE Mapscan	Wet in 2011	Existing	Potential		State of Wyoming	42.44	-107.01	Pathfinder Reservoir-Pathfinder Dam	PATHFINDER	29N	85W	34
881	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		BLM	42.44	-106.98	Pathfinder Reservoir-Pathfinder Dam	OSCAR T. ANNIS	29N	85W	35
882	Reservoir		ACE Mapscan	Wet in 2009 & 2011	Existing	Yes		Private	42.44	-106.98	Pathfinder Reservoir-Pathfinder Dam	PATHFINDER	29N	85W	35

APPENDIX 3B

UPPER NORTH PLATTE RIVER WATERSHED: PERTINENT ECOLOGICAL SITE DESCRIPTIONS

United States Department of Agriculture
NRCS Natural Resources Conservation Service

Ecological Site Description

Plants | ESIS | ESD | FSGD | ESI Forestland | ESI Rangeland

Data Access

> Return to Reports Selection Screen

Report Selections

> General
> Physiographic Features
> Climate Features
> Water Features
> Soil Features
> Plant Communities
> Site Interpretations
> Supporting Information
> Rangeland Health Reference Sheet
Complete Report
> HTML Printable Format

United States Department of Agriculture
Natural Resources Conservation Service
Ecological Site Description

Section I: Ecological Site Characteristics

Ecological Site Identification and Concept

Site stage: **Provisional**

Provisional: an ESD at the provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of soil units that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state and transition model capturing the ecological processes and vegetative states and community phases as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. It is expected that the provisional ESD will continue refinement towards an approved status.

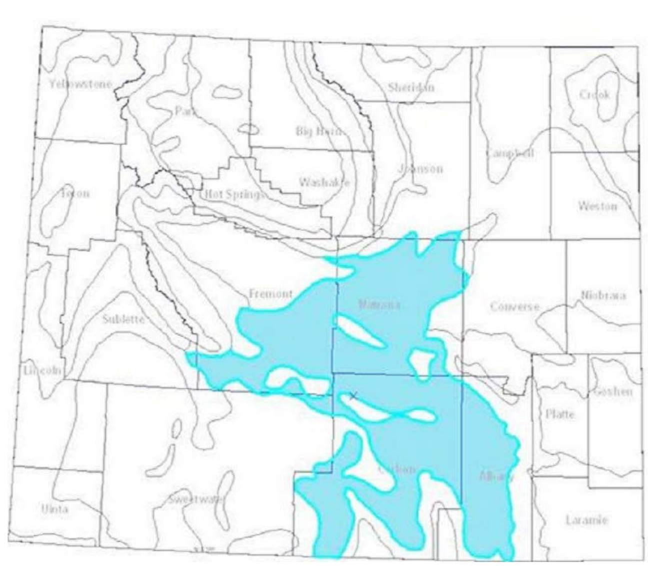
Site name: **Shallow Loamy (SwLy) 10-14" P.Z., High Plains Southeast**

Site type: Rangeland

Site ID: R034AY362WY

Major land resource area (MLRA): 034A-Cool Central Desertic Basins and Plateaus

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic □eatures

This site usually occurs in an upland position on south and west facing slopes□but may be found on all slopes and positions.

Landform: □1) □ill
□2) Ridge
□3) Escarpment

	Minimum	Maximum
Elevation (feet):	□□00	□□00
Slope (percent):	0	4□
Flooding		
Frequency:	□one	□one
Ponding		
Depth (inches):	0	0
Frequency:	□one	□one
Runoff class:	□egligible	□igh
Aspect:	□o Influence on this site	

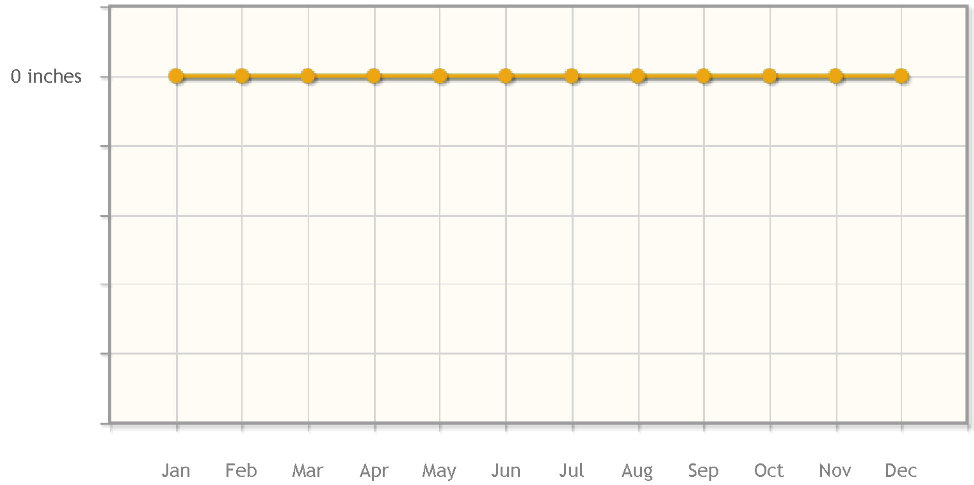
Climatic □eatures

Annual precipitation ranges from 10-14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more dry 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 outbrea□s in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Extreme storms may occur during the winter□but most severely affect ranch operations during late winter and spring. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than □0 mph. □rowth of native cool season plants begins about April 1□ and continues to about □une 1□. Some green up of cool season plants usually occurs in September. The following information is from the □□aramie□climate station□Minimum Maximum □ yrs. out of 10 between □rost-free period □days)□□□ 14□ □une 1 □ September 16 □reeze-free period □days)□□4 1□3 May 1□ □ September 2□ Annual Precipitation □inches)□□.□ 1□.34 Mean annual precipitation□11.□3 inches Mean annual air temperature□42.2 □ □30.4 □ Avg. Min. to □3.□ □ Avg. Max.) □or detailed information visit the □atural Resources Conservation Service □ational Water and Climate Center at http□□www.wcc.nrcs.usda.gov□website. □ther climate station□s) representative of this precipitation zone include □Dixon □and □Medicine Bow□.

	Averaged
Frost-free period (days):	103
Freeze-free period (days):	13□
Mean annual precipitation (inches):	14.00

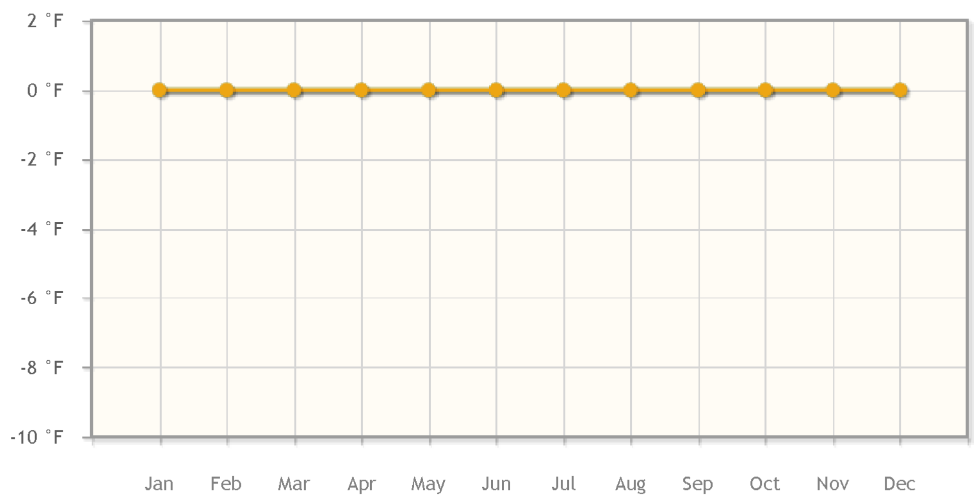
Monthly Precipitation □Inches)□

	□an	□eb	Mar	Apr	May	□un	□ul	Aug	Sep	□ct	□ov	Dec
High	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Low	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Monthly Temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Influencing Water Features

Stream type: None

Representative Soil Features

These are well drained shallow soils (10 to 20 inches deep) over all kinds of bedrock, except igneous or volcanic. Textures range from very fine sandy loams to clay loam.

Surface texture: (1) Loam

□2) Clay loam
□3) Sandy loam

Subsurface texture group: □oamy

	Minimum	Maximum
Surface fragments <=3" (% cover):	0	20
Surface fragments >3" (% cover):	0	1□
Subsurface fragments <=3" (% volume):	0	30
Subsurface fragments >3" (% volume):	0	20

Drainage class: Well drained to somewhat excessively drained

Permeability class: Moderately slow to moderately rapid

	Minimum	Maximum
Depth (inches):	10	20
Available water capacity (inches):	1.00	2.□0
Electrical conductivity (mmhos/cm):	0	□
Sodium adsorption ratio:	0	□
Calcium carbonate equivalent (percent):	0	1□
Soil reaction (1:1 water):	6.6	□.4

Plant Communities

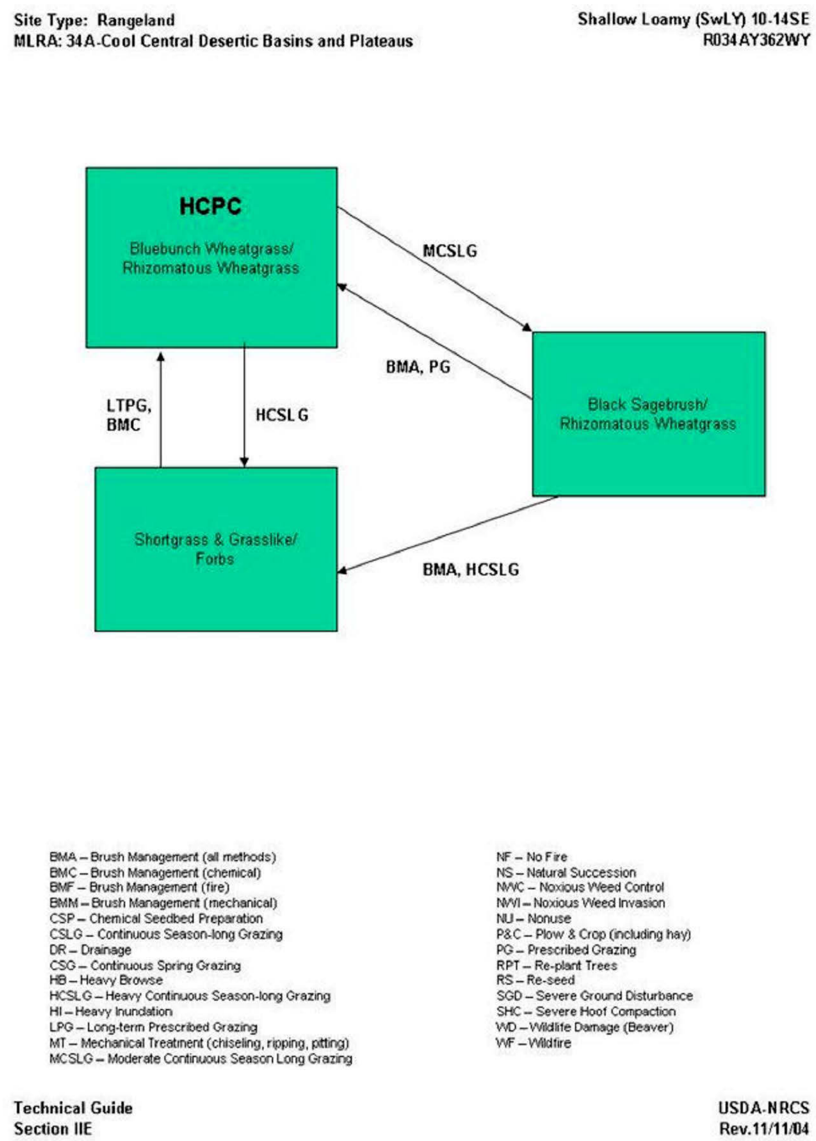
Ecological Dynamics of the Site

As this site deteriorates from improper grazing management□species such as threadleaf sedge□prairie □unegrass□Sandberg bluegrass□and low growing forbs become dominant. Bluebunch wheatgrass and needleandthread decrease.

The □istoric 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.

State-and-Transition Diagram



Bluebunch Wheatgrass/ Rhizomatous Wheatgrass Plant Community (HCPC)

The interpretive plant community for this site is the □istoric Climax Plant Community. Potential vegetation is about □0□ grasses or grass-li□e plants□10□ forbs□and 20□ woody plants.
The ma□or grasses include bluebunch wheatgrass□western wheatgrass□needleandthread□ and Indian ricegrass. □ther grasses include□Sandberg and mutton bluegrass□prairie □unegrass□bottlebrush squirreltail□plains reedgrass□and threadleaf sedge. Blac□ sagebrush□big sagebrush□and green rabbitbrush are the ma□or woody plants.

A typical plant composition for this state consists of bluebunch wheatgrass 1□-30□ □ western wheatgrass 1□-2□□ □needleandthread □-10□ □muttongrass □-10□ other grasses and grass-li□e plants 10-20□ □perennial forbs □-1□□ □blac□sagebrush □-10□ □and other shrubs □-10□ □round cover□by ocular estimate□varies from 1□-2□□ .

The total annual production □air-dry weight) of this state is about □00 pounds per acre□but

Bluebunch Wheatgrass/ Rhizomatous Wheatgrass Plant Community (HCPC) Plant Species Composition

Grass/Grasslike

				Pseudoroegneria spicata		
				Pascopyrum smithii		
				Poa fendleriana		
				Hesperostipa comata		
				Achnatherum hymenoides		
				Bouteloua gracilis		
				Carex filifolia		
				Calamagrostis montanensis		
				Elymus elymoides		
				Koeleria macrantha		
				Muhlenbergia montana		
				Nassella viridula		
				Poa canbyi		
				Poa secunda		

Forb

				Achillea		
				Artemisia frigida		
				Castilleja		
				Delphinium		
				Phlox hoodii		

Shrub/Vine

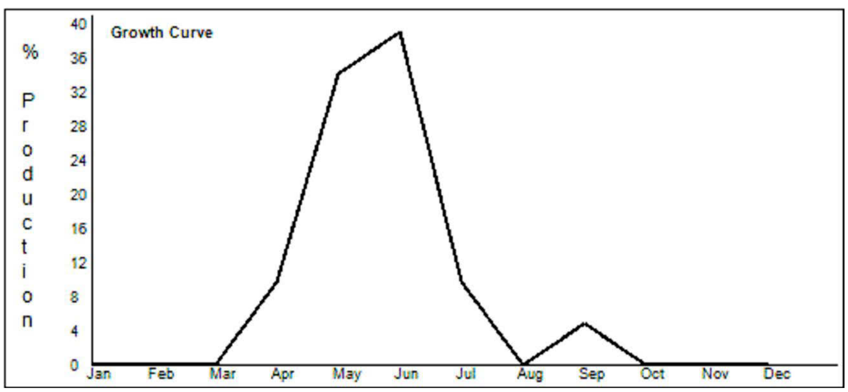
~		~	~	*Artemisia nova*	~	~
~					~	~
		~	~		~	~
		~	~	*Artemisia tridentata*	~	~
		~	~	*Chrysothamnus viscidiflorus*	~	~
		~	~	*Krascheninnikovia lanata*	~	~
		~	~	*Purshia tridentata*	~	~
		~	~	*Rhus trilobata*	~	~

Plant Growth Curve

Growth curve number: ~

Growth curve name: ~

Growth curve description: ~



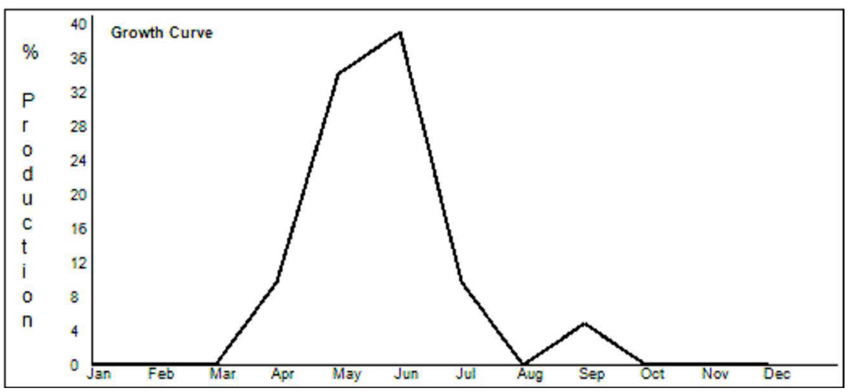
Black Sagebrush/Rhizomatous Wheatgrass Plant Community

Plant Growth Curve

Growth curve number:

Growth curve name:

Growth curve description:



Short Grass & Grasslike/Forb Plant Community

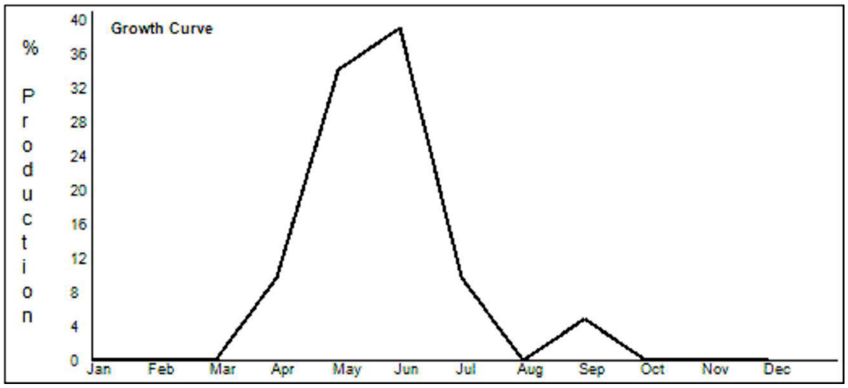
Plant Growth Curve

Growth curve number: [illegible]

Growth curve name: [illegible]

Growth curve description: [illegible]

[illegible]



Section II: Ecological Site Interpretations

Animal Community

[illegible]

[illegible]

[illegible]

[illegible]

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Plant Preference by Animal Kind

Animal Kind: ~~~~~~~~~~~~~

~~ ~~~~	~~~~~~~~~~~~~~	~~~~~ ~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Achnatherum ×bloomeri [hymenoides × occidentale]	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Achnatherum hymenoides	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Achillea millefolium	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium textile	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Amelanchier alnifolia	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Ambrosia psilostachya	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Antennaria	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia cana	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Arenaria	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Artemisia frigida	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia nova	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia pedatifida	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia tridentata	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Astragalus	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Atriplex canescens	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
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~~ ~~~~~~~~~	Atriplex confertifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex gardneri	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bassia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bouteloua gracilis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Calamagrostis canadensis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex duriuscula	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~	Calamagrostis montanensis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Carex nebrascensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Callitriche stagnalis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Castilleja	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~~ ~~~~~~~~~	Calamagrostis stricta subsp. inexpansa	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cercocarpus montanus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Chrysothamnus viscidiflorus	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~ ~~~~~~~~~	Comandra umbellata subsp. pallida	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Crepis acuminata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Dasiphora fruticosa subsp. floribunda	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Deschampsia caespitosa	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Delphinium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Distichlis spicata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus canadensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Elymus elymoides subsp. elymoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Erigeron	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Eriogonum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Eucephalus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Hesperostipa comata subsp. comata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus arcticus subsp. littoralis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~ ~~~~~~~~~	Juncus balticus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juniperus scopulorum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Kochia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Leymus cinereus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Leptodactylon pungens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linanthus pungens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	Lomatium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Lygodesmia juncea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia montana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Muhlenbergia richardsonis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Nassella viridula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Oryzopsis bloomeri	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Paronychia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Phlox	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Pinus flexilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~	Populus deltoides subsp. monilifera	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa fendleriana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa juncifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa secunda	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Psoralidium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Puccinellia nuttalliana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Redfieldia flexuosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ribes	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Schizachyrium scoparium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Sedum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Shepherdia argentea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Sporobolus airoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~~		~~~~~~~ ~~~~~~ ~~~~~~~ ~~~~~~												
~~	*Stenotus acaulis*	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	*Stanleya pinnata*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	*Symphoricarpos occidentalis*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	*Tetradymia canescens*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	*Tetradymia spinosa*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Trifolium*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Triglochin*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Viola*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Xylorhiza*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	*Zigadenus venenosus*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~~~~~~~~~~~

~~ ~~~~~	~~~~~~~~~~~~~~~~	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	*Achnatherum ×bloomeri [hymenoides × occidentale]*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	*Achnatherum hymenoides*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	*Achillea millefolium*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Allium textile*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	*Amelanchier alnifolia*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	*Ambrosia psilostachya*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Antennaria*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	*Artemisia cana*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Arenaria*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	*Artemisia frigida*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	*Artemisia nova*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	*Artemisia pedatifida*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Artemisia tridentata*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Astragalus*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~ ~~~~~~~~~	Atriplex canescens	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex confertifolia	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex gardneri	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bassia americana	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bouteloua gracilis	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Calamagrostis canadensis	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Carex duriuscula	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex filifolia	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~ ~~~~~~~~	Calamagrostis montanensis	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Carex nebrascensis	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Callitriche stagnalis	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Castilleja	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~ ~~~~~~~~~ ~~~~~~~~	Calamagrostis stricta subsp. inexpansa	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cercocarpus montanus	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Chrysothamnus viscidiflorus	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~ ~~~~~~~~	Comandra umbellata subsp. pallida	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Crepis acuminata	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Dasiphora fruticosa subsp. floribunda	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Deschampsia caespitosa	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Delphinium	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Distichlis spicata	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus canadensis	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Elymus elymoides subsp. elymoides	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~	Elymus trachycaulus	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Eriogonum	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Eucephalus	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Hesperostipa comata subsp. comata	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus arcticus subsp. littoralis	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~ ~~~~~~~~	Juncus balticus	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juniperus scopulorum	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Kochia americana	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~	Leymus cinereus	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~	Leptodactylon pungens	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linanthus pungens	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~	Lomatium	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Lygodesmia juncea	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia montana	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	Muhlenbergia richardsonis	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Nassella viridula	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Oryzopsis bloomeri	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Paronychia	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Penstemon	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Pinus flexilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~	Populus deltoides subsp. monilifera	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa fendleriana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa juncifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa secunda	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Psoralidium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~	Pseudoroegneria spicata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Puccinellia nuttalliana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Redfieldia flexuosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ribes	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Schizachyrium scoparium	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Sedum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Shepherdia argentea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus airoides		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~~~	Sphaeralcea coccinea	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Stenotus acaulis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Stanleya pinnata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Symphoricarpos occidentalis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia canescens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia spinosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Xylorhiza	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Zigadenus venenosus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~~~~~~~~~

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~~ ~~~~~~~~~~	Achnatherum ×bloomeri [hymenoides × occidentale]	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Achnatherum hymenoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Achillea millefolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium textile	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Amelanchier alnifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Ambrosia psilostachya	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Antennaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia cana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Arenaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia frigida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia nova	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia pedatifida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Artemisia tridentata	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Astragalus	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Atriplex canescens	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Atriplex confertifolia	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Atriplex gardneri	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Bassia americana	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Bouteloua gracilis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Calamagrostis canadensis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Carex duriuscula	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Carex filifolia	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Calamagrostis montanensis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Carex nebrascensis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Callitriche stagnalis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Castilleja	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Calamagrostis stricta subsp. inexpansa	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Cercocarpus montanus	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Chrysothamnus viscidiflorus	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Cicuta	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Cornus	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Comandra umbellata subsp. pallida	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Crepis acuminata	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Dasiphora floribunda	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Dasiphora fruticosa subsp. floribunda	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Deschampsia caespitosa	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Delphinium	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Distichlis spicata	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Elymus canadensis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~

~~ ~~~~~~~~~~~~~	Elymus elymoides subsp. elymoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Eriogonum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Eucephalus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Hesperostipa comata subsp. comata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus arcticus subsp. littoralis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~ ~~~~~~~~~	Juncus balticus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juniperus scopulorum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Kochia americana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Leymus cinereus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Leptodactylon pungens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linanthus pungens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	Lomatium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Lygodesmia juncea	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia montana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Muhlenbergia richardsonis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Nassella viridula	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Oryzopsis bloomeri	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Paronychia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Pascopyrum smithii	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Pinus flexilis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Populus deltoides subsp. monilifera	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Poa fendleriana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa juncifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Poa secunda	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Psoralidium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~	Pseudoroegneria spicata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Puccinellia nuttalliana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Redfieldia flexuosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ribes	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Schizachyrium scoparium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sedum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Shepherdia argentea		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~~~~ ~~~~~~~~~~ ~~~~~~	Sisyrinchium	~~~~~~~ ~~~~~~ ~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus airoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Sphaeralcea coccinea	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Stenotus acaulis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Stanleya pinnata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Symphoricarpos occidentalis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia canescens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia spinosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Xylorhiza	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Zigadenus venenosus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~~~~~~~~

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~~ ~~~~~~~~~~	Achnatherum ×bloomeri [hymenoides × occidentale]	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Achnatherum hymenoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Achillea millefolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium textile	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Amelanchier alnifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Ambrosia psilostachya	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Antennaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia cana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Arenaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia frigida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Artemisia nova	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia pedatifida	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia tridentata	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Astragalus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex canescens	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex confertifolia	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex gardneri	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bassia americana	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bouteloua gracilis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis canadensis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex duriuscula	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex filifolia	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis montanensis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex nebrascensis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Callitriche stagnalis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Castilleja	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis stricta subsp. inexpansa	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cercocarpus montanus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Chrysothamnus viscidiflorus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Comandra umbellata subsp. pallida	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Crepis acuminata	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora fruticosa subsp. floribunda	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Deschampsia caespitosa	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Delphinium	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~	Distichlis spicata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Elymus canadensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Elymus elymoides subsp. elymoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Elymus trachycaulus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eriogonum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Ericameria nauseosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eucephalus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Glyceria grandis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Hesperostipa comata subsp. comata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus arcticus subsp. littoralis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Juncus balticus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Juniperus scopulorum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Kochia americana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Koeleria macrantha	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leymus cinereus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Leptodactylon pungens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Linanthus pungens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lomatium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~	Lygodesmia juncea	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Muhlenbergia montana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia richardsonis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~~~	Nassella viridula	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Oryzopsis bloomeri	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Paronychia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Pinus flexilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~	Populus deltoides subsp. monilifera	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa fendleriana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa juncifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa secunda	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Psoralidium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Puccinellia nuttalliana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Redfieldia flexuosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ribes	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
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	Schizachyrium scoparium	~~~~~~												
~~	Sedum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Shepherdia argentea	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus airoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stenotus acaulis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stanleya pinnata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Symphoricarpos occidentalis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia canescens	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia spinosa	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Xylorhiza	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Zigadenus venenosus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~~~~~~~~~

~~	~~~~~~~~~~~~	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achnatherum ×bloomeri [hymenoides × occidentale]	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achnatherum hymenoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achillea millefolium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium textile	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Amelanchier alnifolia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ambrosia psilostachya	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Antennaria	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia cana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~	Arenaria	~~~~~~~ ~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~	Artemisia frigida	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~	Artemisia nova	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Artemisia pedatifida	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Artemisia tridentata	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~	Astragalus	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~~	Atriplex canescens	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~~	Atriplex confertifolia	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Atriplex gardneri	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Bassia americana	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Bouteloua gracilis	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~~~	Calamagrostis canadensis	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~~~	Carex duriuscula	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~	Carex filifolia	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~	Calamagrostis montanensis	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~~~	Carex nebrascensis	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~	Callitriche stagnalis	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~	Castilleja	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~~~ ~~~~~~~~~	Calamagrostis stricta subsp. inexpansa	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~	Cercocarpus montanus	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Chrysothamnus viscidiflorus	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Cicuta	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~~~~~	Cornus	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~~	Comandra umbellata subsp. pallida	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~	Crepis acuminata	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~ ~~~~~~~~	Dasiphora floribunda	~~~~~~ ~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Dasiphora fruticosa subsp. floribunda	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~

~~ ~~~~~~~~~~	[Deschampsia caespitosa]()	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	[Delphinium]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	[Distichlis spicata]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Elymus canadensis]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	[Elymus elymoides subsp. elymoides]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~~	[Elymus lanceolatus subsp. lanceolatus]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Elymus trachycaulus]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Equisetum]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Erigeron]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	[Eriogonum]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Ericameria nauseosa]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	[Eucephalus]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Glyceria grandis]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	[Hesperostipa comata subsp. comata]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Hydrophyllum]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Iris]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Juncus arcticus subsp. littoralis]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~ ~~~~~~~~~	[Juncus balticus]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Juniperus scopulorum]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	[Kochia americana]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Koeleria macrantha]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Krascheninnikovia lanata]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	[Leymus cinereus]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	[Leptodactylon pungens]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Linanthus pungens]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	[Lomatium]()	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Lygodesmia juncea]()	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~	Muhlenbergia montana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Muhlenbergia richardsonis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Nassella viridula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Oryzopsis bloomeri	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Paronychia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Pinus flexilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~	Populus deltoides subsp. monilifera	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa fendleriana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa juncifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Poa secunda	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Psoralidium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Puccinellia nuttalliana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Redfieldia flexuosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ribes	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Sarcobatus vermiculatus	~~~~~~~ ~~~~~~ ~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Schizachyrium scoparium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Sedum	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Shepherdia argentea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Sporobolus airoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Sporobolus cryptandrus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Stenotus acaulis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Stanleya pinnata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	Symphoricarpos occidentalis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Tetradymia canescens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia spinosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Xylorhiza	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Zigadenus venenosus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~~~~~~~~~

~~ ~~~~~	~~~~~~~~~~~~~~~	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Achnatherum ×bloomeri [hymenoides × occidentale]	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~ ~~~~~~~	Achnatherum hymenoides	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achillea millefolium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Allium textile	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Amelanchier alnifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ambrosia psilostachya	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Antennaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia cana	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Arenaria	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Artemisia frigida	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia nova	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia pedatifida	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Astragalus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Atriplex canescens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Atriplex confertifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex gardneri	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bassia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bouteloua gracilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Calamagrostis canadensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Carex duriuscula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Carex filifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Calamagrostis montanensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Carex nebrascensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Callitriche stagnalis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Castilleja	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~	Calamagrostis stricta subsp. inexpansa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Cercocarpus montanus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Chrysothamnus viscidiflorus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Cornus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Comandra umbellata subsp. pallida	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Crepis acuminata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Dasiphora fruticosa subsp. floribunda	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Deschampsia caespitosa	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Delphinium	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Distichlis spicata	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus canadensis	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus elymoides subsp. elymoides	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eriogonum	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eucephalus	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hesperostipa comata subsp. comata	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus arcticus subsp. littoralis	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juniperus scopulorum	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leymus cinereus	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linanthus pungens	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lomatium	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lygodesmia juncea	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia montana	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia richardsonis	~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~~~	Nassella viridula	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Oryzopsis bloomeri	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Paronychia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Pinus flexilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~	Populus deltoides subsp. monilifera	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa fendleriana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa juncifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa secunda	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Psoralidium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Puccinellia nuttalliana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Redfieldia flexuosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ribes	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Sarcobatus vermiculatus	~~~~~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~

	Schizachyrium scoparium	~~~~~~ ~~~~~ ~~~~~~												
~~ ~~~~~~	Sedum	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Shepherdia argentea	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Sporobolus airoides	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Sporobolus cryptandrus	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Stenotus acaulis	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Stanleya pinnata	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~	Symphoricarpos occidentalis	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Tetradymia canescens	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia spinosa	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Xylorhiza	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Zigadenus venenosus	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

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Hydrology Functions

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Recreational Uses

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Wood Products

Other Products

Supporting Information

State Correlation

This site has been correlated with the following states: WY

Inventory Data References

Site Authors

Quality Assurance

Reference Sheet

Author(s)/participant(s):

Contact for lead author:

Date: **MLRA:** **Ecological Site:**

must

Composition (indicators 10 and 12) based on:

Indicators

each

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1. Number and extent of rills:

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2. **Presence of water flow patterns:**~~~~~~~~~~~~~~~~~~~~

3. **Number and height of erosional pedestals or terracettes:**~~~~~~~~~~~~~~~~~~
~~~~~~~~~~

4. **Bare ground from Ecological Site Description or other studies (rock, litter, standing dead, lichen, moss, plant canopy are not bare ground):** ~~~~~~~~~~~~~~~~
~~~~~~

5. **Number of gullies and erosion associated with gullies:**~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~

6. **Extent of wind scoured, blowouts and/or depositional areas:**~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~

7. **Amount of litter movement (describe size and distance expected to travel):**
~~~~~~

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**~~~~~~
~~~~~~
~~~~~~~~~~~~~~~~~~~~~

9. **Soil surface structure and SOM content (include type and strength of structure, and A-horizon color and thickness):**~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

10. **Effect on plant community composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** ~~~~~~
~~~~~~
~~~~~~

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** ~~~
~~~~~~

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

14. **Average percent litter cover (15-25□) and depth (0.25 to 0.5inches):**

15. **Expected annual production (this is □O□A□ above-ground production, not □ust forage production):**

16. **Potential invasive (including noxious) species (native and non-native). □ist Species which BO□□ 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 is NO□ expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**

□eference Sheet Approval

0 inches

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

Section I: Ecological Site Characteristics

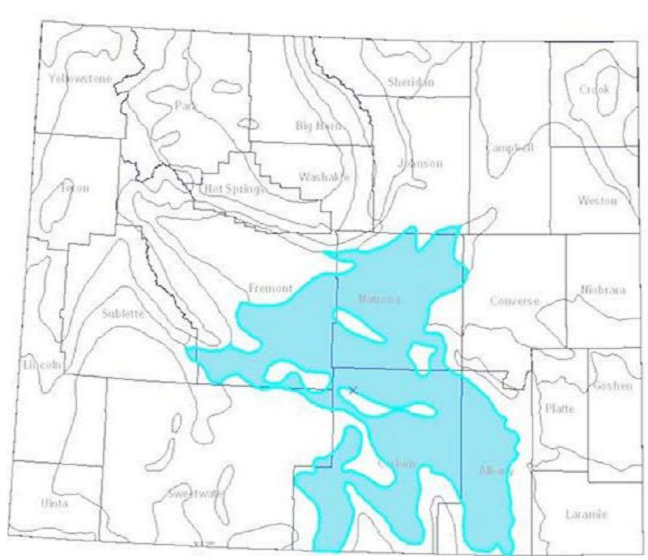
Ecological Site Identification and Concept

Site stage: **Provisional**

Provisional: an ESD at the provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of soil units that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state and transition model capturing the ecological processes and vegetative states and community phases as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. It is expected that the provisional ESD will continue refinement towards an approved status.

Site name: **Loamy (Ly) 10-14" P.Z., High Plains Southeast**
Site type: Rangeland
Site ID: R034AY322WY
Major land resource area (MLRA): 034A-Cool Central Desertic Basins and Plateaus

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic □eatures

This site usually occurs in an upland position on relatively flat to moderately sloping land on all exposures.

Landform: □1) Alluvial fan
□2) □ill
□3) Plateau

	Minimum	Maximum
Elevation (feet):	□□00	□□00
Slope (percent):	0	30
Ponding		
Depth (inches):	0	0
Frequency:	□one	□one
Runoff class:	□egligible	□ow
Aspect:	□o Influence on this site	

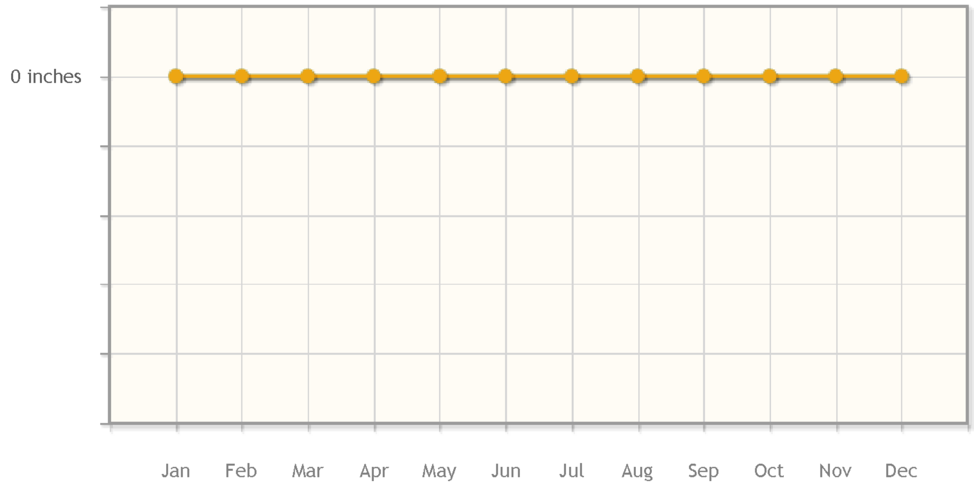
Climatic □eatures

Annual precipitation ranges from 10-14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more dry 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 outbrea□s in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Extreme storms may occur during the winter□but most severely affect ranch operations during late winter and spring. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than □0 mph. □rowth of native cool season plants begins about April 1□ and continues to about □une 1□. Some green up of cool season plants usually occurs in September. The following information is from the □□aramie□climate station□Minimum Maximum □ yrs. out of 10 between □rost-free period □days)□□□ 14□ □une 1 □ September 1□ □reeze-free period □days)□□4 1□3 May 1□ □ September 2□ Annual Precipitation □inches)□□.□ 1□.34 Mean annual precipitation□11.□3 inches Mean annual air temperature□42.2 □ □30.4 □ Avg. Min. to □3.□ □ Avg. Max.) □or detailed information visit the □atural Resources Conservation Service □ational Water and Climate Center at http□□www.wcc.nrcs.usda.gov□website. □ther climate station□s) representative of this precipitation zone include □Dixon □and □Medicine Bow□.

	Averaged
Frost-free period (days):	103
Freeze-free period (days):	13□
Mean annual precipitation (inches):	14.00

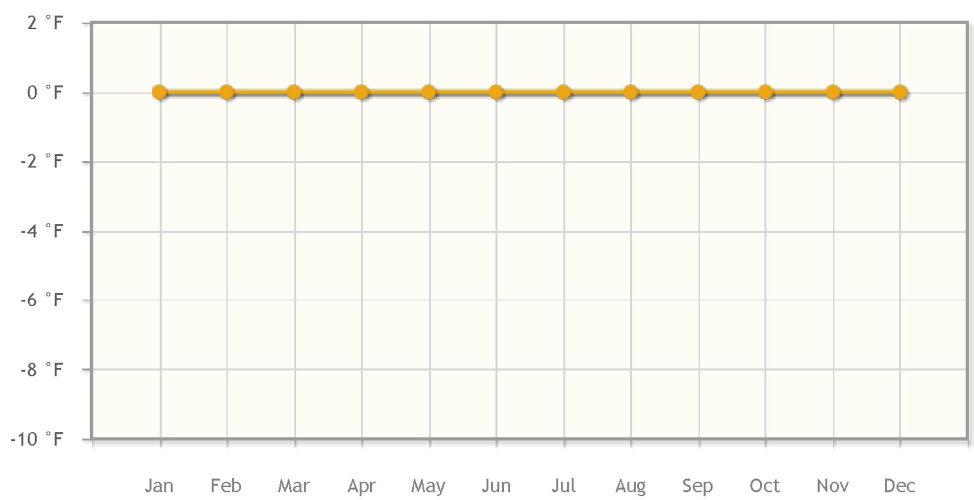
Monthly Precipitation □Inches)□

	□an	□eb	Mar	Apr	May	□un	□ul	Aug	Sep	□ct	□ov	Dec
High	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Low	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Monthly Temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Influencing Water Features

Stream type: None

Representative Soil Features

The soils of this site are deep to moderately deep (greater than 20" to bedrock) and well-drained. Textures range from loams to very fine sandy loam.

Surface texture: (1) Loam

□2) Clay loam
□3) □ine sandy loam

Subsurface texture group: □oamy

	Minimum	Maximum
Surface fragments <=3" (% cover):	0	20
Surface fragments >3" (% cover):	0	0
Subsurface fragments <=3" (% volume):	0	10
Subsurface fragments >3" (% volume):	0	□

Drainage class: Moderately well drained to well drained

Permeability class: Moderately slow to moderate

	Minimum	Maximum
Depth (inches):	20	□0
Available water capacity (inches):	2.□0	□.00
Electrical conductivity (mmhos/cm):	0	□
Sodium adsorption ratio:	0	□
Calcium carbonate equivalent (percent):	0	1□
Soil reaction (1:1 water):	□.□	□.4

Plant Communities

Ecological Dynamics of the Site

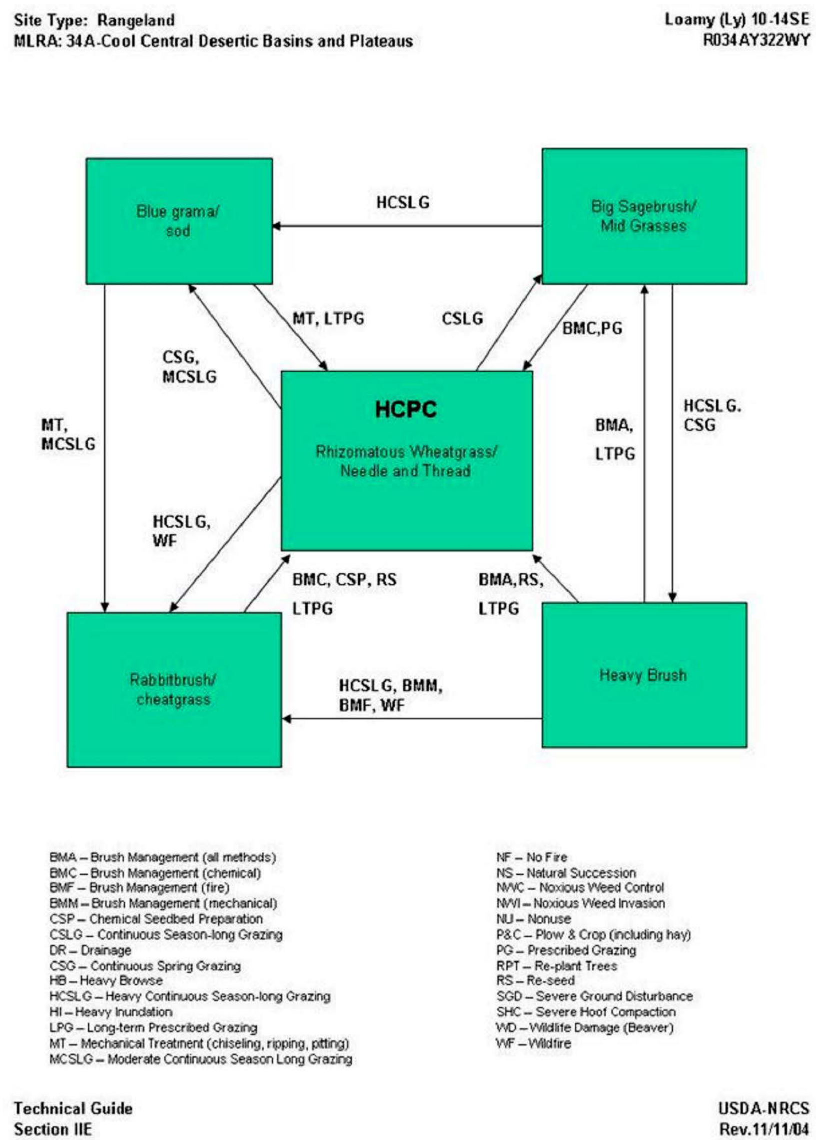
As this site deteriorates from improper grazing management□woody species such as big sagebrush and rubber rabbitbrush will increase. Bunchgrasses such as needle and thread□ bluebunch wheatgrass□and green needlegrass will decrease in frequency and production. These are usually replaced by prairie □unegrass□Sandberg bluegrass□blue grama□and several undesirable forbs.

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

The □istoric 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.

State-and-Transition Diagram



Rhizomatous Wheatgrass/Needle and Thread Plant Community (HCPC)

The interpretive plant community for this site is the □istoric Climax Plant Community. Potential vegetation is estimated at □0□ grasses or grass-li□e plants□10□ forbs and 10□ woody plants.
The ma□or grasses include rhizomatous wheatgrass□needle and thread□bluebunch wheatgrass□and green needlegrass. Big sagebrush and rubber rabbitbrush are the ma□or woody plants.
A typical plant composition for this state consists of rhizomatous wheatgrass 30-40□ □ needle and thread 10-20□ □bluebunch wheatgrass □-1□□ □green needlegrass □-10□ □ muttongrass □-10□ □perennial forbs □-10□ □and big sagebrush □-1□□ . □round cover□by ocular estimate□varies from 30-40□ .

The total annual production □air-dry weight) of this state is about 1100 pounds per acre□but it can range from about □00lbs.□acre in unfavorable years to about 1400 lbs.□acre in above average years.

Rhizomatous Wheatgrass/Needle and Thread Plant Community (HCPC) Plant Species Composition

Grass/Grasslike

Species
Pascopyrum smithii
Hesperostipa comata
Pseudoroegneria spicata
Nassella viridula
Poa fendleriana
Achnatherum ×bloomeri [hymenoides × occidentale]
Achnatherum hymenoides
Bouteloua gracilis
Carex duriuscula
Carex filifolia
Calamagrostis montanensis
Elymus elymoides
Koeleria macrantha
Muhlenbergia montana
Poa canbyi
Poa secunda

Forb

				Achillea		
				Artemisia frigida		
				Delphinium		
				Penstemon		
				Phlox hoodii		
				Sphaeralcea coccinea		

Shrub/Vine

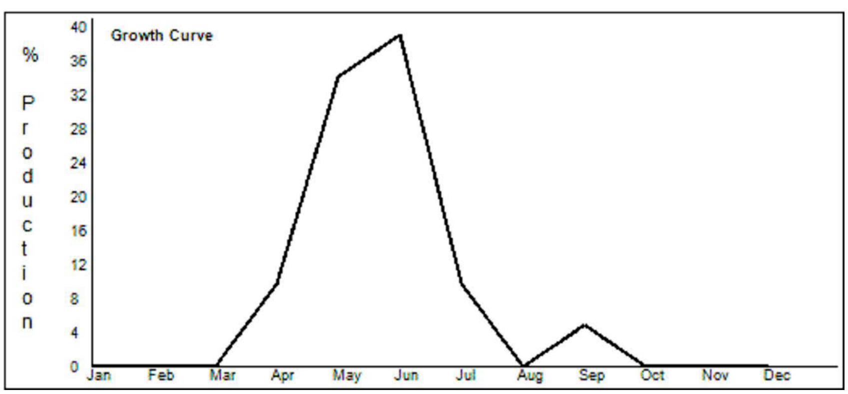
				Artemisia tridentata		
				Chrysothamnus viscidiflorus		

Plant Growth Curve

Growth curve number:

Growth curve name:

Growth curve description:



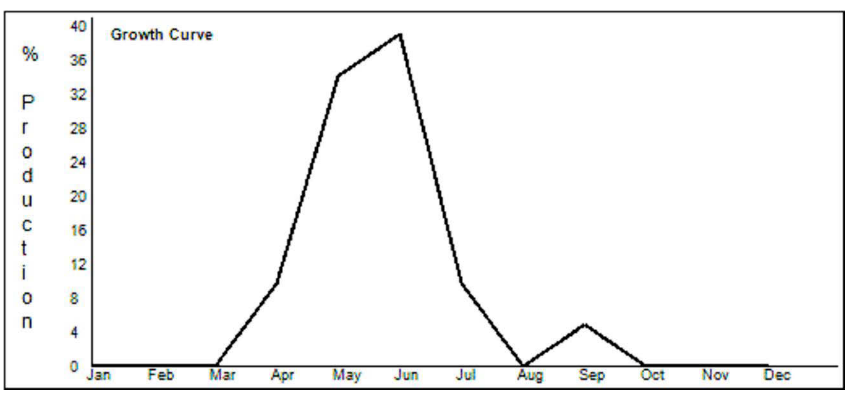
Big Sagebrush/Mid Grass Plant Community

Plant Growth Curve

Growth curve number: ~

Growth curve name: ~

Growth curve description: ~



Blue Grama Sod Plant Community

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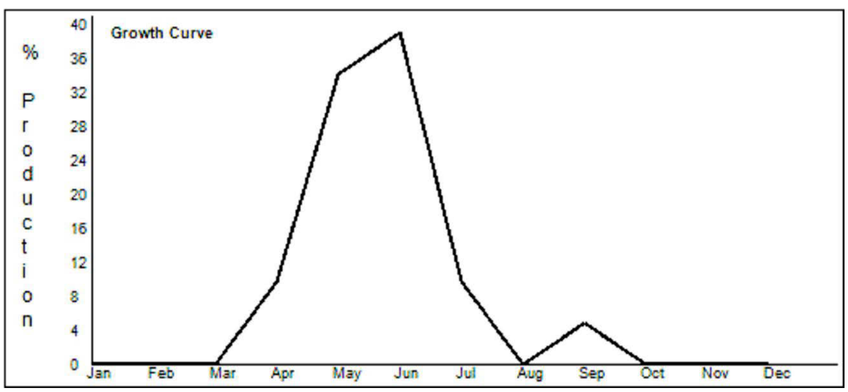
Plant Growth Curve

Growth curve number:	˜˜˜˜˜
Growth curve name:	˜˜˜˜˜˜˜˜˜˜˜˜˜˜
Growth curve description:	˜˜˜˜˜˜˜˜˜˜˜˜˜

				˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜˜							
˜˜˜˜	˜˜˜˜	˜˜˜˜	˜˜˜˜	˜˜˜˜	˜˜˜˜	˜˜˜˜	˜˜˜˜	˜˜˜˜	˜˜˜˜	˜˜˜˜	˜˜˜˜
˜˜	˜˜	˜˜	˜˜˜	˜˜˜	˜˜˜	˜˜˜	˜˜	˜˜	˜˜	˜˜	˜˜



Rabbitbrush/Cheatgrass Plant Community

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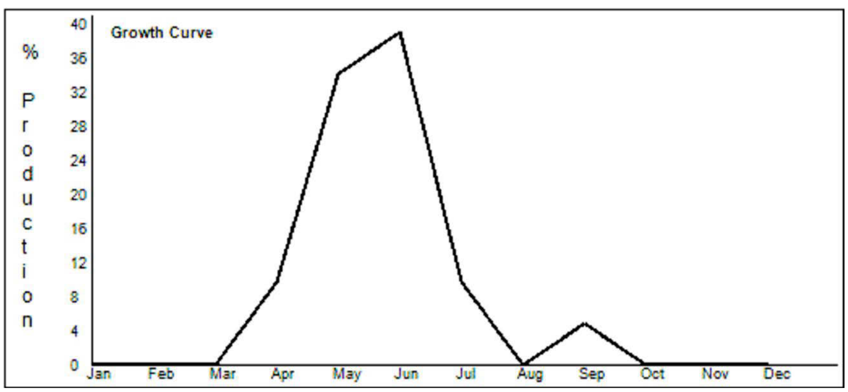
[illegible]

[illegible]

Plant Growth Curve

Growth curve number:	[illegible]
Growth curve name:	[illegible]
Growth curve description:	[illegible]

[illegible]



Heavy Brush Plant Community

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

□Brush Management with □ong Term Prescribed □razing will convert the plant community similar to the Big Sagebrush□Mid □rass Plant Community.

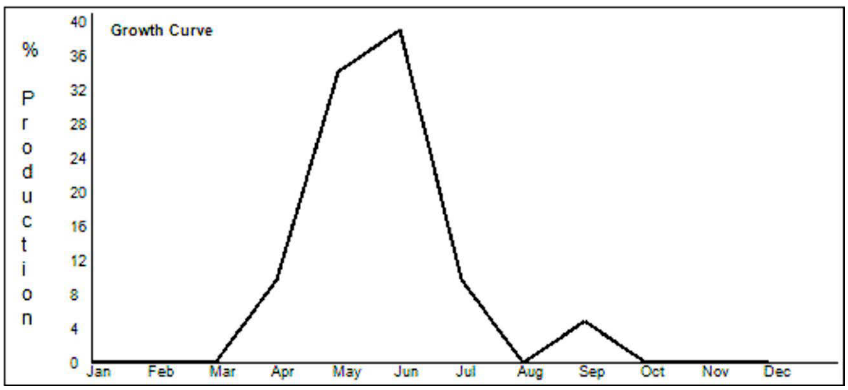
□□eavy Continuous Season-long □razing following Brush Management □mechanical or fire) or Wild □ire will convert the plant community to the Rabbitbrush□Cheatgrass Plant Community.

Plant Growth Curve

Growth curve number:	WY0□01
Growth curve name:	34AI□□pland Sites
Growth curve description:	All □pland Sites

Percent Production by Month

□an	□eb	Mar	Apr	May	□un	□ul	Aug	Sep	□ct	□ov	Dec
0	0	0	10	3□	40	10	0	□	0	0	0



Section II: Ecological Site Interpretations

Animal Community

Animal Community □Wildlife Interpretations
Rhizomatous Wheatgrass□□eedle and Thread Plant Community □□CPC)□The predominance of grasses in this plant community favors grazers and mixed feeders such as antelope and el□. Suitable thermal and escape cover is limited to topographical variances. When found ad□acent to sagebrush dominated sites□this plant community may provide brood rearing and foraging opportunities for sage grouse□as well as le□sites. □ther birds and mammals visit this site and may include meadow lar□s□raptors□rabbits□ and ground squirrels.

Big Sagebrush□Mid □rass Plant Community□This plant community may be useful for the same wildlife that would use the □istoric Climax Plant Community. Additional cover is available in this community but foraging resources have been reduced.

Blue □rama Sod Plant Community□This plant community may be beneficial for the same wildlife that would use the □istoric Climax Plant Community. □owever□the plant community composition is less diverse□and thus□less apt to meet the seasonal needs of these animals.

Rabbitbrush□Cheatgrass Plant Community□This plant community provides very little wildlife habitat. Some forage value and cover may be attributed to this community.

□eavy Brush Plant Community□This plant community may be useful for the same wildlife that would use the □istoric Climax Plant Community. Additional cover is available in this community but foraging resources have been reduced.

Animal Community □ □razing Interpretations
The following table lists suggested stoc□ing 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. □ften□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. □nder more intensive grazing management□improved harvest efficiencies can result in an increased carrying capacity. If distribution problems occur□stoc□ing rates must be reduced to maintain plant health and vigor.

Plant Community Production Carrying Capacity□
□lb.□ac) □A□M□ac)
Rhizomatous Wheatgrass□□eedle and Thread □□CPC) □00-1400 0.4
Big Sagebrush□Mid □rass □00-1300 0.3
Blue □rama Sod 400-□00 0.2
Rabbitbrush□Cheatgrass □0-□00 0.0□
□eavy Brush 400-□00 0.2

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

□razing by domestic livestoc□is one of the ma□or 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 livestoc□use needs to be supplemented with protein because the quality does not meet minimum livestoc□requirements.

Plant Preference by Animal Kind

Animal □ind: A□□antelope

Common name	Scientific name	Plant part	□	□	M	A	M	□	□	A	S	□	□	D
Bloomer□s ricegrass	*Achnatherum ×bloomeri [hymenoides × occidentale]*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
common yarrow	*Achillea millefolium*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
textile onion	*Allium textile*	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
Sas□atoon serviceberry	*Amelanchier alnifolia*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Cuman ragweed	*Ambrosia psilostachya*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
pussytoes	*Antennaria*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□

silver sagebrush	Artemisia cana	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
sandwort	Arenaria	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
fringed sagewort	Artemisia frigida	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
blac□ sagebrush	Artemisia nova	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
birdfoot sagebrush	Artemisia pedatifida	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
big sagebrush	Artemisia tridentata	Entire plant	P	P	P	□	□	□	D	D	D	P	P	P
mil□vetch	Astragalus	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
fourwing saltbush	Atriplex canescens	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
shadscale saltbush	Atriplex confertifolia	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
□ardner□s saltbush	Atriplex gardneri	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
green molly	Bassia americana	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
blue grama	Bouteloua gracilis	Entire plant	□	□	□	□	□	□	D	D	D	□	□	□
blue□oint	Calamagrostis canadensis	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
needleleaf sedge	Carex duriuscula	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
plains reedgrass	Calamagrostis montanensis	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
□ebras□a sedge	Carex nebrascensis	Entire plant	□	□	□	P	P	P	□	□	□	D	D	D
pond water-starwort	Callitriche stagnalis	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Indian paintbrush	Castilleja	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
northern reedgrass	Calamagrostis stricta subsp. inexpansa	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
alderleaf mountain mahogany	Cercocarpus montanus	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
Douglas rabbitbrush	Chrysothamnus viscidiflorus	Entire plant	P	P	P	□	□	□	D	D	D	D	D	D
water hemloc□	Cicuta	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
dogwood	Cornus	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
pale bastard toadflax	Comandra umbellata subsp. pallida	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
tapertip haw□sbeard	Crepis acuminata	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
shrubby cinquefoil	Dasiphora floribunda	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
shrubby cinquefoil	Dasiphora fruticosa subsp. floribunda	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□

tufted hairgrass	*Deschampsia caespitosa*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
lar□spur	*Delphinium*	Entire plant	T	T	T	T	T	T	T	T	T	T	T	T
inland saltgrass	*Distichlis spicata*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
Canada wildrye	*Elymus canadensis*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
bottlebrush squirreltail	*Elymus elymoides subsp. elymoides*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
streamban□ wheatgrass	*Elymus lanceolatus subsp. lanceolatus*	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
slender wheatgrass	*Elymus trachycaulus*	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
horsetail	*Equisetum*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
fleabane	*Erigeron*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
buc□wheat	*Eriogonum*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
rubber rabbitbrush	*Ericameria nauseosa*	Entire plant	D	D	D	□	□	□	□	□	□	D	D	D
aster	*Eucephalus*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
American mannagrass	*Glyceria grandis*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
needle and thread	*Hesperostipa comata subsp. comata*	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
waterleaf	*Hydrophyllum*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
iris	*Iris*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
mountain rush	*Juncus arcticus subsp. littoralis*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
Baltic rush	*Juncus balticus*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
Roc□y Mountain □uniper	*Juniperus scopulorum*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
green molly	*Kochia americana*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
prairie □unegrass	*Koeleria macrantha*	Entire plant	□	□	□	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	□	□	□	□	□	□
granite pric□ly phlox	*Leptodactylon pungens*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
granite pric□ly phlox	*Linanthus pungens*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
biscuitroot	*Lomatium*	Entire plant	□	□	□	D	D	D	D	D	D	□	□	□
rush s□eletonplant	*Lygodesmia juncea*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□

mountain muhly	*Muhlenbergia montana*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
mat muhly	*Muhlenbergia richardsonis*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
green needlegrass	*Nassella viridula*	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
	Oryzopsis bloomeri	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
nailwort	*Paronychia*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
western wheatgrass	*Pascopyrum smithii*	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
beardtongue	*Penstemon*	Entire plant	□	□	□	P	P	P	P	P	P	□	□	□
□ood□s phlox	*Phlox hoodii*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
phlox	*Phlox*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
limber pine	*Pinus flexilis*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
American bistort	*Polygonum bistortoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
	Poa canbyi	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
plains cottonwood	*Populus deltoides subsp. monilifera*	Entire plant	D	D	D	□	□	□	D	D	D	D	D	D
mutton bluegrass	*Poa fendleriana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
	Poa juncifolia	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
al□ali bluegrass	*Poa secunda*	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
primrose	*Primula*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
cho□echerry	*Prunus virginiana*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
scurfpea	*Psoralidium*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
bluebunch wheatgrass	*Pseudoroegneria spicata*	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
□uttall□s al□aligrass	*Puccinellia nuttalliana*	Entire plant	□	□	□	D	D	D	□	□	□	□	□	□
antelope bitterbrush	*Purshia tridentata*	Entire plant	P	P	P	D	D	D	P	P	P	P	P	P
blowout grass	*Redfieldia flexuosa*	Entire plant	□	□	□	□	□	□	D	D	D	□	□	□
s□un□bush sumac	*Rhus trilobata*	Entire plant	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	□	□	□
doc□	*Rumex*	Entire plant	□	□	□	□	□	□	□	□	□	□	□	□
willow	*Salix*		P	P	P	□	□	□	D	D	D	P	P	P

~~	Sarcobatus vermiculatus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Schizachyrium scoparium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sedum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Shepherdia argentea	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus airoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stenotus acaulis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stanleya pinnata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Symphoricarpos occidentalis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia canescens	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia spinosa	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Xylorhiza	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Zigadenus venenosus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind: ~~~~~~~~~~~

~~ ~~~~~	~~~~~~~~~~~~~~~	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achnatherum ×bloomeri [hymenoides × occidentale]	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achnatherum hymenoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achillea millefolium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium textile	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Amelanchier alnifolia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ambrosia psilostachya	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Antennaria	~~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Artemisia cana	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Arenaria	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Artemisia frigida	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Artemisia nova	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Artemisia pedatifida	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Artemisia tridentata	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Astragalus	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Atriplex canescens	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Atriplex confertifolia	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Atriplex gardneri	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Bassia americana	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Bouteloua gracilis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Calamagrostis canadensis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Carex duriuscula	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Carex filifolia	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Calamagrostis montanensis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Carex nebrascensis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Callitriche stagnalis	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Castilleja	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Calamagrostis stricta subsp. inexpansa	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Cercocarpus montanus	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Chrysothamnus viscidiflorus	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Cicuta	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Cornus	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Comandra umbellata subsp. pallida	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
~~	Crepis acuminata	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~

~~ ~~~~~~~~~~~	Dasiphora floribunda	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Dasiphora fruticosa subsp. floribunda	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Deschampsia caespitosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Delphinium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Distichlis spicata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus canadensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Elymus elymoides subsp. elymoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Elymus trachycaulus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Eriogonum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Eucephalus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Hesperostipa comata subsp. comata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus arcticus subsp. littoralis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Juncus balticus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Juniperus scopulorum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Kochia americana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Leymus cinereus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Leptodactylon pungens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linanthus pungens	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~	Lomatium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Lygodesmia juncea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia montana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Muhlenbergia richardsonis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Nassella viridula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Oryzopsis bloomeri	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Paronychia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Pinus flexilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~	Populus deltoides subsp. monilifera	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa fendleriana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa juncifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa secunda	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Psoralidium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Puccinellia nuttalliana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Redfieldia flexuosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Ribes	~~~~~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~

	Rosa woodsii var. woodsii	~~~~~~~ ~~~~~~												
~~	Rumex	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Schizachyrium scoparium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sedum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Shepherdia argentea	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Sisyrinchium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus airoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Sphaeralcea coccinea	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Stenotus acaulis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Stanleya pinnata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Symphoricarpos occidentalis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia canescens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia spinosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Xylorhiza	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Zigadenus venenosus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind: ~~~~~~~~~~

~~ ~~~~~	~~~~~~~~~~~~~~~~	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Achnatherum ×bloomeri [hymenoides × occidentale]	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Achnatherum hymenoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Achillea millefolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium textile	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~~~~ ~~~~~~	Amelanchier alnifolia	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ambrosia psilostachya	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Antennaria	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia cana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Arenaria	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Artemisia frigida	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia nova	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia pedatifida	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Astragalus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Atriplex canescens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Atriplex confertifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex gardneri	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bassia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bouteloua gracilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Calamagrostis canadensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Carex duriuscula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Carex filifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Calamagrostis montanensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Carex nebrascensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Callitriche stagnalis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Castilleja	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~	Calamagrostis stricta subsp. inexpansa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Cercocarpus montanus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Chrysothamnus viscidiflorus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~ ~~~~~~~~~	Comandra umbellata subsp. pallida	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Crepis acuminata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Dasiphora fruticosa subsp. floribunda	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Deschampsia caespitosa	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Delphinium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Distichlis spicata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus canadensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Elymus elymoides subsp. elymoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Eriogonum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Eucephalus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Hesperostipa comata subsp. comata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus arcticus subsp. littoralis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~ ~~~~~~~~~	Juncus balticus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juniperus scopulorum	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Kochia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leymus cinereus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Leptodactylon pungens	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linanthus pungens	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lomatium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lygodesmia juncea	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia montana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia richardsonis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Nassella viridula	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Oryzopsis bloomeri	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Paronychia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pinus flexilis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Populus deltoides subsp. monilifera	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa fendleriana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa juncifolia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa secunda	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Psoralidium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pseudoroegneria spicata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Puccinellia nuttalliana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Redfieldia flexuosa	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Rhus trilobata		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~		~~~~~~~ ~~~~~~												
~~	*Ribes*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Rosa woodsii var. woodsii*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Rumex*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Salix*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Sarcobatus vermiculatus*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Schizachyrium scoparium*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	*Sedum*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	*Shepherdia argentea*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Sisyrinchium*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	*Sporobolus airoides*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Sphaeralcea coccinea*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~	*Sporobolus cryptandrus*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	*Stenotus acaulis*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Stanleya pinnata*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~	*Symphoricarpos occidentalis*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	*Tetradymia canescens*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Tetradymia spinosa*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Trifolium*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Triglochin*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Viola*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	*Xylorhiza*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	*Zigadenus venenosus*	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~~~~~~~~

~~ ~~~~~	~~~~~~~~~~~~~~~	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	*Achnatherum ×bloomeri [hymenoides × occidentale]*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	*Achnatherum hymenoides*	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~	Achillea millefolium	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Allium textile	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Amelanchier alnifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ambrosia psilostachya	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Antennaria	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia cana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Arenaria	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Artemisia frigida	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia nova	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia pedatifida	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Astragalus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Atriplex canescens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Atriplex confertifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex gardneri	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bassia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bouteloua gracilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Calamagrostis canadensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Carex duriuscula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Carex filifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Calamagrostis montanensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Carex nebrascensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Callitriche stagnalis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Castilleja	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~	Calamagrostis stricta subsp. inexpansa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Cercocarpus montanus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Chrysothamnus viscidiflorus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Cicuta	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~ ~~~~~~~~~	Comandra umbellata subsp. pallida	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Crepis acuminata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Dasiphora fruticosa subsp. floribunda	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Deschampsia caespitosa	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Delphinium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Distichlis spicata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus canadensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Elymus elymoides subsp. elymoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Eriogonum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Eucephalus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Hesperostipa comata subsp. comata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus arcticus subsp. littoralis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Juncus balticus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Juniperus scopulorum	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Kochia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Krascheninnikovia lanata	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Leymus cinereus	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Leptodactylon pungens	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linanthus pungens	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~	Lomatium	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Lygodesmia juncea	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia montana	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	Muhlenbergia richardsonis	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Nassella viridula	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Oryzopsis bloomeri	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Paronychia	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Pinus flexilis	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~ ~~~~~~	Populus deltoides subsp. monilifera	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa fendleriana	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa juncifolia	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa secunda	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Psoralidium	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Pseudoroegneria spicata	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Puccinellia nuttalliana	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Purshia tridentata		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	[Redfieldia flexuosa](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Rhus trilobata](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Ribes](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Rosa woodsii var. woodsii](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Rumex](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Salix](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Sarcobatus vermiculatus](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Schizachyrium scoparium](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Sedum](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Shepherdia argentea](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Sisyrinchium](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Sporobolus airoides](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Sphaeralcea coccinea](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Sporobolus cryptandrus](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Stenotus acaulis](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Stanleya pinnata](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Symphoricarpos occidentalis](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Tetradymia canescens](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Tetradymia spinosa](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Trifolium](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Triglochin](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Viola](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Xylorhiza](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	[Zigadenus venenosus](#)	~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~~

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~~ ~~~~~~~~~	Achnatherum ×bloomeri [hymenoides × occidentale]	~~~~~~~ ~~~~~~													
~~ ~~~~~~~~~	Achnatherum hymenoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~	Achillea millefolium	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Allium textile	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~~~~~	Amelanchier alnifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~	Ambrosia psilostachya	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Antennaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~	Artemisia cana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Arenaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~	Artemisia frigida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~	Artemisia nova	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~	Artemisia pedatifida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Artemisia tridentata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Astragalus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~	Atriplex canescens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~	Atriplex confertifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~	Atriplex gardneri	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Bassia americana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Bouteloua gracilis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Calamagrostis canadensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~	Carex duriuscula	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~	Carex filifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~	Calamagrostis montanensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~	Carex nebrascensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~	Callitriche stagnalis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~~~	Castilleja	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~	Calamagrostis stricta subsp. inexpansa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	

~~ ~~~~~~~~ ~~~~~~~~	Cercocarpus montanus	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Chrysothamnus viscidiflorus	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~ ~~~~~~~~	Comandra umbellata subsp. pallida	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Crepis acuminata	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Dasiphora fruticosa subsp. floribunda	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Deschampsia caespitosa	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Delphinium	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Distichlis spicata	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus canadensis	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Elymus elymoides subsp. elymoides	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Eriogonum	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Eucephalus	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Hesperostipa comata subsp. comata	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus arcticus subsp. littoralis	~~~~~~ ~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus balticus	~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Juniperus scopulorum	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

- Kochia americana
- Koeleria macrantha
- Krascheninnikovia lanata
- Leymus cinereus
- Leptodactylon pungens
- Linanthus pungens
- Lomatium
- Lygodesmia juncea
- Muhlenbergia montana
- Muhlenbergia richardsonis
- Nassella viridula
- Oryzopsis bloomeri
- Paronychia
- Pascopyrum smithii
- Penstemon
- Phlox hoodii
- Phlox
- Pinus flexilis
- Polygonum bistortoides
- Poa canbyi
- Populus deltoides subsp. monilifera
- Poa fendleriana
- Poa juncifolia
- Poa secunda
- Primula
- Prunus virginiana

~~	Psoralidium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Puccinellia nuttalliana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Purshia tridentata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Redfieldia flexuosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Rhus trilobata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ribes	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Schizachyrium scoparium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sedum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Shepherdia argentea	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Sisyrinchium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus airoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Sphaeralcea coccinea	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Stenotus acaulis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Stanleya pinnata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Symphoricarpos occidentalis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia canescens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia spinosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Xylorhiza	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Zigadenus venenosus		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

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Animal kind:~~~~~~~~~~~

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~~ ~~~~~~~~~~	Achnatherum ×bloomeri [hymenoides × occidentale]	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Achnatherum hymenoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Achillea millefolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium textile	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Amelanchier alnifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Ambrosia psilostachya	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Antennaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia cana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Arenaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia frigida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia nova	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia pedatifida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia tridentata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Astragalus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex canescens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex confertifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex gardneri	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bassia americana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Bouteloua gracilis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis canadensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Carex duriuscula	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Carex filifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Calamagrostis montanensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Carex nebrascensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Callitriche stagnalis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Castilleja	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis stricta subsp. inexpansa	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cercocarpus montanus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Chrysothamnus viscidiflorus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Comandra umbellata subsp. pallida	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Crepis acuminata	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora fruticosa subsp. floribunda	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Deschampsia caespitosa	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Delphinium	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Distichlis spicata	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus canadensis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus elymoides subsp. elymoides	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus lanceolatus subsp. lanceolatus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eriogonum	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eucephalus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hesperostipa comata subsp. comata	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Juncus arcticus subsp. littoralis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Juncus balticus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Juniperus scopulorum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Kochia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Leymus cinereus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Leptodactylon pungens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linanthus pungens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	Lomatium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Lygodesmia juncea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia montana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Muhlenbergia richardsonis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Nassella viridula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Oryzopsis bloomeri	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Paronychia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Pinus flexilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~	Populus deltoides subsp. monilifera	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa fendleriana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa juncifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Poa secunda	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Primula	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Psoralidium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Puccinellia nuttalliana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Redfieldia flexuosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ribes	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Schizachyrium scoparium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Sedum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Shepherdia argentea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Sporobolus airoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~	Sporobolus cryptandrus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Stenotus acaulis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stanleya pinnata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~	Symphoricarpos occidentalis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia canescens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia spinosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

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~~	Xylorhiza	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~
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~~	Zigadenus venenosus	~~~~~~	~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~

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Hydrology Functions

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Recreational Uses

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Wood Products

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Other Products

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Supporting Information

State Correlation

This site has been correlated with the following states: WY

Inventory Data References

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Site uthors

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Reference Sheet

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Contact for lead author

Date **MR** **cological Site**

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Composition indicators and ased on

Indicators

each

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umer and etent of rills

Presence of ater flo patterns

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umer and height of erosional pedestals or terracettes

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are ground from cological Site Description or other studies roc litter standing dead lichen moss plant canopy are not are ground

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umer of gullies and erosion associated ith gullies

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tent of ind scoured loouts andor depositional areas

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mount of litter movement descrie sie and distance epected to travel

Soil surface top fe mm resistance to erosion staility values are averages most sites ill sho a range of values

Soil surface structure and SOM content include type and strength of structure and horion color and thicness

ffect on plant community composition relative proportion of different functional groups and spatial distriution on infiltration and runoff

Presence and thicness of compaction layer usually none descrie soil profile features hich may e mistaen for compaction on this site

FunctionalStructural roups list in order of descending dominance y aoveground eight using symols to indicate much greater than greater than and eual to ith dominants and sudominants and "others" on separate lines

mount of plant mortality and decadence include hich functional groups are epected to sho mortality or decadence

verage percent litter cover and depth to inches

pected annual production this is O aoveground production not ust forage production

Potential invasive including noious species native and nonnative ist Species hich OH characterie degraded states and have the potential to ecome a dominant or codominant species on the ecological site if their future estalishment and groth is not actively controlled y management interventions Species that ecome dominant for only one to several years eg shortterm response to drought or ildfire are not invasive plants ote that unlie other indicator e are descriing hat is O epected in the reference state for the ecological site

Perennial plant reproductive capaility

Reference Sheet pproval

0 inches

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

Section I: Ecological Site Characteristics

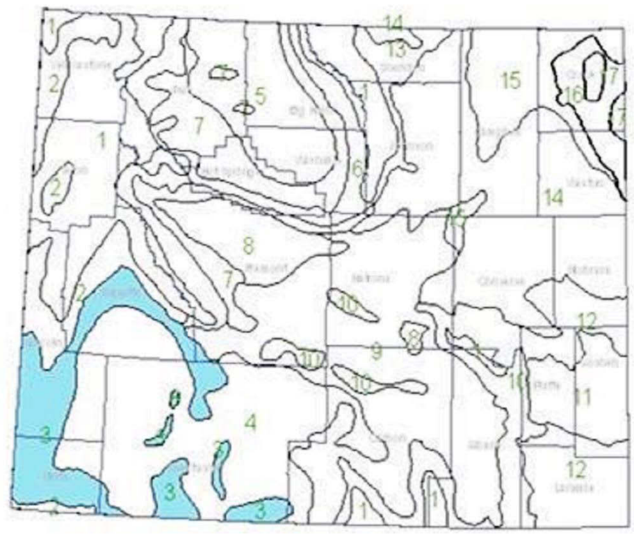
Ecological Site Identification and Concept

Site stage: **Provisional**

Provisional: an ESD at the provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of soil units that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state and transition model capturing the ecological processes and vegetative states and community phases as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. It is expected that the provisional ESD will continue refinement towards an approved status.

Site name: **Shallow Loamy (SwLy) 10-14” Foothills and Basins West**
Site type: Rangeland
Site ID: R034AY262WY
Major land resource area (MLRA): 034A-Cool Central Desertic Basins and Plateaus

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic Features

This site will usually occur in an upland position on rolling to steep slopes. It is found on all exposures□but is more common on south and west facing slopes. Slopes average □to 3□□ and elevations are mostly above □000 feet.

Landform: □1) Ridge
□2) Escarpment

	Minimum	Maximum
Elevation (feet):	6□00	□□00
Slope (percent):	□	60
Flooding		
Frequency:	□one	□one
Ponding		
Depth (inches):	0	0
Frequency:	□one	□one
Runoff class:	□egligible	□igh
Aspect:	□o Influence on this site	

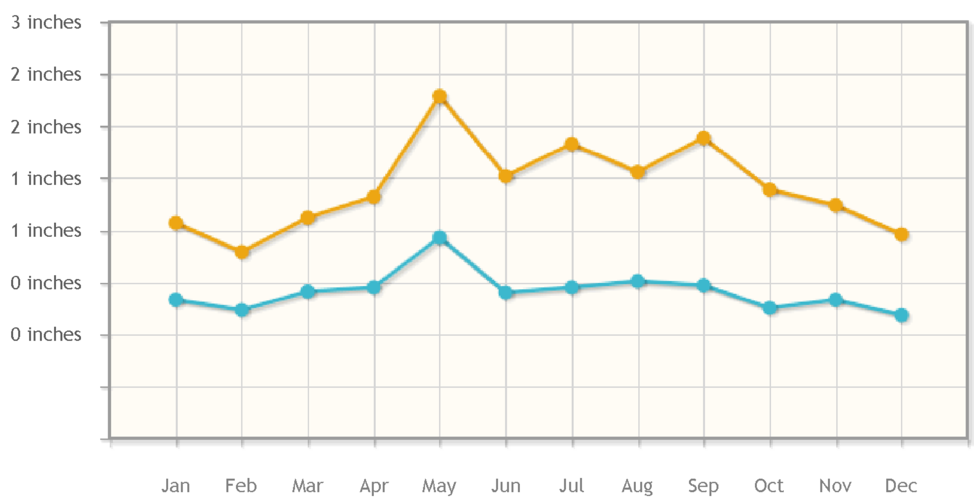
Climatic Features

Annual precipitation ranges from 10-14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more dry 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 outbrea□s in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Extreme storms may occur during the winter□but most severely affect ranch operations during late winter and spring. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than □0 mph. □rowth of native cool season plants begins about April 1□ and continues to about August 1□. Some green up of cool season plants usually occurs in September depending upon fall moisture occurrences. □or detailed information visit the □atural Resources Conservation Service □ational Water and Climate Center at http□□www.wcc.nrcs.usda.gov□cgibin□state.pl□state□wy website. □ther climate stations representative of this precipitation zone include □Border 3 □ □and □emmerer Wtr Trtmt□in □incoln County□□Evanston 1 E□in □inta County□and □Merna□in Sublette County.

	Averaged
Frost-free period (days):	42
Freeze-free period (days):	□□
Mean annual precipitation (inches):	14.00

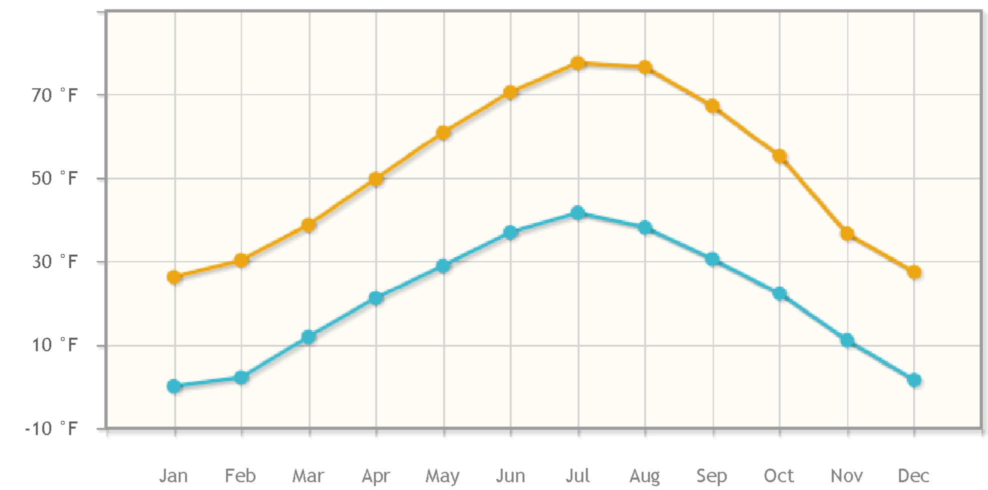
Monthly Precipitation □Inches)□

	□an	□eb	Mar	Apr	May	□un	□ul	Aug	Sep	□ct	□ov	Dec
High	1.0□	0.□□	1.12	1.32	2.2□	1.□2	1.□3	1.□6	1.□□	1.3□	1.24	0.□6
Low	0.33	0.23	0.41	0.4□	0.□3	0.40	0.4□	0.□1	0.4□	0.2□	0.33	0.1□



Monthly Temperature □□□)□

	□an	□eb	Mar	Apr	May	□un	□ul	Aug	Sep	□ct	□ov	Dec
High	26.2	30.2	3□.□	4□.□	60.□	□0.6	□□.6	□6.6	6□.3	□□.2	36.6	2□.4
Low	0.0	2.1	11.□	21.1	2□.□	36.□	41.6	3□.1	30.□	22.2	11.0	1.□



Climate stations: □1) WY□260□Pinedale□Wyoming. Period of record 1□□1-2000

Influencing Water Features

There are no water features associated with this site.

Wetland Description □Cowardin System)

System	Subsystem	Class
□one	□□A	□□A

Representative Soil Features

These are well drained shallow soils □10 to 20 inches deep) over all □inds of bedroc□ except igneous or volcanic. Textures range from very fine sandy loams to clay loam. Parent material is residuum□colluvium□and alluvium from sedimentary roc□. Surface texture can be loam□clay loam□sandy loam□fine sandy loam□and silty clay loam with surface texture modifiers of gravelly and channery.

Ma□or soil series correlated to this site includes□Anchutz□Blazon□□eltner□□ossilon□ Thermopolis□and Worfman.

□ther soil series in M□RA 34A correlated to this site include□□ighams□Rentsac□Tigon□ Ashuelot variant□Roxal□Midfor□□Prow□Rencot□Redthayne□and Southace.

Surface texture: □1) □oam
□2) Clay loam
□3) Sandy loam

Subsurface texture group: Clayey

	Minimum	Maximum
Surface fragments <=3" (% cover):	0	20
Surface fragments >3" (% cover):	0	1□

Subsurface fragments <=3" (% volume):	0	30
Subsurface fragments >3" (% volume):	0	20

Drainage class: Well drained to somewhat excessively drained

Permeability class: Moderately slow to moderately rapid

	Minimum	Maximum
Depth (inches):	10	20
Available water capacity (inches):	1.00	2.□0
Electrical conductivity (mmhos/cm):	0	□
Sodium adsorption ratio:	0	□
Calcium carbonate equivalent (percent):	0	1□
Soil reaction (1:1 water):	6.6	□.4

Plant Communities

Ecological Dynamics of the Site

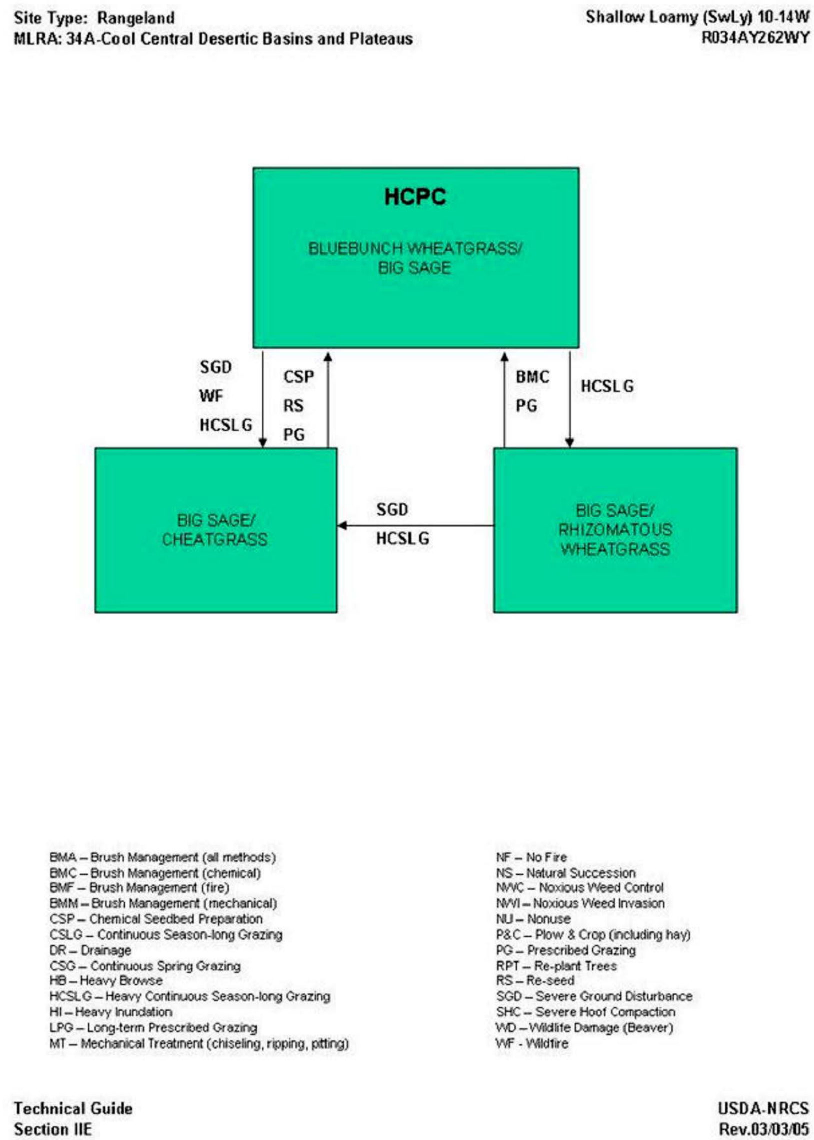
As this site deteriorates□species such as rabbitbrush and big sagebrush will increase. Cool season bunchgrasses such as bluebunch wheatgrass□needleandthread□and Indian ricegrass will decrease in frequency and production.

These plant communities narratives may not represent every possibility□but they probably are the most prevalent and repeatable plant communities. The plant composition tables shown above have been developed from the best available □nowledge at the time of this revision. As more data is collected□some of these plant communities may be revised or removed□and new ones may be added. □one of these plant communities should necessarily be thought of as □Desired Plant Communities□. According to the □SDA □RCS □ational Range and Pasture □andboo□□Desired Plant Communities □DPC□s) will be determined by the decision-ma□ers and will meet minimum quality criteria established by the □RCS. The main purpose for including any description of a plant community here is to capture the current □nowledge and experience at the time of this revision.

The □istoric 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.

State-and-Transition Diagram



Bluebunch Wheatgrass/Big Sagebrush (HCPC)

Bluebunch Wheatgrass/Big Sagebrush (HCPC) Plant Species Composition

Grass/Grasslike

				Pseudoroegneria spicata		
				Pascopyrum smithii		
				Hesperostipa comata		
				Achnatherum hymenoides		
				Elymus elymoides		
				Achnatherum lettermanii		
				Carex duriuscula		
				Calamagrostis montanensis		
				Koeleria macrantha		
				Poa fendleriana		
				Poa secunda		

Forb

				Achillea millefolium		
				Antennaria rosea		
				Astragalus		
				Castilleja		
				Crepis acuminata		
				Erigeron		

[illegible]	[illegible]	*Eriogonum*	[illegible]	[illegible]
[illegible]	[illegible]	*Eucephalus*	[illegible]	[illegible]
[illegible]	[illegible]	*Linanthus pungens*	[illegible]	[illegible]
[illegible]	[illegible]	*Lithospermum*	[illegible]	[illegible]
[illegible]	[illegible]	*Mertensia*	[illegible]	[illegible]
[illegible]	[illegible]	*Paronychia*	[illegible]	[illegible]
[illegible]	[illegible]	*Penstemon*	[illegible]	[illegible]
[illegible]	[illegible]	*Phacelia*	[illegible]	[illegible]
[illegible]	[illegible]	*Phlox hoodii*	[illegible]	[illegible]
[illegible]	[illegible]	*Stenotus acaulis*	[illegible]	[illegible]
[illegible]	[illegible]	*Trifolium*	[illegible]	[illegible]

Shrub/Vine

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	*Artemisia tridentata*	[illegible]	[illegible]
[illegible]				[illegible]	[illegible]
	[illegible]	[illegible]	*Chrysothamnus viscidiflorus*	[illegible]	[illegible]
	[illegible]	[illegible]	*Krascheninnikovia lanata*	[illegible]	[illegible]

Annual Production by Plant Type

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

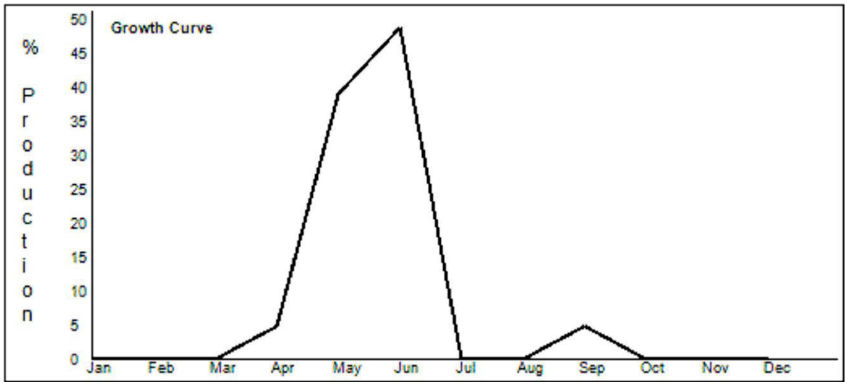
Plant Growth Curve

Growth curve number: [illegible]

Growth curve name: [illegible]

Growth curve description: [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



Big Sagebrush/Rhizomatous Wheatgrass

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Plant Growth Curve

Growth curve number:	~~~~
Growth curve name:	~~~~~~~~~~~~
Growth curve description:	~~~~~~~~~~~

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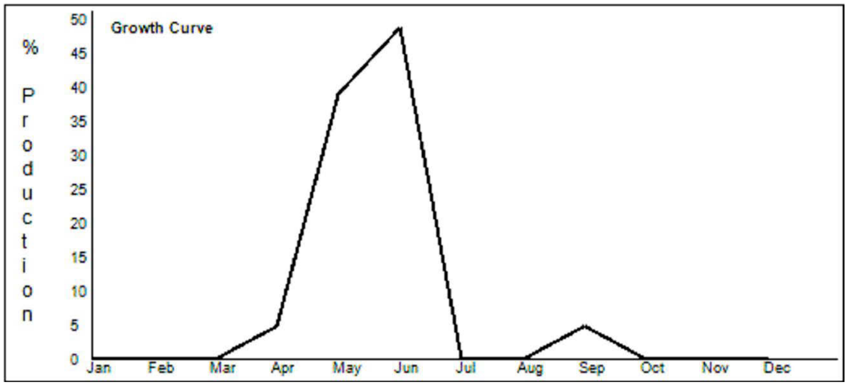

Big Sagebrush/Cheatgrass

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Plant Growth Curve

Growth curve number:	~~~~~
Growth curve name:	~~~~~~~~~~~~~
Growth curve description:	~~~~~~~~~~~~

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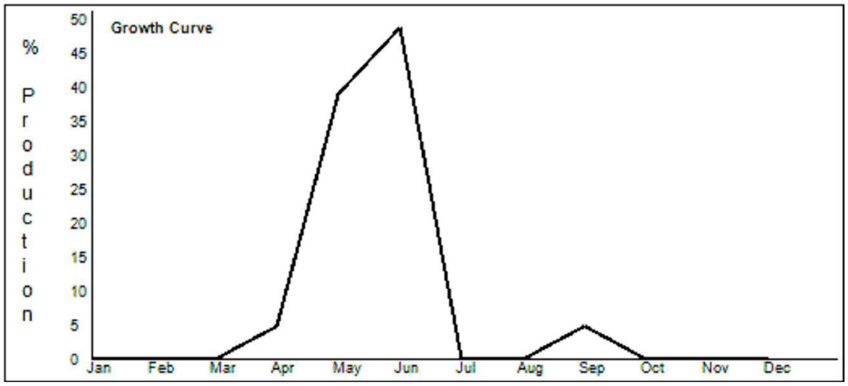

Section II: Ecological Site Interpretations

Animal Community

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[illegible]

[illegible]

[illegible]

Plant Preference by Animal Kind

Animal □ind:[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Achnatherum hymenoides	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Achnatherum lettermanii	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Achillea millefolium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Acer negundo	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Agoseris glauca	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Allium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Amelanchier alnifolia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Antennaria	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Artemisia arbuscula	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Artemisia arbuscula subsp. longiloba	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Artemisia cana	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Arenaria	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Artemisia frigida	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Aristida	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Artemisia nova	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Artemisia pedatifida	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Artemisia tridentata	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Astragalus	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Atriplex canescens	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

~~ ~~~~~~~~~	Atriplex confertifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex gardneri	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Betula occidentalis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Buglossoides arvensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis canadensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~~~	Calamagrostis canadensis var. macouniana	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex duriuscula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex interior	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~	Calamagrostis montanensis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Carex nebrascensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Castilleja	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~~	Calamagrostis stricta subsp. inexpansa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Cercocarpus montanus var. montanus	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cerastium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Chrysothamnus viscidiflorus	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~ ~~~~~~~~~	Comandra umbellata subsp. pallida	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Crepis acuminata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Deschampsia caespitosa	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Delphinium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Distichlis spicata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Dodecatheon	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus elymoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Elymus trachycaulus		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

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~~	Equisetum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Eriogonum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Eucephalus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Glyceria grandis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	Glycyrrhiza lepidota	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria striata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Grayia spinosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hesperostipa comata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Heracleum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Hydrophyllum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Iris missouriensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iva axillaris	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus balticus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juniperus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Kochia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Leymus cinereus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leptodactylon pungens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lithospermum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lomatium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lupinus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Mentha arvensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Mertensia		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

		~~ ~~~~~~ ~~~~~~~												
~~	Muhlenbergia asperifolia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia richardsonis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Osmorhiza	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Paronychia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pedicularis groenlandica	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phacelia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Picrothamnus desertorum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pinus flexilis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Plantago	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Populus angustifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Poa fendleriana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa juncifolia	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Populus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa secunda	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Prunus virginiana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Puccinellia nuttalliana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pyrrocoma	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ranunculus		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Rhus trilobata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sedum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Senecio	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Shepherdia argentea	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Solidago	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus airoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stanleya	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stellaria	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Symphoricarpos occidentalis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tanacetum vulgare	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia canescens	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia spinosa	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Thermopsis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Vicia americana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Xylorhiza glabriuscula	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Zigadenus venenosus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:

	Achnatherum hymenoides	

Animal kind:

	Achnatherum lettermanii	
	Achillea millefolium	
	Acer negundo	
	Agoseris glauca	
	Allium	
	Amelanchier alnifolia	
	Antennaria	
	Artemisia arbuscula	
	Artemisia arbuscula subsp. longiloba	
	Artemisia cana	
	Arenaria	
	Artemisia frigida	
	Aristida	
	Artemisia nova	
	Artemisia pedatifida	

Animal kind:

	Artemisia tridentata	

Animal kind:

	Astragalus	
	Atriplex canescens	
	Atriplex confertifolia	

~~	Atriplex gardneri	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Betula occidentalis	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Buglossoides arvensis	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis canadensis	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis canadensis var. macouniana	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex duriuscula	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex interior	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis montanensis	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex nebrascensis	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Castilleja	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis stricta subsp. inexpansa	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cercocarpus montanus var. montanus	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cerastium	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Chrysothamnus viscidiflorus	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Comandra umbellata subsp. pallida	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Crepis acuminata	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Deschampsia caespitosa	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Delphinium	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Distichlis spicata	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dodecatheon	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~

~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Elymus elymoides		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

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Animal kind:~~~~~~~~~~~~

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~~ ~~~~~~~~~~~ ~~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Eriogonum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Eucephalus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Glyceria grandis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	Glycyrrhiza lepidota	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria striata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Grayia spinosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hesperostipa comata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Heracleum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Hydrophyllum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Iris missouriensis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iva axillaris	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus balticus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juniperus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Kochia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~~~	Leymus cinereus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leptodactylon pungens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lithospermum		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Lomatium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lupinus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Mentha arvensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Mertensia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia asperifolia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia richardsonis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Osmorhiza	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Paronychia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind: ~~~~~~~~~~~~

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~~	Pascopyrum smithii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind: ~~~~~~~~~~~~

~~ ~~~~~	~~~~~~~~~~~~~~~~	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pedicularis groenlandica	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phacelia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Picrothamnus desertorum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pinus flexilis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Plantago	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Populus angustifolia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Polygonum bistortoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind: ~~~~~~~~~~~~

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	Poa fendleriana		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

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Animal kind:~~~~~~~~~~~

~~ ~~~~~	~~~~~~~~~~~~~~~	~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa juncifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Populus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Poa secunda	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~ ~~~~~~~~~	Pseudoroegneria spicata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Puccinellia nuttalliana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pyrrocoma	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Ranunculus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sedum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Senecio	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Shepherdia argentea	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Solidago	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Sporobolus airoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stanleya	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stellaria		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~	Symphoricarpos occidentalis	~~~~~~~ ~~~~~~ ~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tanacetum vulgare	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia canescens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia spinosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Thermopsis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Triglochin	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Vicia americana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Xylorhiza glabriuscula	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Zigadenus venenosus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~~~~~~~~~

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~~ ~~~~~~~~~~	Achnatherum hymenoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Achnatherum lettermanii	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Achillea millefolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Acer negundo	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Agoseris glauca	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Amelanchier alnifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Antennaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia arbuscula	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia arbuscula subsp. longiloba	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia cana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Arenaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia frigida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Aristida		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~	Artemisia nova	~~~~~~~ ~~~~~~ ~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia pedatifida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia tridentata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Astragalus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex canescens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex confertifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex gardneri	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Betula occidentalis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Buglossoides arvensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis canadensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Calamagrostis canadensis var. macouniana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Carex duriuscula	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex interior	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Calamagrostis montanensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Carex nebrascensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Castilleja	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Calamagrostis stricta subsp. inexpansa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~ ~~~~~~~~~	Cercocarpus montanus var. montanus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cerastium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Chrysothamnus viscidiflorus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Comandra umbellata subsp. pallida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Crepis acuminata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Dasiphora floribunda	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
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~~ ~~~~~~~~~~	Deschampsia caespitosa	~~~~~~~ ~~~~~~ ~~~~~~~												
~~	Delphinium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Distichlis spicata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dodecatheon	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Elymus elymoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Elymus trachycaulus	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eriogonum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Ericameria nauseosa	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eucephalus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Glyceria grandis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Glycyrrhiza lepidota	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Glyceria striata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Grayia spinosa	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Hesperostipa comata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Heracleum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~	Iris missouriensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Iva axillaris	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus balticus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juniperus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Kochia americana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Koeleria macrantha	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leymus cinereus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Leptodactylon pungens		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~		~~~~~~~ ~~~~~~													
~~	Linum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Lithospermum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Lomatium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Lupinus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Mentha arvensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Mertensia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Muhlenbergia asperifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Muhlenbergia richardsonis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Osmorhiza	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~	Paronychia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Pascopyrum smithii	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Pedicularis groenlandica	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Penstemon	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Phacelia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Phlox hoodii	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Phlox	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Picrothamnus desertorum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Pinus flexilis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~~~	Plantago	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~	Populus angustifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Polygonum bistortoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Poa canbyi	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Poa fendleriana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
	Poa juncifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~	Populus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Poa secunda	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Primula		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	

		~~ ~~~~~~ ~~~~~~~												
~~	Prunus virginiana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~ ~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Puccinellia nuttalliana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pyrrocoma	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Ranunculus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sedum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Senecio	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Shepherdia argentea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Solidago	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Sporobolus airoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stanleya	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stellaria	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Symphoricarpos occidentalis	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	Tanacetum vulgare	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia canescens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia spinosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Thermopsis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Triglochin	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Vicia americana	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Xylorhiza glabriuscula	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Zigadenus venenosus	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~

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~~	Achnatherum hymenoides	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achnatherum lettermanii	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achillea millefolium	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Acer negundo	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Agoseris glauca	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Amelanchier alnifolia	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Antennaria	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia arbuscula	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia arbuscula subsp. longiloba	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia cana	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Arenaria	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia frigida	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Aristida	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia nova	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia pedatifida	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia tridentata	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Astragalus	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex canescens var. canescens	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Atriplex confertifolia		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

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~~	Atriplex gardneri	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Betula occidentalis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Buglossoides arvensis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis canadensis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex duriuscula	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex interior	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis montanensis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex nebrascensis	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Castilleja	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis stricta subsp. inexpansa	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cercocarpus montanus var. montanus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cerastium	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Chrysothamnus viscidiflorus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Comandra umbellata subsp. pallida	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Crepis acuminata	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Deschampsia caespitosa	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Delphinium	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dodecatheon	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus elymoides	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus lanceolatus subsp. lanceolatus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Eriogonum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Ericameria nauseosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eucephalus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Glyceria grandis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Glycyrrhiza lepidota	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Glyceria striata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Grayia spinosa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Hesperostipa comata subsp. comata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Heracleum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~~	Iris missouriensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Iva axillaris	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus balticus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juniperus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Kochia americana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Koeleria macrantha	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leymus cinereus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Leptodactylon pungens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lithospermum	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lomatium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lupinus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Mentha arvensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Mertensia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia asperifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia richardsonis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Osmorhiza		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Paronychia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pedicularis groenlandica	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phacelia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Picrothamnus desertorum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pinus flexilis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Plantago	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Polygonum bistortoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Poa fendleriana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Populus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Puccinellia nuttalliana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Purshia tridentata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pyrrocoma	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ranunculus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Rhus trilobata var. trilobata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sedum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Senecio		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Shepherdia argentea	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Solidago	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus airoides	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stanleya	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stellaria	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Symphoricarpos occidentalis	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tanacetum vulgare	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia canescens	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Thermopsis	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Vicia americana	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Xylorhiza glabriuscula	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Zigadenus venenosus	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Animal kind:~~

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~~	Achnatherum hymenoides	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achnatherum lettermanii	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Achillea millefolium	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Acer negundo	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Agoseris glauca	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Amelanchier alnifolia	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Antennaria		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~ ~~~~~~~~~~	Artemisia arbuscula	~~~~~~~ ~~~~~~ ~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia arbuscula subsp. longiloba	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia cana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Arenaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia frigida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Aristida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia nova	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia pedatifida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia tridentata	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Astragalus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex canescens	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex confertifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Atriplex gardneri	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Betula occidentalis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Buglossoides arvensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis canadensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Calamagrostis canadensis var. macouniana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Carex duriuscula	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex interior	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Calamagrostis montanensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Carex nebrascensis	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Castilleja	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Calamagrostis stricta subsp. inexpansa	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~ ~~~~~~~~~	Cercocarpus montanus var. montanus	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cerastium	~~~~~~~ ~~~~~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~

~~	Chrysothamnus viscidiflorus	~~~~~~												
~~	Cicuta	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Comandra umbellata subsp. pallida	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Crepis acuminata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Deschampsia caespitosa	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Delphinium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Distichlis spicata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dodecatheon	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus elymoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eriogonum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eucephalus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glycyrrhiza lepidota	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria striata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Grayia spinosa	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hesperostipa comata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Heracleum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris missouriensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iva axillaris	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus balticus		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Juniperus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Kochia americana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leymus cinereus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leptodactylon pungens	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lithospermum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lomatium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lupinus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Mentha arvensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Mertensia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia asperifolia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia richardsonis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Osmorhiza	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Paronychia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pascopyrum smithii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pedicularis groenlandica	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Penstemon	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phacelia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Picrothamnus desertorum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pinus flexilis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Plantago	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Polygonum bistortoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

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~~ ~~~~~~~~	Poa fendleriana	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa juncifolia	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Populus	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Poa secunda	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~ ~~~~~~~~	Pseudoroegneria spicata	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Puccinellia nuttalliana	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Purshia tridentata	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pyrrocoma	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Ranunculus	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sedum	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Senecio	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Shepherdia argentea	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Solidago	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~	Sporobolus airoides	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stanleya	~~~~~~~ ~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stellaria	~~~~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~

~~ ~~~~~~~~~~	Symphoricarpos occidentalis	~~~~~~~ ~~~~~~													
~~ ~~~~~	Tanacetum vulgare	~~~~~~~ ~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~~~	Tetradymia canescens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Tetradymia spinosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Thermopsis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Trifolium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~~~	Triglochin	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Vicia americana	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~	Viola	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~ ~~~~~~~	Xylorhiza glabriuscula	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
~~	Zigadenus venenosus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	

Animal kind:~~~~~~~~~~~

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~~ ~~~~~~~~~~	Achnatherum hymenoides	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~	Achnatherum lettermanii	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Achillea millefolium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Acer negundo	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Agoseris glauca	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Allium	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~~~	Amelanchier alnifolia	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Antennaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia arbuscula	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia arbuscula subsp. longiloba	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Artemisia cana	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Arenaria	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Artemisia frigida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Aristida	~~~~~~~ ~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Artemisia nova		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

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~~	Artemisia pedatifida	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Artemisia tridentata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Astragalus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex canescens	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex confertifolia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Atriplex gardneri	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Betula occidentalis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Buglossoides arvensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis canadensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis canadensis var. macouniana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex duriuscula	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex interior	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis montanensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Carex nebrascensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Castilleja	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Calamagrostis stricta subsp. inexpansa	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cercocarpus montanus var. montanus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cerastium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Chrysothamnus viscidiflorus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cicuta	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Cornus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Comandra umbellata subsp. pallida	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Crepis acuminata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Dasiphora floribunda	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Deschampsia caespitosa	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Delphinium		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Distichlis spicata	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus elymoides	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus lanceolatus subsp. lanceolatus	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Elymus trachycaulus	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Equisetum	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Erigeron	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eriogonum	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Ericameria nauseosa	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Eucephalus	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria grandis	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glycyrrhiza lepidota	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Glyceria striata	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Grayia spinosa	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hesperostipa comata	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Heracleum	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Hydrophyllum	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iris missouriensis	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Iva axillaris	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juncus balticus	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Juniperus	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Kochia americana	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Koeleria macrantha	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Krascheninnikovia lanata	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leymus cinereus	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Leptodactylon pungens	~~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Linum		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lithospermum		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

~~	Lomatium	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Lupinus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Mentha arvensis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Mertensia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia asperifolia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Muhlenbergia richardsonis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Osmorhiza	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Paronychia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Pascopyrum smithii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pedicularis groenlandica	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
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~~	Phacelia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox hoodii	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Phlox	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Picrothamnus desertorum	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pinus flexilis	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Plantago	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Polygonum bistortoides	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa canbyi	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Poa fendleriana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Poa juncifolia	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Populus	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Poa secunda	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Primula	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Prunus virginiana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Pseudoroegneria spicata	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
	Puccinellia nuttalliana		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

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~~	Purshia tridentata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Pyrrocoma	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Ranunculus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rhus trilobata	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rosa woodsii var. woodsii	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Rumex	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Salix	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sarcobatus vermiculatus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sedum	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~	Senecio	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~	Shepherdia argentea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sisyrinchium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Solidago	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Sporobolus airoides	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sphaeralcea coccinea	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Sporobolus cryptandrus	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Stanleya	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~	Stellaria	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Symphoricarpos occidentalis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~	Tanacetum vulgare	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~~~	Tetradymia canescens	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Tetradymia spinosa	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Thermopsis	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Trifolium	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~ ~~~~~~~~~	Triglochin	~~~~~~ ~~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Vicia americana	~~~~~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
~~	Viola		~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

	Xylorhiza glabriuscula		
	Zigadenus venenosus		

Hydrology Functions

Recreational Uses

Wood Products

Other Products

Supporting Information

Associated Sites

	R034AY222WY	
	R034AY258WY	

Similar Sites

	R034AY162WY	
	R034AY222WY	

Inentory ata References

Site Authors

uality Assurance

Reference Sheet

Authorsparticipants

ontact for lead author

ate **MRA** **cological Site**

must

omposition indicators and ased on

Indicators

each

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umer and etent of rills

Presence of ater flo patterns

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umer and height of erosional pedestals or terracettes

---

are ground from cological Site escription or other studies roc litter standing dead lichen moss plant canopy are not are ground

umer of gullies and erosion associated ith gullies

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tent of ind scoured loouts andor depositional areas

Amount of litter moement descrie sie and distance epected to trael

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Soil surface top fe mm resistance to erosion staility alues are aerages most sites ill sho a range of alues

---

Soil surface structure and SOM content include type and strength of structure and Ahorion color and thicness

---

ffect on plant community composition relatie proportion of different functional groups and spatial distriution on infiltration and runoff

---

Presence and thicness of compaction layer usually none descrie soil profile features hich may e mistaen for compaction on this site

---

FunctionalStructural roups list in order of descending dominance y aoeground eight using symols to indicate much greater than greater than and eual to ith dominants and sudominants and "others" on separate lines

---

Amount of plant mortality and decadence include hich functional groups are epected to sho mortality or decadence

Aerage percent litter coer and depth inches

pected annual production this is OA aoeground production not ust forage production

Potential inasie including noious species natie and nonnatie ist Species hich OH characterie degraded states and hae the potential to ecome a dominant or codominant species on the ecological site if their future estalishment and groth is not actiely controlled y management interentions Species that ecome dominant for only one to seeral years eg shortterm response to drought or ildfire are not inasie plants ote that unlie other indicator e are descriing hat is O epected in the reference state for the ecological site

Perennial plant reproductie capaility

Reference Sheet Approal

90°F

APPENDIX 3C

UPPER NORTH PLATTE RIVER WATERSHED: LANDFIRE DATA EVALUATION

Upper North Platte River Watershed : LANDFIRE				
Existing Vegetation Type	Physiognomy (form/morphological structure of vegetation)	Acres	Percent of Watershed	Cumulative Percent
Inter-Mountain Basins Big Sagebrush Shrubland	Shrubland	668364.43	32.809%	32.809%
Inter-Mountain Basins Big Sagebrush Steppe	Shrubland	313539.23	15.391%	48.199%
Rocky Mountain Lodgepole Pine Forest	Conifer	161740.52	7.939%	56.139%
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	Conifer	149424.39	7.335%	63.474%
Artemisia tridentata ssp. vaseyana Shrubland Alliance	Shrubland	135394.98	6.646%	70.120%
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	Conifer-Hardwood	81338.27	3.993%	74.113%
Western Cool Temperate Pasture and Hayland	Agricultural	69515.51	3.412%	77.525%
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	Shrubland	49152.45	2.413%	79.938%
Rocky Mountain Aspen Forest and Woodland	Hardwood	40948.74	2.010%	81.948%
Rocky Mountain Lower Montane-Foothill Shrubland	Shrubland	28473.21	1.398%	83.346%
Rocky Mountain Foothill Limber Pine-Juniper Woodland	Conifer	23736.13	1.165%	84.511%
Inter-Mountain Basins Semi-Desert Shrub-Steppe	Shrubland	22100.77	1.085%	85.596%
Inter-Mountain Basins Semi-Desert Grassland	Grassland	22035.67	1.082%	86.677%
Southern Rocky Mountain Ponderosa Pine Woodland	Conifer	21616.15	1.061%	87.739%
Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	Grassland	19547.14	0.960%	88.698%
Open Water	Open Water	19521.83	0.958%	89.656%
Introduced Upland Vegetation-Annual and Biennial Forbland	Exotic Herbaceous	17677.35	0.868%	90.524%
Western Cool Temperate Developed Ruderal Shrubland	Developed	16732.32	0.821%	91.345%
Introduced Upland Vegetation-Annual Grassland	Exotic Herbaceous	15802.65	0.776%	92.121%
Inter-Mountain Basins Mat Saltbush Shrubland	Shrubland	14573.89	0.715%	92.837%
Rocky Mountain Subalpine/Upper Montane Riparian Shrubland	Riparian	12421.07	0.610%	93.446%
Rocky Mountain Montane Riparian Forest and Woodland	Riparian	11630.44	0.571%	94.017%
Developed-Roads	Developed-Roads	9812.29	0.482%	94.499%
Inter-Mountain Basins Montane Sagebrush Steppe	Shrubland	9760.83	0.479%	94.978%
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	Conifer	9207.72	0.452%	95.430%
Barren	Barren	8500.71	0.417%	95.847%
Western Great Plains Floodplain Forest and Woodland	Riparian	8428.48	0.414%	96.261%
Inter-Mountain Basins Sparsely Vegetated Systems	Sparsely Vegetated	8214.57	0.403%	96.664%
Inter-Mountain Basins Greasewood Flat	Shrubland	5910.90	0.290%	96.954%
Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	Conifer	5477.74	0.269%	97.223%
Western Cool Temperate Developed Ruderal Grassland	Developed	4725.30	0.232%	97.455%
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	Conifer	4485.47	0.220%	97.675%
Introduced Upland Vegetation-Perennial Grassland and Forbland	Exotic Herbaceous	4088.84	0.201%	97.876%
Rocky Mountain Subalpine-Montane Mesic Meadow	Grassland	4046.49	0.199%	98.075%
Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	Conifer	3979.60	0.195%	98.270%
Rocky Mountain Wetland-Herbaceous	Riparian	3714.23	0.182%	98.452%
Southern Rocky Mountain Montane-Subalpine Grassland	Grassland	3704.48	0.182%	98.634%
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	Conifer	3563.13	0.175%	98.809%
Developed-Low Intensity	Developed-Low Intensity	3194.00	0.157%	98.966%
Western Cool Temperate Urban Shrubland	Developed	3115.88	0.153%	99.119%
Western Cool Temperate Close Grown Crop	Agricultural	2611.27	0.128%	99.247%
Western Great Plains Floodplain Herbaceous	Riparian	2023.51	0.099%	99.346%
Rocky Mountain Alpine Turf	Grassland	1530.10	0.075%	99.422%
Western Cool Temperate Urban Herbaceous	Developed	1517.42	0.074%	99.496%
Western Great Plains Depressional Wetland Systems	Riparian	1168.13	0.057%	99.553%
Quercus gambelii Shrubland Alliance	Shrubland	1021.93	0.050%	99.604%
Inter-Mountain Basins Juniper Savanna	Conifer	930.22	0.046%	99.649%
Rocky Mountain Subalpine/Upper Montane Riparian Forest and Woodland	Riparian	869.81	0.043%	99.692%
Rocky Mountain Alpine/Montane Sparsely Vegetated Systems	Sparsely Vegetated	731.58	0.036%	99.728%
Developed-Medium Intensity	Developed-Medium Intensity	634.94	0.031%	99.759%
Western Cool Temperate Developed Ruderal Deciduous Forest	Developed	537.35	0.026%	99.785%
Colorado Plateau Pinyon-Juniper Woodland	Conifer	498.92	0.024%	99.810%
Western Great Plains Floodplain Shrubland	Riparian	444.04	0.022%	99.832%
Quarries-Strip Mines-Gravel Pits	Quarries-Strip Mines-Gravel Pits	436.76	0.021%	99.853%
Rocky Mountain Montane Riparian Shrubland	Riparian	396.22	0.019%	99.873%
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	Conifer	394.48	0.019%	99.892%
Western Cool Temperate Fallow/Idle Cropland	Agricultural	265.01	0.013%	99.905%
Western Cool Temperate Urban Deciduous Forest	Developed	256.57	0.013%	99.918%
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Shrubland	220.35	0.011%	99.928%
Northwestern Great Plains Mixedgrass Prairie	Grassland	173.96	0.009%	99.937%
Western Cool Temperate Undeveloped Ruderal Shrubland	Developed	169.43	0.008%	99.945%
Western Cool Temperate Urban Evergreen Forest	Developed	168.07	0.008%	99.953%
Northern Rocky Mountain Subalpine Woodland and Parkland	Conifer	151.84	0.007%	99.961%
Inter-Mountain Basins Mixed Salt Desert Scrub	Shrubland	129.43	0.006%	99.967%
Rocky Mountain Poor-Site Lodgepole Pine Forest	Conifer	127.72	0.006%	99.974%
Western Cool Temperate Developed Ruderal Evergreen Forest	Developed	118.50	0.006%	99.979%
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	Shrubland	97.43	0.005%	99.984%
Western Cool Temperate Urban Mixed Forest	Developed	69.01	0.003%	99.988%
Developed-High Intensity	Developed-High Intensity	66.72	0.003%	99.991%
Southern Rocky Mountain Ponderosa Pine Savanna	Conifer	64.48	0.003%	99.994%
Southern Rocky Mountain Pinyon-Juniper Woodland	Conifer	22.26	0.001%	99.995%
Snow-Ice	Snow-Ice	22.01	0.001%	99.996%
Western Cool Temperate Undeveloped Ruderal Grassland	Developed	15.79	0.001%	99.997%
Introduced Riparian Forest and Woodland	Exotic Tree-Shrub	14.67	0.001%	99.998%
Rocky Mountain Alpine Dwarf-Shrubland	Grassland	11.56	0.001%	99.998%
Northern Rocky Mountain Subalpine-Upper Montane Grassland	Grassland	9.10	0.0004%	99.999%
Western Cool Temperate Wheat	Agricultural	7.78	0.0004%	99.999%
Western Cool Temperate Row Crop	Agricultural	4.22	0.0002%	99.999%
Western Cool Temperate Developed Ruderal Mixed Forest	Developed	4.00	0.0002%	99.999%
Colorado Plateau Mixed Low Sagebrush Shrubland	Shrubland	3.33	0.0002%	100.000%
Western Cool Temperate Undeveloped Ruderal Deciduous Forest	Developed	3.11	0.0002%	100.000%

Existing Vegetation Type	Physiognomy (form/morphological structure of vegetation)	Acres	Percent of Watershed	Cumulative Percent
Southern Rocky Mountain Juniper Woodland and Savanna	Conifer	2.45	0.0001%	100.000%
Western Cool Temperate Undeveloped Ruderal Evergreen Forest	Developed	1.11	0.0001%	100.000%
Western Great Plains Shortgrass Prairie	Grassland	0.89	0.00004%	100.000%
Abies concolor Forest Alliance	Conifer	0.67	0.00003%	100.000%
Southern Colorado Plateau Sand Shrubland	Shrubland	0.44	0.00002%	100.000%

Upper North Platte River Watershed : LANDFIRE Wetlands				
Existing Vegetation Type	**Physiognomy (form/morphological structure of vegetation)**	**Acres**	**Percent of Watershed**	**Cumulative Percent**
Rocky Mountain Subalpine/Upper Montane Riparian Shrubland	Riparian	12421.07	0.610%	0.61%
Rocky Mountain Montane Riparian Forest and Woodland	Riparian	11630.44	0.571%	1.18%
Western Great Plains Floodplain Forest and Woodland	Riparian	8428.48	0.414%	1.59%
Rocky Mountain Wetland-Herbaceous	Riparian	3714.23	0.182%	1.78%
Western Great Plains Floodplain Herbaceous	Riparian	2023.51	0.099%	1.88%
Western Great Plains Depressional Wetland Systems	Riparian	1168.13	0.057%	1.93%
Rocky Mountain Subalpine/Upper Montane Riparian Forest and Woodland	Riparian	869.81	0.043%	1.98%
Western Great Plains Floodplain Shrubland	Riparian	444.04	0.022%	2.00%
Rocky Mountain Montane Riparian Shrubland	Riparian	396.22	0.019%	2.02%
Introduced Riparian Forest and Woodland	Riparian	14.67	0.001%	2.02%

APPENDIX 3D

UPPER NORTH PLATTE RIVER WATERSHED: WYNDD EVALUATION

Wyoming Natural Diversity Database: Wildlife Species of Concern in the Upper North Platte Watershed			
Common Name	**Scientific Name**	**Listing Status**	**Tracked/Watched**
Amphibians			
Eastern Clade Western Toad	Anaxyrus boreas - Eastern Clade	Petition Under Review (UR)	Tracked
Great Basin Spadefoot	Spea intermontana		Tracked
Northern Leopard Frog	Lithobates pipiens	Not Warranted for Listing (NW)	Tracked
Southern Rockies Wood Frog	Lithobates sylvaticus - Southern Rockies		Tracked
Tiger Salamander	Ambystoma mavortium		Watched
Birds			
American Avocet	Recurvirostra americana		Watched
American Bittern	Botaurus lentiginosus		Tracked
American Dipper	Cinclus mexicanus		Watched
American Three-toed Woodpecker	Picoides dorsalis		Tracked
American White Pelican	Pelecanus erythrorhynchos		Tracked
Bald Eagle	Haliaeetus leucocephalus	Delisted, formally monitored (DM)	Tracked
Barn Owl	Tyto alba		Watched
Black Tern	Chlidonias niger		Tracked
Black-billed Cuckoo	Coccyzus erythropthalmus		Tracked
Black-crowned Night-Heron	Nycticorax nycticorax		Watched
Black-necked Stilt	Himantopus mexicanus		Watched
Black-throated Gray Warbler	Setophaga nigrescens		Tracked
Blue Grosbeak	Passerina caerulea		Watched
Bobolink	Dolichonyx oryzivorus		Tracked
Boreal Owl	Aegolius funereus		Tracked
Brewer's Sparrow	Spizella breweri		Watched
Brown-capped Rosy-Finch	Leucosticte australis		Tracked
Bufflehead	Bucephala albeola		Watched
Burrowing Owl	Athene cunicularia		Tracked
California Gull	Larus californicus		Watched
Calliope Hummingbird	Selasphorus calliope		Tracked
Canyon Wren	Catherpes mexicanus		Watched
Caspian Tern	Hydroprogne caspia		Tracked
Chestnut-collared Longspur	Calcarius ornatus		Tracked
Clark's Grebe	Aechmophorus clarkii		Tracked
Clay-colored Sparrow	Spizella pallida		Watched
Columbian Sharp-tailed Grouse	Tympanuchus phasianellus columbianus	Not Warranted for Listing (NW)	Tracked
Common Goldeneye	Bucephala clangula		Watched
Common Loon	Gavia immer		Tracked
Common Tern	Sterna hirundo		Watched
Dark-eyed Junco	Junco hyemalis		Tracked
Dickcissel	Spiza americana		Watched
Eastern Screech-Owl	Megascops asio		Watched
Ferruginous Hawk	Buteo regalis		Tracked
Flammulated Owl	Psiloscops flammeolus		Watched
Forster's Tern	Sterna forsteri		Tracked
Golden Eagle	Aquila chrysaetos		Watched
Golden-crowned Kinglet	Regulus satrapa		Watched
Grasshopper Sparrow	Ammodramus savannarum		Watched
Great Gray Owl	Strix nebulosa		Tracked
Greater Sage-Grouse	Centrocercus urophasianus	Candidate Warranted but Precluded (C)	Tracked
Hammond's Flycatcher	Empidonax hammondii		Watched
Harlequin Duck	Histrionicus histrionicus		Tracked
Herring Gull	Larus argentatus		Watched
Lewis's Woodpecker	Melanerpes lewis		Tracked
Loggerhead Shrike	Lanius ludovicianus		Tracked
Long-billed Curlew	Numenius americanus		Tracked
McCown's Longspur	Rhynchophanes mccownii		Tracked
Merlin	Falco columbarius		Watched
Mountain Plover	Charadrius montanus	Not Warranted for Listing (NW)	Tracked
Northern Goshawk	Accipiter gentilis	Not Warranted for Listing (NW)	Tracked
Northern Pygmy-Owl	Glaucidium gnoma		Tracked
Olive-sided Flycatcher	Contopus cooperi		Watched
Osprey	Pandion haliaetus		Watched
Peregrine Falcon	Falco peregrinus	Delisted, formally monitored (DM)	Tracked
Piping Plover	Charadrius melodus	Listed Threatened (LT)	Watched
Pygmy Nuthatch	Sitta pygmaea		Tracked
Red-eyed Vireo	Vireo olivaceus		Watched
Red-necked Phalarope	Phalaropus lobatus		Watched
Ring-billed Gull	Larus delawarensis		Watched
Ring-necked Duck	Aythya collaris		Watched
Rose-breasted Grosbeak	Pheucticus ludovicianus		Watched
Sage Thrasher	Oreoscoptes montanus		Watched

Sagebrush Sparrow	Artemisiospiza nevadensis		Tracked
Sandhill Crane	Grus canadensis		Watched
Short-eared Owl	Asio flammeus		Tracked
Snowy Egret	Egretta thula		Watched
Snowy Plover	Charadrius nivosus		Tracked
Sprague's Pipit	Anthus spragueii	Candidate Warranted but Precluded (C)	Watched
Townsend's Warbler	Setophaga townsendi		Watched
Trumpeter Swan	Cygnus buccinator	Not Warranted for Listing (NW)	Tracked
Tundra Swan	Cygnus columbianus		Watched
Virginia Rail	Rallus limicola		Watched
Virginia's Warbler	Oreothlypis virginiae		Tracked
Western Scrub-Jay	Aphelocoma californica		Tracked
White-faced Ibis	Plegadis chihi		Tracked
White-tailed Ptarmigan	Lagopus leucura	Petition Under Review (UR)	Tracked
White-winged Crossbill	Loxia leucoptera		Watched
Williamson's Sapsucker	Sphyrapicus thyroideus		Tracked
Yellow-billed Cuckoo	Coccyzus americanus		Tracked
Crustaceans			
Pocket Pouch Fairy Shrimp	Branchinecta lateralis		Tracked
Fish			
Colorado River Cutthroat Trout	Oncorhynchus clarkii pleuriticus	Not Warranted for Listing (NW)	Tracked
Greenback Cutthroat Trout	Oncorhynchus clarkii stomias	Listed Threatened (LT)	Tracked
Mountain Sucker	Catostomus platyrhynchus		Watched
Insects			
A Rita Dotted-Blue subspecies	Euphilotes rita coloradensis		Tracked
A Tiger Beetle	Cicindela limbata		Tracked
Hudsonian Emerald	Somatochlora hudsonica		Tracked
Monarch Butterfly	Danaus plexippus plexippus	Petition Under Review (UR)	Tracked
Tawny Crescent	Phyciodes batesii		Tracked
Mammals			
Bighorn Sheep	Ovis canadensis		Watched
Black-footed Ferret	Mustela nigripes	Listed Endangered (LE), and Endangered - Nonessential Experimental Population (LEXN)	Tracked
Canada Lynx	Lynx canadensis	Listed Threatened (LT)	Tracked
Dwarf Shrew	Sorex nanus		Watched
Eastern Cottontail	Sylvilagus floridanus		Watched
Fisher	Pekania pennanti	Not Warranted for Listing (NW)	Tracked
Fringed Myotis	Myotis thysanodes		Tracked
Grizzly Bear	Ursus arctos arctos	Listed Threatened (LT)	Tracked
Hayden's Shrew	Sorex haydeni		Tracked
Hoary Bat	Lasiurus cinereus		Watched
Little Brown Myotis	Myotis lucifugus	Petition Under Review (UR)	Watched
Long-eared Myotis	Myotis evotis		Watched
Long-legged Myotis	Myotis volans		Watched
Medicine Bow Mountain Pika	Ochotona princeps princeps - Medicine Bow Mountains	Not Warranted for Listing (NW)	Watched
North American Wolverine	Gulo gulo luscus	Not Warranted for Listing (NW)	Tracked
Northern River Otter	Lontra canadensis		Tracked
Olive-backed Pocket Mouse	Perognathus fasciatus		Watched
Pacific Marten	Martes caurina		Watched
Pallid Bat	Antrozous pallidus		Tracked
Plains Bison	Bos bison bison	Not Warranted for Listing (NW)	Tracked
Pygmy Rabbit	Brachylagus idahoensis	Not Warranted for Listing (NW)	Tracked
Ringtail	Bassariscus astutus		Watched
Sierra Madre Pika	Ochotona princeps princeps - Sierra Madre	Not Warranted for Listing (NW)	Watched
Silver-haired Bat	Lasionycteris noctivagans		Watched
Southern Rocky Mountain Pygmy Shrew	Sorex hoyi montanus		Tracked
Southern Rocky Mountain Uinta Chipmunk	Tamias umbrinus montanus		Watched
Swift Fox	Vulpes velox	Not Warranted for Listing (NW)	Tracked
Thirteen-lined Ground Squirrel	Ictidomys tridecemlineatus		Tracked
Townsend's Big-eared Bat	Corynorhinus townsendii		Tracked
Western Small-footed Myotis	Myotis ciliolabrum		Watched
White-tailed Prairie Dog	Cynomys leucurus	Petition Under Review (UR)	Tracked
Wyoming Ground Squirrel	Urocitellus elegans		Watched
Wyoming Pocket Gopher	Thomomys clusius	Not Warranted for Listing (NW)	Tracked
Yuma Myotis	Myotis yumanensis		Tracked
Molluscs			
Creeping Ancylid	Ferrissia rivularis		Tracked
Dusky Fossaria	Fossaria dalli		Tracked
Golden Fossaria	Fossaria obrussa		Tracked

Pewter Physa	Physa acuta		Tracked
Tadpole Physa	Physa gyrina		Tracked
Reptiles			
Bullsnake	Pituophis catenifer sayi		Watched
Eastern Yellow-bellied Racer	Coluber constrictor flaviventris		Watched
Northern Many-lined Skink	Plestiodon multivirgatus multivirgatus		Tracked
Pale Milksnake	Lampropeltis triangulum multistriata		Watched
Plains Box Turtle	Terrapene ornata ornata		Tracked
Plains Gartersnake	Thamnophis radix		Watched
Plateau Fence Lizard	Sceloporus tristichus		Tracked
Smooth Greensnake	Opheodrys vernalis		Tracked

Wyoming Natural Diversity Database: Vegetative Species of Concern in the Upper North Platte Watershed			
Common Name	**Scientific Name**	**Listing Status**	**Tracked/Watched**
Fern and Fern Ally			
Blunt-leaf spike-moss	Selaginella mutica		Tracked
Lance-leaved moonwort	Botrychium lanceolatum var. lanceolatum		Tracked
Mingan Island moonwort	Botrychium minganense		Tracked
Oak fern	Gymnocarpium dryopteris		Tracked
Rocky Mountain polypody	Polypodium saximontanum		Tracked
Flowering Plants			
Alkali Wildrye	Elymus simplex var. simplex		Watched
Alpine kittentails	Besseya alpina		Tracked
Bigelow's groundsel	Ligularia bigelovii var. hallii		Tracked
Blowout penstemon	Penstemon haydenii	Listed Endangered (LE)	Tracked
Broadleaf arrowhead	Sagittaria latifolia		Tracked
Broad-leaved twayblade	Listera convallarioides		Tracked
Ciliolate-toothed monkey flower	Mimulus rubellus		Tracked
Clustered Lady's-slipper	Cypripedium fasciculatum		Watched
Colorado spiny aster	Machaeranthera coloradoensis		Tracked
Daggett rockcress	Boechera pendulina var. russeola		Watched
Devil's Gate twinpod	Physaria eburniflora		Watched
Dwarf bilberry	Vaccinium myrtillus var. oreophilum		Tracked
Eggleston's sedge	Carex egglestonii		Tracked
Emory's sedge	Carex emoryi		Tracked
Erect cryptantha	Cryptantha stricta		Watched
Flatleaf pondweed	Potamogeton robbinsii		Tracked
Gibbens' beardtongue	Penstemon gibbensii	Not Warranted for Listing (NW)	Tracked
Golden saxifrage	Saxifraga serpyllifolia var. chrysantha		Tracked
Hall's fescue	Festuca hallii		Tracked
Halls sedge	Carex parryana var. unica		Tracked
Hooker buckwheat	Eriogonum hookeri		Tracked
Large-flower triteleia	Triteleia grandiflora		Tracked
Little golden-aster	Heterotheca pumila		Tracked
Longleaf pondweed	Potamogeton nodosus		Tracked
Marsh felwort	Lomatogonium rotatum		Tracked
Mountain muhly	Muhlenbergia montana		Tracked
Narrowleaved bladderpod	Lesquerella parvula		Tracked
Nelson's sedge	Carex nelsonii		Tracked
Nevada needlegrass	Achnatherum nevadense		Tracked
North Park beardtongue	Penstemon cyathophorus		Tracked
Northern bentgrass	Agrostis mertensii		Tracked
Northern blackberry	Rubus acaulis		Tracked
Northern white rush	Juncus triglumis var. albescens		Tracked
Pale blue-eye-grass	Sisyrinchium pallidum		Watched
Park milkvetch	Astragalus leptaleus		Tracked
Persistent sepal yellowcress	Rorippa calycina		Watched
Pinnate fleabane	Erigeron pinnatisectus		Tracked
Pygmy goldenweed	Tonestus pygmaeus		Tracked
Rocky Mountain nailwort	Paronychia pulvinata		Tracked
Rocky Mountain phacelia	Phacelia denticulata		Tracked
Rocky Mountain snowlover	Chionophila jamesii		Tracked
Saffron groundsel	Packera crocata		Tracked
Slender-leaved lovage	Ligusticum tenuifolium		Tracked
Slender-leaved wild buckwheat	Eriogonum exilifolium		Tracked
Slender-trumpet ipomopsis	Ipomopsis aggregata var. tenuituba		Tracked
Small spikerush	Eleocharis parvula		Tracked
Streambank groundsel	Packera pseudaurea var. flavula		Tracked
Tall fleabane	Erigeron elatior		Tracked
Western goldenweed	Pyrrocoma crocea var. crocea		Tracked
Western phacelia	Phacelia incana		Tracked
Western sedge	Carex occidentalis		Tracked
Western trillium	Trillium ovatum ssp. ovatum		Tracked
Wyoming locoweed	Oxytropis nana		Watched

APPENDIX 3E

UPPER NORTH PLATTE RIVER WATERSHED: USACE WETLAND TYPES

In the paragraphs that follow, extracts from the USACE (http://el.erdc.usace.army.mil/wetlands/class.html) are presented which describe the nature and function of each.

> *<u>"Slope Wetlands</u>*
> *Slope wetlands are found in association with the discharge of groundwater to the land surface or sites with saturated overflow with no channel formation. They normally occur on sloping land ranging from slight to steep. The predominant source of water is groundwater or interflow discharging at the land surface. Precipitation is often a secondary contributing source of water. Hydrodynamics are dominated by downslope unidirectional water flow. Slope wetlands can occur in nearly flat landscapes if groundwater discharge is a dominant source to the wetland surface. Slope wetlands lose water primarily by saturated subsurface flows, and by evapotranspiration. Slope wetlands may develop channels, but the channels serve only to convey water away from the slope wetland. Slope wetlands are distinguished from depressional wetlands by the lack of a closed topographic depression and the predominance of the groundwater/interflow water source. Fens are a common example of slope wetlands.*
>
> *<u>Depressional Wetlands</u>*
> *Depression wetlands occur in topographic depressions (i.e., closed elevation contours) that allow the accumulation of surface water. Depression wetlands may have any combination of inlets and outlets or lack them completely. Potential water sources are precipitation, overland flow, streams, or groundwater/interflow from adjacent uplands. The predominant direction of flow is from the higher elevations toward the center of the depression. The predominant hydrodynamics are vertical fluctuations that range from diurnal to seasonal. Depression wetlands may lose water through evapotranspiration, intermittent or perennial outlets, or recharge to groundwater. Prairie potholes, playa lakes, vernal pools, and cypress domes are common examples of depression wetlands.*
>
> *<u>Riverine Wetlands</u>*
> *Riverine wetlands occur in floodplains and riparian corridors in association with stream channels. Dominant water sources are overbank flow from the channel or subsurface hydraulic connections between the stream channel and wetlands. Additional sources may be interflow, overland flow from adjacent uplands, tributary inflow, and precipitation. When overbank flow occurs, surface flows down the floodplain may dominate hydrodynamics. In headwaters, riverine wetlands often intergrade with slope wetlands, depressions, poorly drained flats, or uplands as the channel (bed) and bank disappear. Perennial flow is not required. Riverine wetlands lose surface water via the return of floodwater to the channel after flooding and through surface flow to the channel during rainfall events. They lose subsurface water by discharge to the channel, movement to deeper groundwater (for losing streams), and evaporation. Peat may accumulate in off-channel depressions (oxbows) that have become isolated from riverine processes and subjected to long periods of saturation from groundwater sources. Bottomland hardwoods on floodplains are an example of riverine wetlands."*

APPENDIX 3F

UPPER NORTH PLATTE RIVER WATERSHED: GEOLOGIC UNITS IN THE UPPER NORTH PLATTE WATERSHED

Table 1 - Geologic Units in the Upper North Platte Watershed

Symbol/Geologic Period	*Unit Description*
CENOZOIC GEOLOGIC UNITS	
Quaternary geologic units	
Qu	Undivided surficial deposits (Holocene-Pleistocene) – Mostly alluvium, colluvium, and glacial and landslide deposits.
Qa	Alluvium and colluvium (Holocene-Pleistocene) – Clay, silt, sand, and gravel in flood plains, fans, terraces, and slopes.
Qt	Gravel, pediment, and fan deposits (Holocene-Pleistocene) – Mostly locally derived clasts; locally includes some Tertiary gravels.
Qg	Glacial deposits (Holocene-Pleistocene) – Till and outwash of sand, gravel, and boulders.
Qls	Landslide deposits (Holocene-Pleistocene) – Local intermixed landslide and glacial deposits, talus, and rock-glacier deposits.
Qs	Dune sand and loess (Holocene-Pleistocene) – Active and dormant sand dunes.
QTc	Conglomerate (Pleistocene to Miocene) – Giant granite boulders in arkose matrix.
Upper Tertiary geologic units	
Tm	Miocene rocks (undivided) (Miocene) Miocene rocks – Central Wyoming – White soft tuffaceous sandstone; locally derived conglomerate in upper and lower parts of sequence; some lower conglomeratic sequences may be Oligocene; in Granite Mountains, K/Ar age of tuff in lower part of sandstone sequence ~17 Ma, fission-track age of lower conglomerate ~24 Ma. Miocene rocks – Saratoga Valley and west and southwest to Colorado – White massive soft tuffaceous sandstone and lesser white marl; lower part conglomeratic. Underlies North Park Formation in Saratoga Valley. To the west and southwest is referred to as Browns Park Formation. Miocene rocks – Rawlins Area – White massive soft tuffaceous sandstone.
Tmu	Upper Miocene rocks (undivided) (upper Miocene) upper Miocene rocks – Saratoga Valley, North Park Formation – White to greenish-gray tuffaceous sandstone, siltstone, and claystone; locally conglomeratic. upper Miocene rocks – Central Wyoming – Arkosic sandstone, conglomerate, and siltstone; some light-colored tuffaceous radioactive

claystone and white cherty limestone.

Tu Sandstone and Conglomerate (Post Eocene) – Gray, hard, course-grained sandstone and conglomerate.

Lower Tertiary geologic units

Tco Coalmont Formation (Eocene and Paleocene) – Tan to gray, arkosic, micaceous, soft sandstone, claystone, and locally derived conglomerate.

Tha Hanna Formation (Paleocene) – Brown and gray sandstone, shale, conglomerate, and coal; giant quartzite boulders near Medicine Bow Mountains.

TKf Ferris Formation (Paleocene and Upper Cretaceous) – Brown and gray sandstone and shale; sparse carbonaceous shale and coal beds; thin lenses of pebble conglomerate.

MESOZOIC GEOLOGIC UNITS

Upper Cretaceous geologic units

Kmb Medicine Bow Formation (Upper Cretaceous) – Brown and gray sandstone and shale; thin coal and carbonaceous shale beds.

Kfh Fox Hills Sandstone (Upper Cretaceous) – Light-colored sandstone and gray sandy shale containing marine fossils.

Kle Lewis Shale (Upper Cretaceous; ~68 Ma) – Gray marine shale containing abundant interbedded gray and brown lenticular concretion-rich sandstone beds.

Kmv Mesaverde Formation or Group (Upper Cretaceous) – Light-colored, massive to thinbedded sandstone, gray sandy shale, and coal beds.

Rawlins Uplift (South Wyoming) (Upper Cretaceous)

Almond Formation – White and brown, soft sandstone, gray sandy shale, coal and carbonaceous shale.

Pine Ridge Sandstone – Light gray sandstone and thin coal beds.

Allen Ridge Formation – Gray sandstone, shale, and thin coal beds.

Haystack Mountains Formation – Gray marine sandstone and shale.

Kcf Cody Shale and Frontier Formation (Upper Cretaceous)

Kc Cody Shale (Upper Cretaceous; 78-83 Ma) – Dull-gray shale, gray siltstone, and fine-grained gray sandstone.

Kf Frontier Formation (Upper Cretaceous) – Gray sandstone and sandy shale.

Kft Frontier Formation and Mowry and Thermopolis Shales (Upper Cretaceous)

Frontier Formation – Gray sandstone and sandy shale.

Mowry Shale (Upper Cretaceous) – Silvery-gray, hard, and siliceous shale containing abundant fish scales and bentonite beds.

Thermopolis Shale (Lower Cretaceous) – Black, soft, and fissile shale with Muddy Sandstone Member at top of unit.

Ks Steele Shale (Upper Cretaceous) – Gray, soft, marine shale containing numerous bentonite beds and thin lenticular sandstone.

Ksn Steele Shale and Niobrara Formation (Upper Cretaceous)

Steele Shale (Upper Cretaceous) – Gray, soft, marine shale containing numerous bentonite beds and thin lenticular sandstone.

Niobrara Formation (Upper Cretaceous) – Light-colored limestone and gray to yellow speckled limy shale.

Kn Niobrara Formation (Upper Cretaceous) – Light-colored limestone and gray to yellow speckled limy shale.

Lower Cretaceous geologic units

Kmt Mowry and Thermopolis Shales (Upper to Lower Cretaceous)

Mowry Shale (Upper Cretaceous) – Silvery-gray, hard, siliceous shale containing abundant fish scales and bentonite beds.

Thermopolis Shale (Lower Cretaceous) – Black soft fissile shale with Muddy Sandstone Member at top of unit.

Cretaceous and Jurassic geologic units

KJ Cloverly and Morrison Formations (Lower Cretaceous to Jurassic)

Cloverly Formation – Rusty-color sandstone at top, underlain by brightly variegated bentonitic claystone; chert-pebble conglomerate locally at base.

Morrison Formation – Dully variegated, siliceous claystone, nodular white limestone, and gray silty sandstone.

KJs Cloverly, Morrison, and Sundance Formations (Lower Cretaceous to Jurassic)

Cloverly Formation – Rusty-color sandstone at top, which overlies brightly variegated bentonitic claystone; chert-pebble conglomerate locally at the base.

Morrison Formation – Dully variegated, siliceous claystone, nodular white limestone, and gray silty sandstone.

Sundance Formation – Greenish-gray glauconitic sandstone and shale, underlain by red and gray non-glauconitic sandstone and shale.

Triassic geologic units

Ꞧc — Chugwater Group or Formation (Upper and Lower Triassic)

Chugwater Formation (Upper and Lower Triassic) – Red siltstone and shale.

Alcova Limestone Member in upper middle part in north Wyoming. Thin gypsum partings near base in north and northeastern Wyoming.

Chugwater Group or Formation (Upper and Lower Triassic) – Red shale and siltstone containing thin gypsum partings near base. Group includes Popo Agie Formation (red shale and red, yellow, and purple siltstone; lenses of lime-pellet conglomerate), Crow Mountain Sandstone (red and gray, thick bedded), Alcova Limestone, and Red Peak Formation (red siltstone and shale). Chugwater Formation includes as members all the units listed above.

MESOZOIC AND PALEOZOIC GEOLOGIC UNITS

MzPz — Mesozoic and Paleozoic rocks (Mesozoic to Paleozoic)

Mapped in small local areas of complex structure.

South flank of Ferris Mountains – Nugget Sandstone and Chugwater and Goose Egg Formations (Jurassic (?) through Permian)

Triassic and Permian geologic units

ꞦPcg — Chugwater and Goose Egg Formations (Upper Triassic-Permian)

Chugwater Formation (Upper and Lower Triassic) – Red siltstone and shale.

Alcova Limestone Member in upper middle part in north Wyoming. Thin gypsum partings near base in north and northeastern Wyoming.

Goose Egg Formation – Red sandstone and siltstone, white gypsum, halite, and purple to white dolomite and limestone.

ꞦPg — Goose Egg Formation (Lower Triassic-Permian) – Red sandstone and siltstone, white gypsum, halite, and purple to white dolomite and limestone.

PALEOZOIC GEOLOGIC UNITS

Pzr — Paleozoic Rocks (Permian-Cambrian) – east end of Granite Mountains consists of Madison Limestone and Cambrian rocks.

Permian and Pennsylvanian geologic units

PIPM — Casper Formation and Madison Limestone (lower Permian-Upper Mississippian)

Casper Formation – Gray, tan, and red thick-bedded sandstone underlain by interbedded sandstone and pink and gray limestone. May include some

Devonian (?) sandstone along east flank of Laramie Mountains.
Madison Limestone or Group – Group includes Mission Canyon Limestone (blue-gray, massive limestone and dolomite), underlain by Lodgepole Limestone (gray cherty limestone and dolomite).

Permian and Mississippian geologic units

PM Tensleep Sandstone and Amsden Formation (lower Permian to Upper Mississippian)

Tensleep Sandstone (Lower Permian to Upper Mississippian) – White to gray sandstone containing thin limestone and dolomite beds.

Amsden Formation (lower Permian to Middle Pennsylvanian) – Red and green shale and dolomite with a persistent red to brown sandstone at base.

Mississippian geologic units

Mm Madison Limestone or Group (Upper to Lower Mississippian) – Group includes Mission Canyon Limestone (blue-gray, massive limestone and dolomite), underlain by Lodgepole Limestone (gray, cherty limestone and dolomite).

Cambrian geologic units

Ꞓr Cambrian rocks (Middle to Upper Cambrian) – Hard, blue-gray and yellow mottled, dense limestone interbedded with soft, green micaceous shale; dull-red quartz-rich sandstone at base.

PRECAMBRIAN GEOLOGIC UNITS

pꞒr Precambrian rocks – Middle Proterozoic through middle Archean granitic, metasedimentary, metavolcanic, and mafic intrusive rocks.

APPENDIX 3G

UPPER NORTH PLATTE RIVER WATERSHED: HUC 12 BASIN HYDROLOGY

Peak Flow Characteristics

Published regression coefficients for pertinent study regions

Region 1 : Rocky Mountains Region

Recurrence Interval	A	B
1.5 yr	0.126	0.885
2 yr	0.313	0.866
2.33 yr	0.458	0.858
5 yr	1.89	0.829
10 yr	4.71	0.81
25 yr	12.1	0.79
50 yr	22.3	0.776
100 yr	38.6	0.764
200 yr	64.3	0.752
500 yr	120	0.738

Region 3 : Eastern Basins and Eastern Plains Region

Recurrence Interval	A	B
1.5 yr	1.12	0.401
2 yr	2.28	0.402
2.33 yr	3.1	0.403
5 yr	10.1	0.407
10 yr	21.9	0.41
25 yr	48.8	0.416
50 yr	80.9	0.423
100 yr	127	0.432
200 yr	193	0.441
500 yr	323	0.454

Region 6 : High Desert Region

Recurrence Interval	A	B
1.5 yr	12.7	0.626
2 yr	22.2	0.608
2.33 yr	28.1	0.6
5 yr	66.4	0.567
10 yr	116	0.544
25 yr	204	0.52
50 yr	290	0.504
100 yr	394	0.489
200 yr	519	0.476
500 yr	719	0.459

Region 1

Peak flows in cfs for various return periods

HUC12 Basin Name	A (mi2)	1.5 yr	2 yr	2.33 yr	5 yr	10 yr	25 yr	50 yr	100 yr	200 yr	500 yr
38 - Upper Sage Creek-North Platte River	63.96	5.00	11.47	16.23	59.37	136.72	323.20	561.97	925.38	1466.47	2582.03
43 - South Fork Lake Creek	43.58	3.56	8.23	11.68	43.20	100.20	238.70	417.27	690.29	1098.96	1945.37
44 - Pass Creek-Little Pass Creek	44.61	3.63	8.39	11.91	44.04	102.10	243.12	424.86	702.64	1118.32	1978.99
45 - Pass Creek-Lee Creek	51.29	4.11	9.47	13.43	49.44	114.33	271.48	473.49	781.76	1242.16	2193.86
46 - North Draw	52.23	4.18	9.62	13.64	50.19	116.03	275.40	480.21	792.67	1259.22	2223.42
48 - Lower Jack Creek	38.21	3.17	7.34	10.43	38.73	90.06	215.11	376.73	624.21	995.34	1765.19
49 - Little Jack Creek	55.89	4.43	10.20	14.46	53.09	122.56	290.52	506.10	834.74	1324.98	2337.31
50 - Upper Jack Creek	45.22	3.68	8.49	12.05	44.53	103.23	245.73	429.34	709.94	1129.75	1998.85
51 - Upper Spring Creek-North Platte River	41.38	3.40	7.86	11.17	41.38	96.07	229.09	400.77	663.41	1056.83	1872.15
52 - Lower Spring Creek	36.61	3.05	7.07	10.06	37.38	87.00	207.97	364.44	604.16	963.86	1710.38
53 - South Spring Creek	58.67	4.63	10.64	15.07	55.27	127.48	301.88	525.53	866.28	1374.24	2422.56
54 - North Platte River-Elk Hollow Creek	58.26	4.60	10.58	14.98	54.95	126.76	300.23	522.70	861.69	1367.07	2410.15
55 - Brush Creek	39.65	3.27	7.58	10.77	39.94	92.82	221.53	387.77	642.21	1023.57	1814.32
56 - North Brush Creek	42.12	3.45	7.99	11.34	42.00	97.47	232.36	406.39	672.56	1071.17	1897.08
57 - South Brush Creek	24.12	2.11	4.93	7.03	26.45	62.05	149.58	263.65	439.26	704.30	1257.12
58 - French Creek-North Platte River	62.33	4.88	11.21	15.87	58.11	133.88	316.65	550.77	907.24	1438.16	2533.10
59 - North Platte River-North Cottonwood Creek	68.21	5.29	12.12	17.15	62.62	144.03	340.04	590.71	971.96	1539.10	2707.46
60 - Encampment River-West Cottonwood Creek	58.18	4.59	10.56	14.96	54.89	126.62	299.90	522.13	860.77	1365.63	2407.67
61 - Calf Creek	65.79	5.12	11.75	16.63	60.77	139.87	330.46	574.37	945.48	1497.82	2636.19
62 - North Fork Encampment River	31.84	2.69	6.27	8.92	33.30	77.71	186.29	327.08	543.13	867.94	1543.18
63 - Miner Creek	18.98	1.70	4.00	5.72	21.69	51.11	123.79	218.93	365.80	588.21	1053.43
64 - Encampment River- Billie Creek	51.32	4.11	9.48	13.44	49.47	114.39	271.61	473.71	782.12	1242.72	2194.81
65 - Hog Park Creek	19.49	1.75	4.10	5.85	22.17	52.21	126.39	223.45	373.23	599.96	1074.08
66 - Encampment River-West Fork	0.96	0.12	0.30	0.44	1.83	4.56	11.74	21.64	37.47	62.45	116.62
67 - East Fork Encampment River	20.05	1.79	4.20	6.00	22.69	53.41	129.24	228.39	381.36	612.82	1096.67
68 - Beaver Creek-North Platte River	69.79	5.40	12.37	17.49	63.82	146.72	346.24	601.29	989.10	1565.81	2753.58
69 - North Fork Big Creek	31.71	2.69	6.25	8.89	33.19	77.45	185.69	326.05	541.44	865.28	1538.54
70 - Bear Creek-Big Creek	20.44	1.82	4.27	6.10	23.06	54.27	131.25	231.88	387.10	621.90	1112.61

71 - Big Creek-North Platte River	30.62	2.60	6.06	8.63	32.24	75.29	180.62	317.31	527.16	842.81	1499.33
72 - South Fork Big Creek	5.65	0.58	1.40	2.02	7.94	19.14	47.49	85.43	144.83	236.30	430.44
73 - Spring Creek-Big Creek	31.69	2.68	6.24	8.88	33.17	77.40	185.56	325.84	541.09	864.74	1537.60
74 - North Platte River-Cottonwood Creek	38.39	3.18	7.37	10.47	38.89	90.42	215.94	378.16	626.54	998.99	1771.54
75 - South Mullen Creek	26.57	2.30	5.36	7.64	28.66	67.11	161.45	284.20	472.95	757.44	1350.14
76 - Upper Douglas Creek	38.95	3.22	7.46	10.60	39.35	91.48	218.41	382.40	633.45	1009.84	1790.42
77 - Lower Douglas Creek	33.49	2.82	6.55	9.32	34.72	80.95	193.85	340.13	564.45	901.46	1601.65
78 - North Platte River-Sixmile Creek	39.19	3.24	7.50	10.66	39.55	91.93	219.47	384.22	636.43	1014.51	1798.55
79 - Middle Douglas Creek	40.11	3.31	7.66	10.88	40.33	93.69	223.56	391.26	647.90	1032.51	1829.86
80 - Pelton Creek	36.57	3.05	7.07	10.05	37.35	86.93	207.80	364.16	603.69	963.12	1709.09
81 - Camp Creek	0.14	0.02	0.06	0.09	0.37	0.97	2.58	4.89	8.67	14.78	28.34

Region 3

HUC12 Basin Name	A (mi2)	Q 1.5	Q 2	Q 2.33	Q 5	Q 10	Q 25	Q 50	Q 100	Q 200	Q 500
17 - North Platte River-Lost Springs Draw	73.46	6.27	12.83	17.51	58.05	127.50	291.54	498.07	812.71	1283.76	2271.90
20 - Cedar Ridge	16.42	3.44	7.02	9.58	31.55	68.98	156.32	264.26	425.43	663.02	1150.72
21 - Taylor Draw	37.83	4.81	9.82	13.40	44.31	97.13	221.20	376.14	610.11	957.98	1680.80
22 - Lower Saint Mary's Creek	36.45	4.74	9.68	13.20	43.65	95.66	217.82	370.30	600.43	942.48	1652.80
23 - Middle Saint Mary's Creek	47.65	5.27	10.78	14.71	48.68	106.77	243.51	414.75	674.13	1060.72	1866.65
24 - Upper Saint Mary's Creek	61.30	5.83	11.93	16.28	53.93	118.39	270.40	461.36	751.60	1185.29	2092.70
25 - Pass Creek-Rattlesnake Creek	59.14	5.75	11.76	16.05	53.15	116.66	266.40	454.42	740.05	1166.71	2058.94
26 - Pass Creek-Stage Station Springs	54.34	5.56	11.36	15.51	51.35	112.68	257.17	438.43	713.46	1123.93	1981.26
27 - North Platte River-Coal Mine Draw	53.63	5.53	11.30	15.43	51.07	112.07	255.77	435.99	709.41	1117.41	1969.43
28 - Iron Springs Draw	29.45	4.35	8.88	12.12	40.02	87.66	199.34	338.37	547.61	857.93	1500.36
29 - Hugus Draw	55.22	5.59	11.44	15.61	51.68	113.42	258.90	441.42	718.43	1131.92	1995.76
34 - Upper Little Sage Creek	48.03	5.29	10.81	14.76	48.83	107.11	244.29	416.11	676.39	1064.36	1873.23
35 - Lower Little Sage Creek	26.40	4.16	8.50	11.60	38.28	83.82	190.47	323.08	522.35	817.54	1427.69
36 - Miller Creek	44.65	5.14	10.50	14.33	47.40	103.96	236.99	403.46	655.40	1030.64	1812.18
37 - Rasmussen Creek	36.70	4.75	9.70	13.24	43.77	95.93	218.44	371.37	602.21	945.33	1657.94
39 - Lower Sage Creek-Upper North Platte River	31.37	4.46	9.11	12.43	41.06	89.95	204.63	347.52	562.73	882.11	1543.92
40 - North Platte River-First Cottonwood Draw	73.34	6.27	12.82	17.50	58.01	127.42	291.33	497.71	812.12	1282.80	2270.15
41 - Lake Creek-North Platte River	45.99	5.20	10.63	14.50	47.98	105.23	239.94	408.57	663.88	1044.26	1836.82
42 - Pass Creek-Hat Creek	59.64	5.77	11.80	16.10	53.33	117.06	267.33	456.05	742.76	1171.06	2066.84
47 - North Platte River- Saratoga Lake	45.05	5.16	10.54	14.38	47.57	104.34	237.87	404.99	657.93	1034.70	1819.53

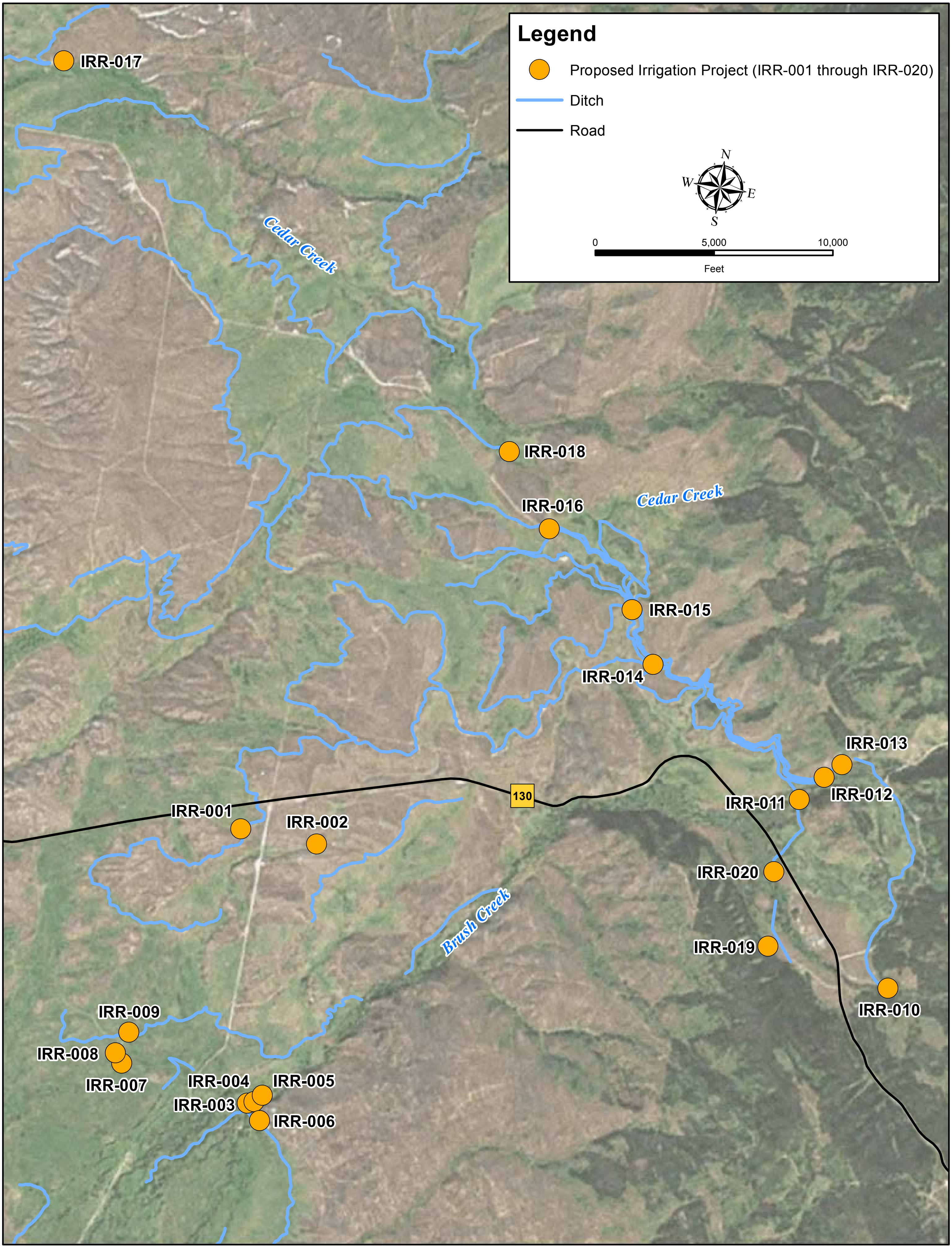
Region 6

HUC12 Basin Name	A (mi2)	Q 1.5	Q 2	Q 2.33	Q 5	Q 10	Q 25	Q 50	Q 100	Q 200	Q 500
1 - Pathfinder Reservoir-Pathfinder Dam	25.11	95.52	157.56	194.36	412.92	669.83	1090.29	1472.01	1905.51	2407.05	3156.82
2 - Pathfinder Reservoir-Sand Creek	45.21	138.04	225.29	276.61	576.37	922.40	1480.35	1979.93	2540.50	3184.72	4135.17
4 - Bear Creek-North Platte River-Pathfinder Reservoir	21.18	85.86	142.07	175.48	374.92	610.57	997.90	1350.96	1753.29	2219.66	2919.50
3 - Sand Creek-Buzzard Ranch	31.84	110.83	182.03	224.11	472.43	762.18	1233.56	1659.13	2140.10	2695.05	3520.29
5 - Deweese Creek	18.39	78.59	130.37	161.22	346.05	565.39	927.20	1258.08	1636.21	2075.25	2736.12
6 - North Platte River-Sunday Morning Creek	29.15	104.87	172.51	212.55	449.35	726.42	1178.18	1586.89	2049.64	2584.09	3380.43
7 - Garden Creek	32.32	111.88	183.72	226.16	476.51	768.50	1243.33	1671.86	2156.03	2714.58	3544.89
8 - North Platte River-Tincup Creek	28.37	103.11	169.71	209.14	442.55	715.87	1161.82	1565.52	2022.85	2551.22	3338.95
9 - Hurt Creek	45.27	138.15	225.47	276.82	576.78	923.04	1481.33	1981.19	2542.07	3186.64	4137.57

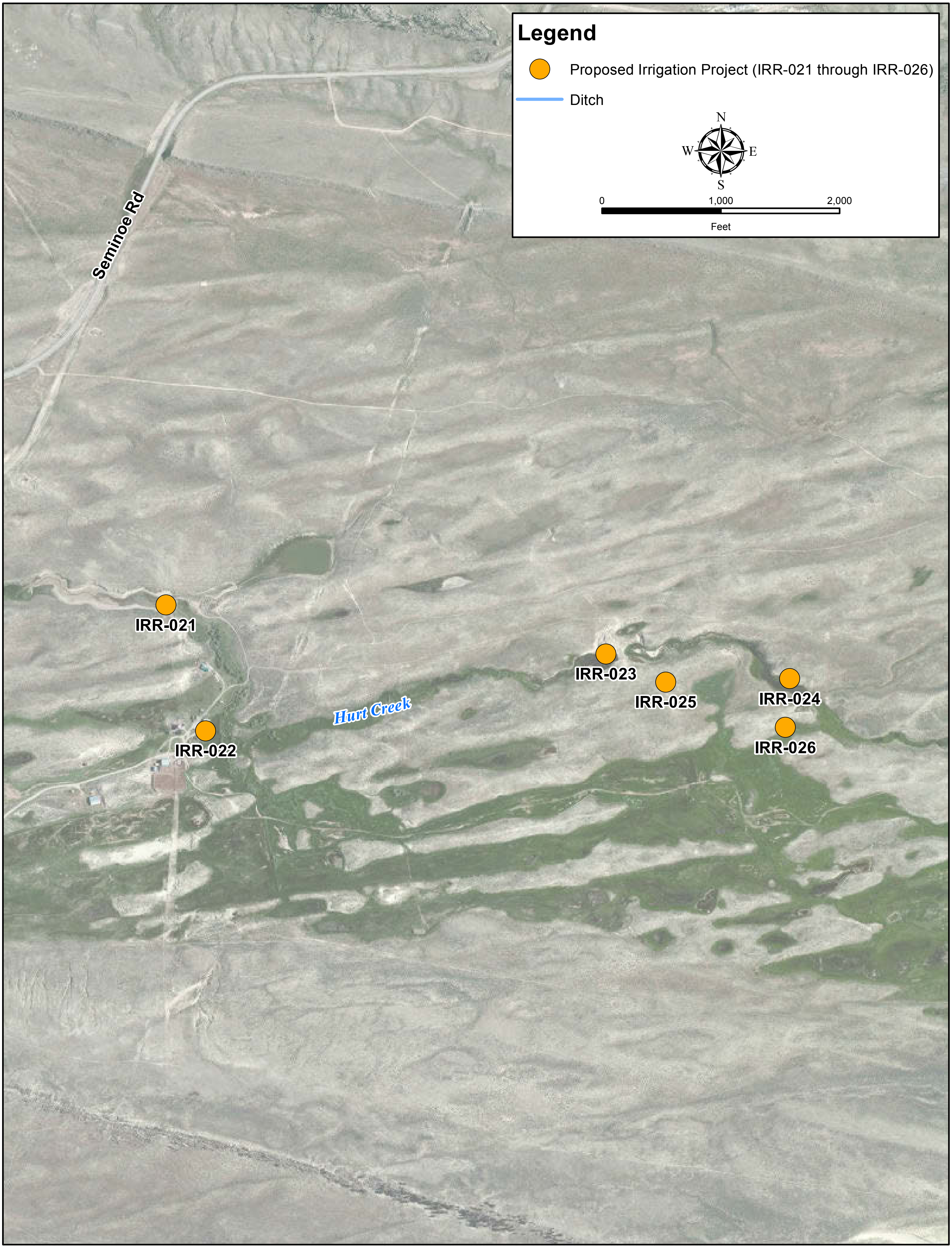
10 - Lower Seminoe Reservoir	15.17	69.68	115.99	143.65	310.32	509.25	838.99	1141.91	1489.41	1893.79	2505.05
11 - Tapers Ranch	10.14	54.14	90.77	112.79	246.90	408.95	680.31	931.92	1222.89	1563.08	2081.81
12 - O'Brien Creek	41.08	130.00	212.54	261.15	545.89	875.55	1408.40	1886.58	2424.20	3042.72	3957.23
13 - Stinkhole Draw	38.16	124.13	203.21	249.83	523.50	841.07	1355.33	1817.64	2338.21	2937.61	3825.33
14 - Middle Seminoe Reservoir	28.17	102.65	168.98	208.25	440.76	713.09	1157.50	1559.89	2015.79	2542.54	3328.00
16 - Dirtyman Draw	37.20	122.17	200.09	246.05	516.00	829.51	1337.52	1794.48	2309.30	2902.24	3780.91
15 - Upper Seminoe Reservoir	11.03	57.08	95.56	118.65	259.02	428.19	710.87	972.47	1274.49	1627.24	2164.16
18 - Ninemile Hill	26.78	99.46	163.86	202.03	428.31	693.76	1127.49	1520.67	1966.59	2482.13	3251.71
19 - Lower Sugar Creek	67.04	176.65	286.27	350.37	720.64	1142.88	1816.93	2414.82	3080.26	3841.63	4954.84
33 - Upper Sugar Creek	68.51	179.06	290.07	354.95	729.54	1156.43	1837.52	2441.34	3113.07	3881.46	5004.36
32 - Middle Sugar Creek	38.90	125.64	205.62	252.76	529.30	850.00	1369.08	1835.51	2360.51	2964.88	3859.57
30 - Grenville Dome	34.46	116.47	191.02	235.03	494.15	795.77	1285.47	1726.76	2224.70	2798.70	3650.75
31 - 101800021304	17.25	75.52	125.42	155.18	333.79	546.16	897.02	1218.38	1586.09	2013.35	2657.38

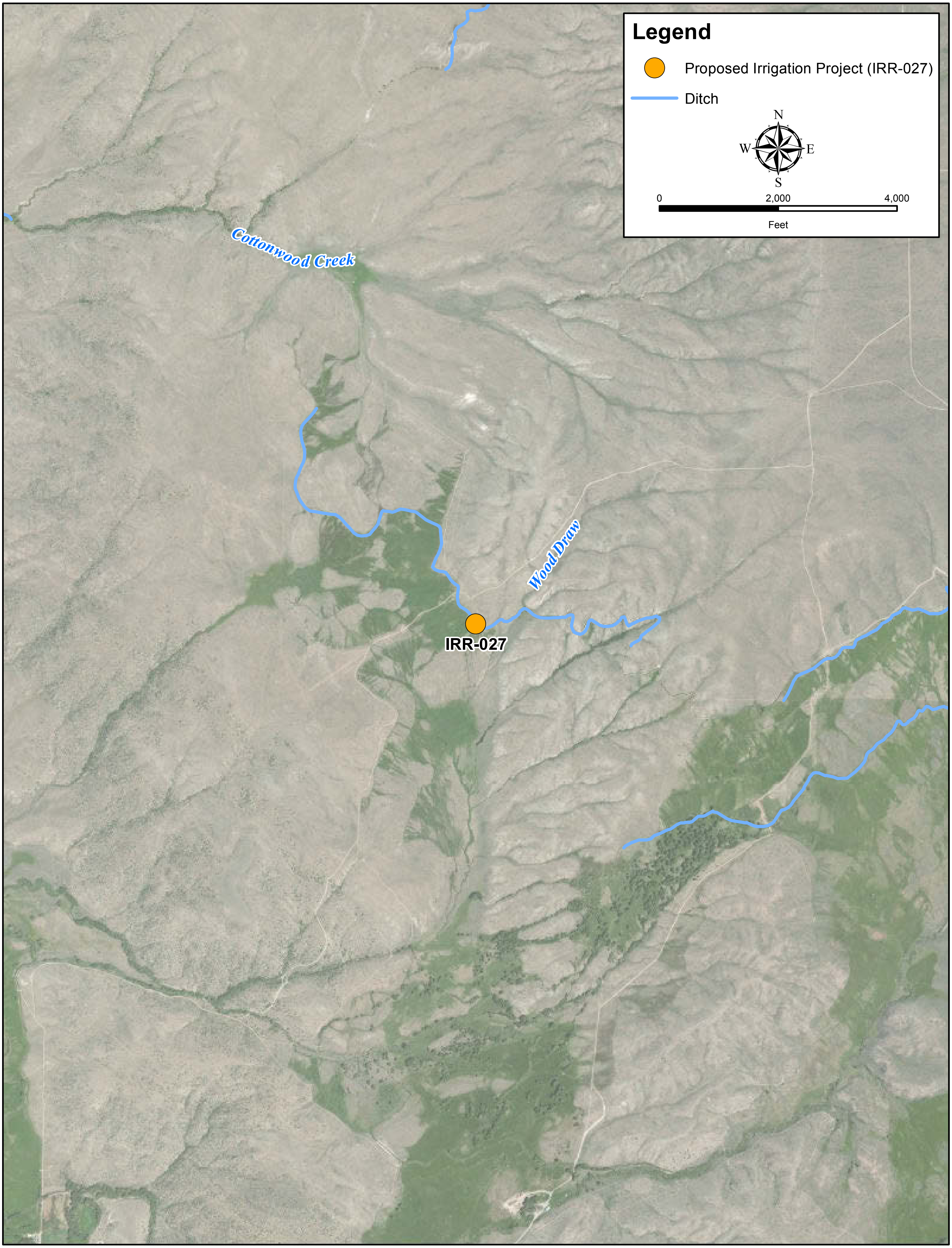
APPENDIX 4A

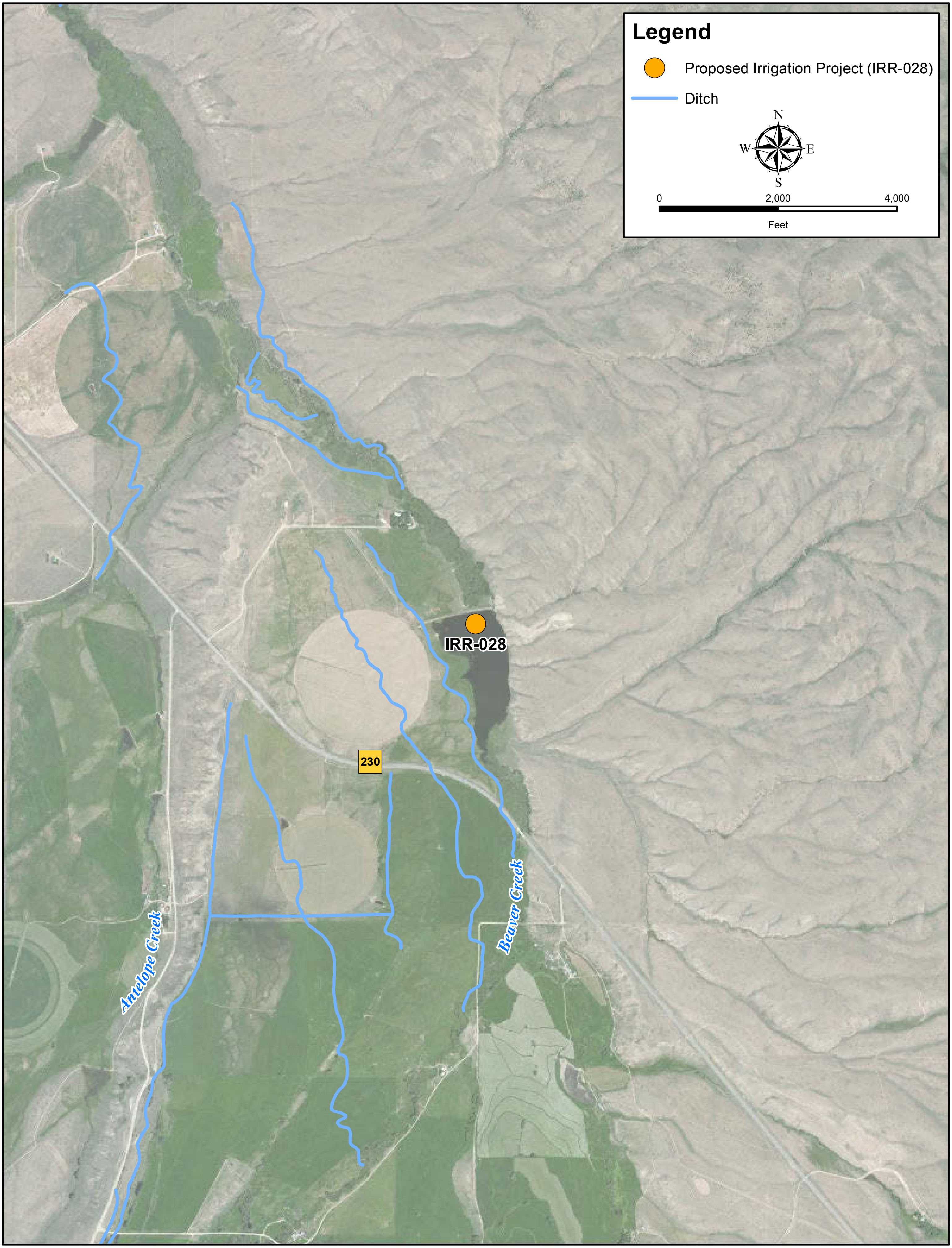
IRRIGATION COMPONENT LOCATION OVERVIEWS



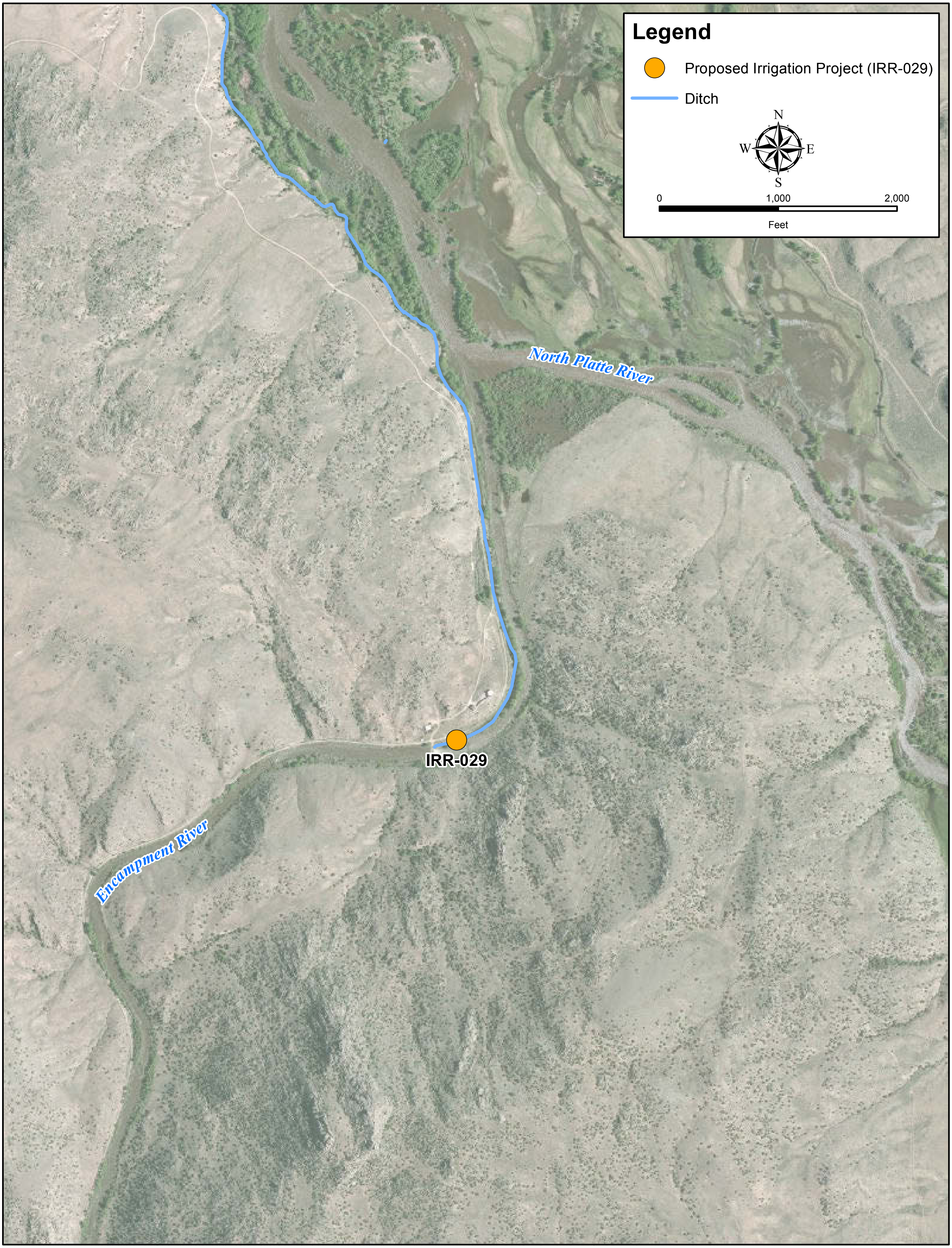
Legend
Proposed Irrigation Project (IRR-001 through IRR-020)
Ditch
Road
N
W
E
S
0
5,000
10,000
Feet
Cedar Creek
Cedar Creek
Brush Creek
130
IRR-001
IRR-002
IRR-003
IRR-004
IRR-005
IRR-006
IRR-007
IRR-008
IRR-009
IRR-010
IRR-011
IRR-012
IRR-013
IRR-014
IRR-015
IRR-016
IRR-017
IRR-018
IRR-019
IRR-020

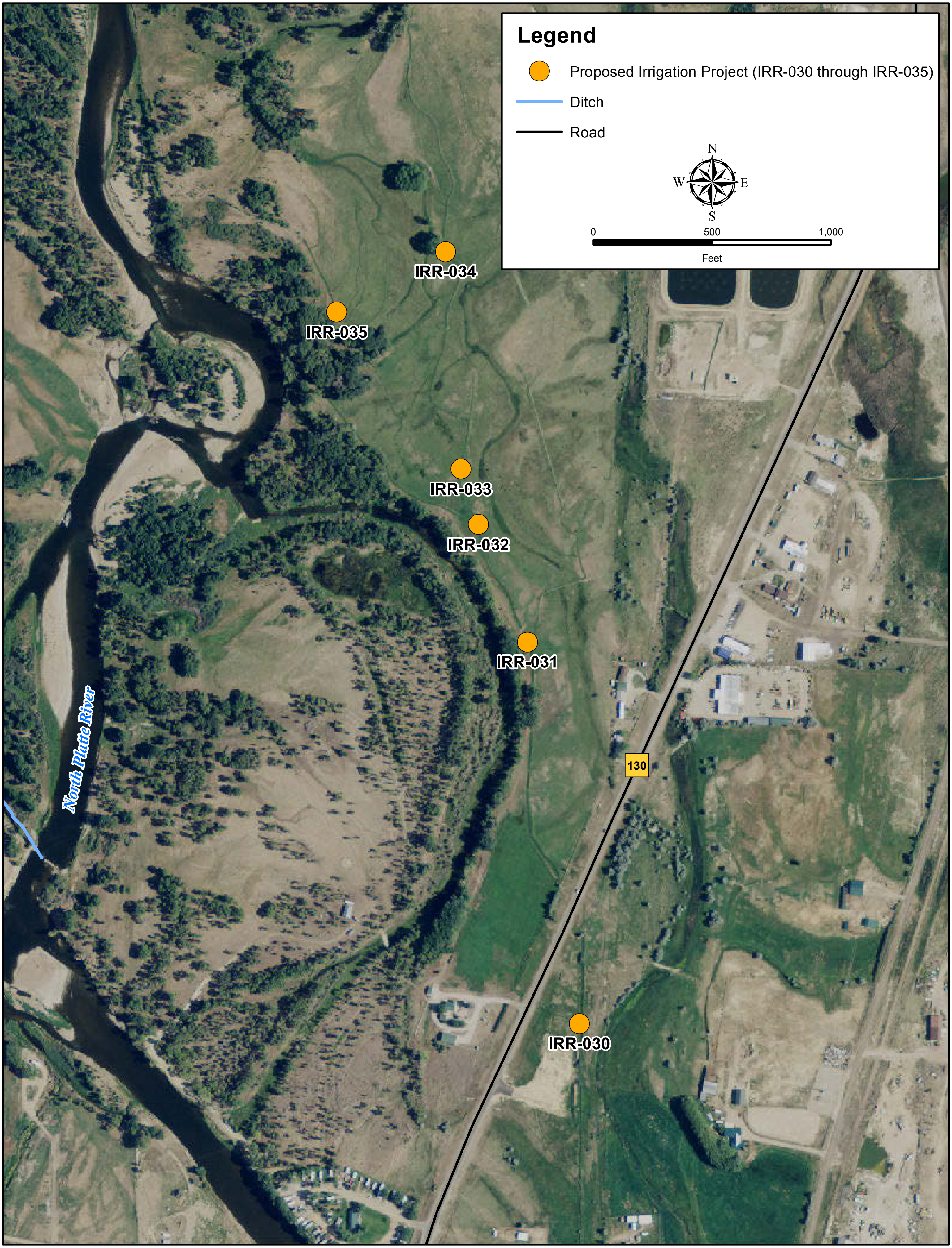

Legend
Proposed Irrigation Project (IRR-021 through IRR-026)
Ditch
N
S
E
W
0
1,000
2,000
Feet
Seminoe Rd
Hurt Creek
IRR-021
IRR-022
IRR-023
IRR-024
IRR-025
IRR-026


Legend
Proposed Irrigation Project (IRR-027)
Ditch
N
W
E
S
0
2,000
4,000
Feet
Cottonwood Creek
Wood Draw
IRR-027

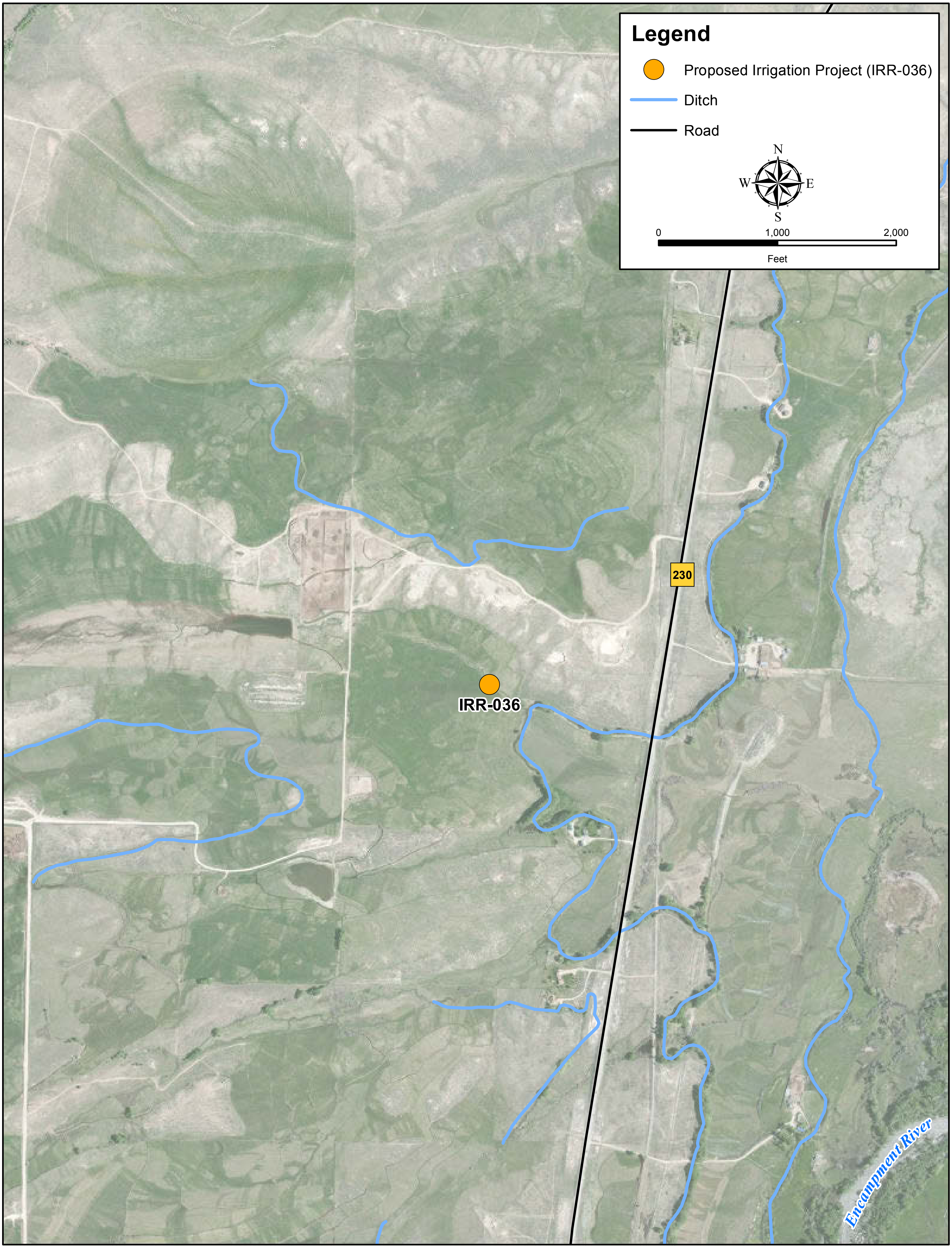


Legend
Proposed Irrigation Project (IRR-028)
Ditch
N
W
E
S
0
2,000
4,000
Feet
IRR-028
230
Antelope Creek
Beaver Creek

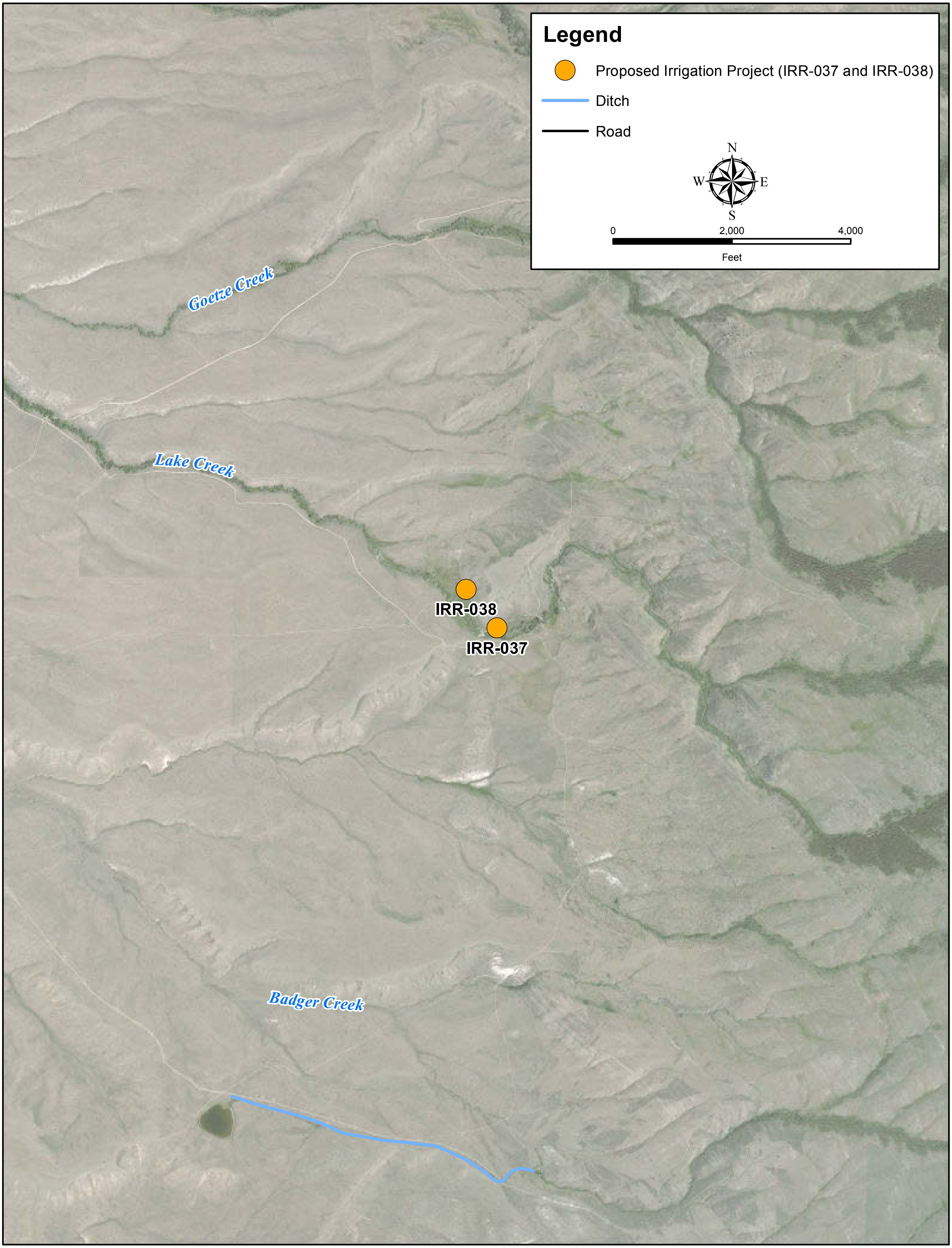

Legend
Proposed Irrigation Project (IRR-029)
Ditch
N
W
E
S
0
1,000
2,000
Feet
North Platte River
Encampment River
IRR-029

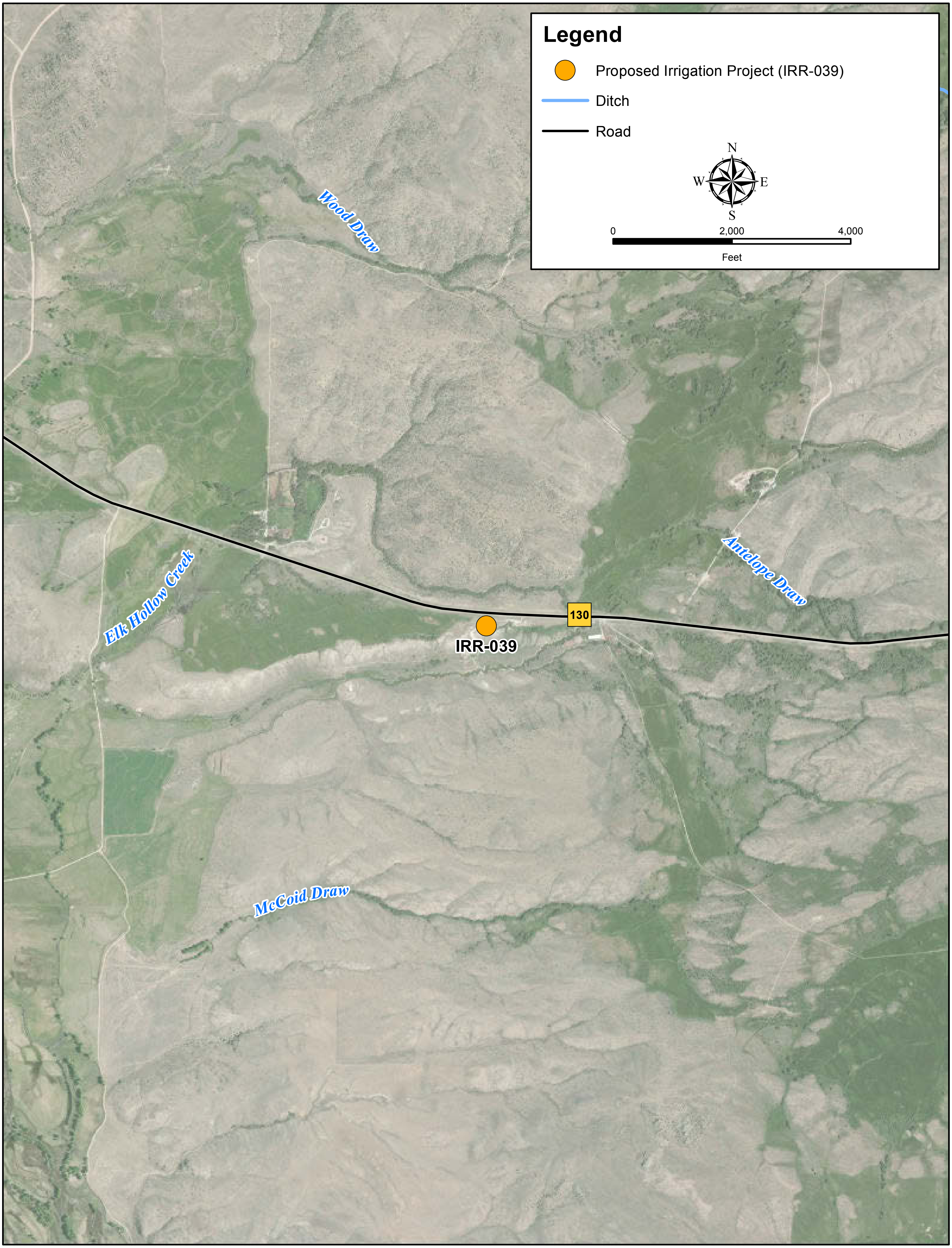


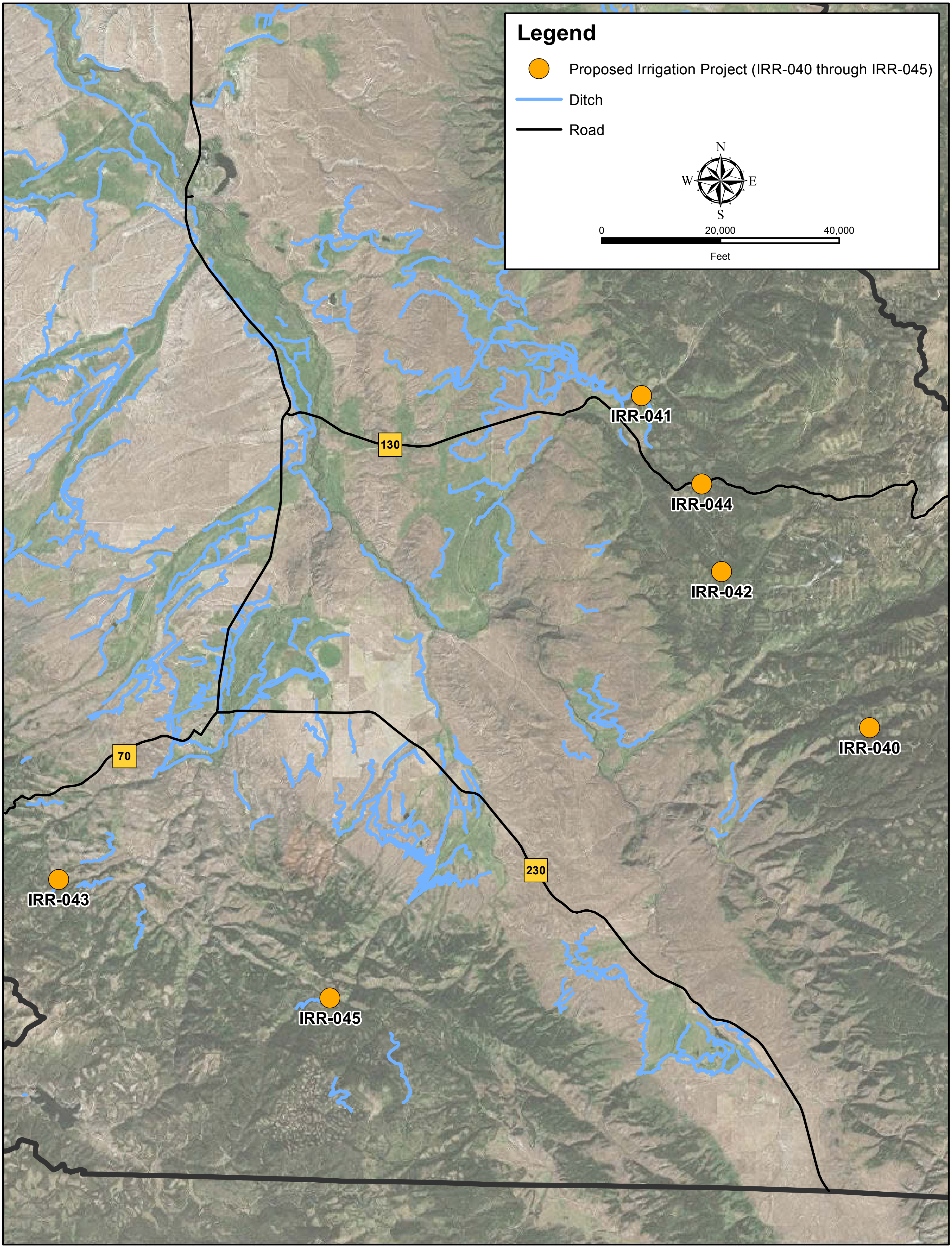
Legend
Proposed Irrigation Project (IRR-030 through IRR-035)
Ditch
Road
N
E
S
W
0
500
1,000
Feet
IRR-034
IRR-035
IRR-033
IRR-032
IRR-031
IRR-030
North Platte River
130

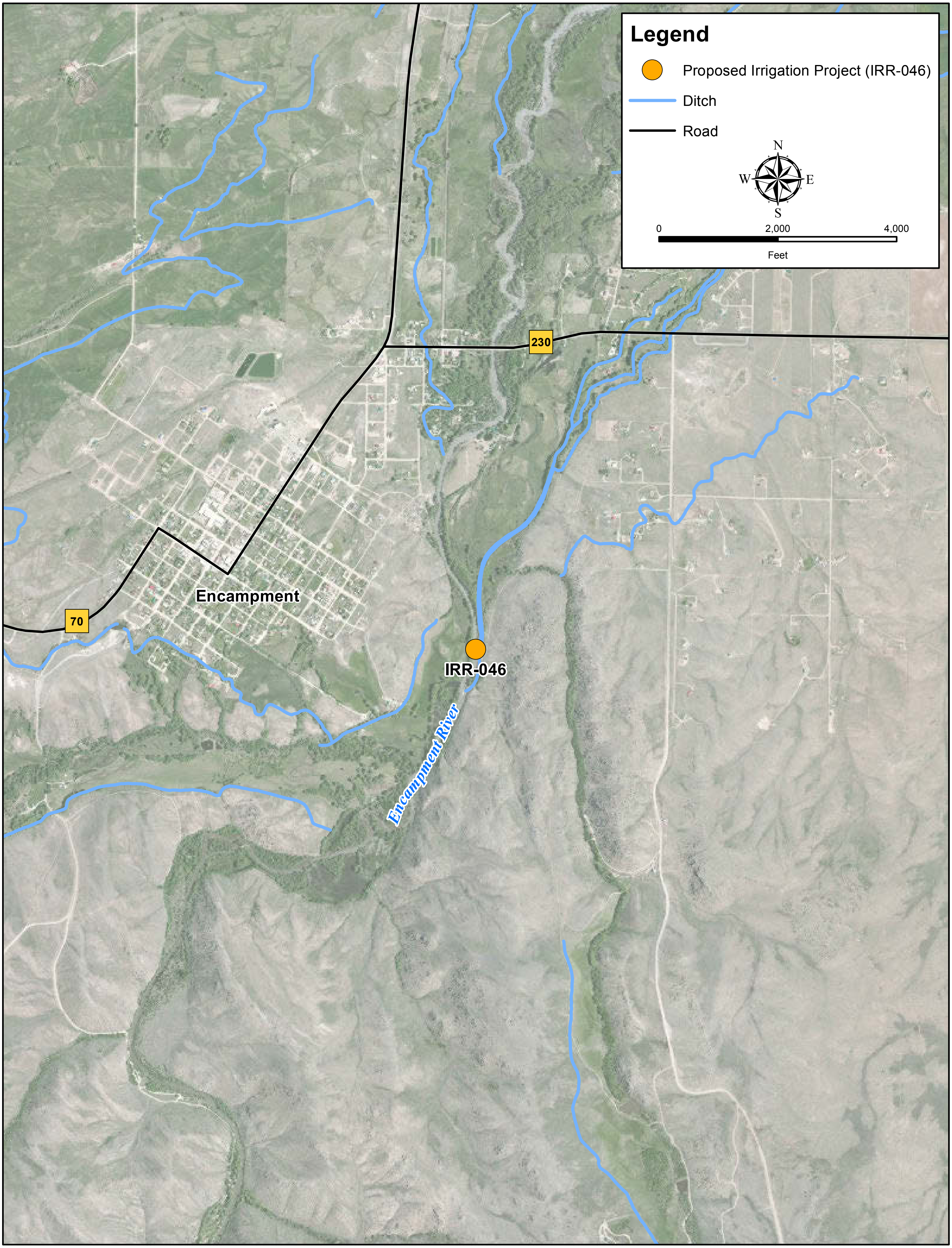


Legend
Proposed Irrigation Project (IRR-036)
Ditch
Road
N
W
E
S
0
1,000
2,000
Feet
230
IRR-036
Encampment River


Legend
Proposed Irrigation Project (IRR-037 and IRR-038)
Ditch
Road
N
W
E
S
0
2,000
4,000
Feet
Goetze Creek
Lake Creek
IRR-038
IRR-037
Badger Creek


Legend
Proposed Irrigation Project (IRR-039)
Ditch
Road
N
W
E
S
0
2,000
4,000
Feet
Wood Draw
Elk Hollow Creek
Antelope Draw
130
IRR-039
McCoid Draw


Legend
Proposed Irrigation Project (IRR-040 through IRR-045)
Ditch
Road
N
W
E
S
0
20,000
40,000
Feet
IRR-041
130
IRR-044
IRR-042
IRR-040
70
IRR-043
230
IRR-045



Legend
Proposed Irrigation Project (IRR-046)
Ditch
Road
N
W
E
S
0
2,000
4,000
Feet
230
70
Encampment
IRR-046
Encampment River

APPENDIX 4B

RESERVOIR PERMITTING CONSIDERATIONS

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MEMO

SUBJECT: Upper North Platte Municipal Reservoirs

DATE: October 7, 2015

There are two documents that control the construction of municipal reservoirs in the North Platte basin. The first is the Modified North Platte Decree (MNPD). The MNPD requires the reporting of a reservoir filings for municipal and industrial for reservoirs with a capacity of greater than 20 acre-feet in the North Platte basin.

The second is the Platte River Recovery and Implementation Program (PRRIP). The PRRIP is for the recovery of the endangered species on the Platte River in central Nebraska. The PRRIP established a depletion standard for the state of Wyoming, and Wyoming's Depletions Plan requires that an application for any filing will be reviewed for depletive effects and may potentially require the offset of depletions from the proposed project.

There are two paths that may be followed. In the first path, an application for a municipal reservoir in the upper North Platte can be filed. The applicant must then begin to address the depletions caused by their proposed project. The major user of water in the North Platte River in Wyoming is agriculture (approximately 94% of Wyoming's allocation is used by agriculture). To offset depletions would most likely require the project proponent to have to purchase irrigated lands and transfer the consumptive use to cover the depletions.

The project proponents would also have to deal with Section 404 of the Clean Water Act. This would be the requirement to offset any impacted wetlands.

To offset depletions and impacted wetlands would take years of planning and would be very expensive.

In the second path, for both the MNPD and PRRIP, the state of Wyoming included the modification of Pathfinder Reservoir to recover the approximately 54,000 acre-feet lost to sediment. The 54,000 acre-feet was split into two accounts. 34,000 acre-feet was put into an environmental account for the benefit of the endangered species in central Nebraska. The remaining 20,000 acre-feet is for future municipal water use for the municipalities in the North Platte drainage. This account has a firm yield of 9,600 acre-feet on an annual basis.

Municipalities below Pathfinder can access this water by contracting with the Wyoming Water Development Commission (WWDC) for release of the water from the reservoir. The municipalities would stand the conveyance losses to get the water to their point of diversion.

Those municipalities above Pathfinder would contract with WWDC to purchase some of the water from the municipal account. They would then have to submit an exchange petition to the State Engineer's Office which would allow them to divert direct flow water out of priority and then make the river whole again with the release of the stored water from Pathfinder Reservoir. The municipality would stand the conveyance losses to implement the exchange.

As a side note: Pathfinder Modification is set up as an emergency source for municipalities, and is not generally viewed as a long-term solution to municipal needs. This may force municipalities to seek their own reservoirs under the first path listed above.

Irrigation depletions are handled differently. There are reporting requirements for irrigation reservoir in certain parts of the North Platte drainage. There are acreage caps both above and below Pathfinder Reservoir. Along with the acreage cap there are also consumptive use caps. The irrigated acres are mapped on an annual basis and the consumptive use is calculated based on the weather and types of crops grown.

If additional water is applied to the lands through a supplemental (another source) supply source or from storage then the consumptive use of the crops for those lands increases which is applied towards the consumptive use cap.

Also, if additional lands are irrigated then these apply toward both the acreage cap as well as the consumptive use cap.

ANDERSON CONSULTING ENGINEERS, INC.

Civil • Water Resources • Environmental