South Platte River Watershed Study

Final Report
June 2018

South Platte River Watershed
Level I Study

Submitted to the

Wyoming Water Development Commission

Laramie County Conservation District

and

Laramie Rivers Conservation District

Prepared by:

Dahlgren Consulting, Inc., Cheyenne, Wyoming

WWC Engineering, Laramie, Wyoming
(https://www.wwcengineering.com)

Ayres Associates, Cheyenne, Wyoming
(https://www.ayresassociates.com)

InfoMaption, Inc., Ft. Collins, Colorado
(http://www.infomaption.com)

Neirbo Hydrogeology, Ft. Collins, Colorado
(http://www.neirbo.com)

McGrane Water Engineering, LLC, Lyons, Colorado
(https://mcgranewater.com)

Ecosystem Management, Inc., Albuquerque, NM
(http://www.emi-nm.com)

Final Report June 2018

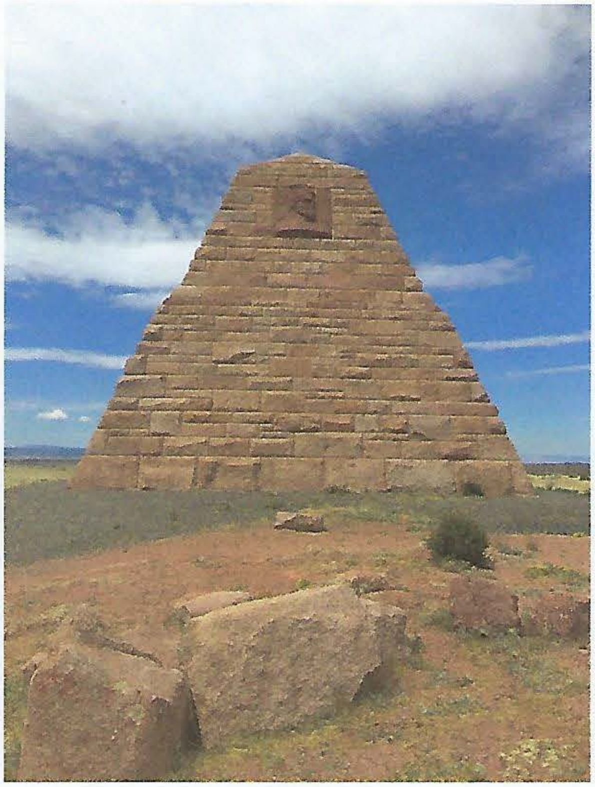
WWDC Contract No. D5SL0296616

Acknowledgements:

The Dahlgren Consulting project team would like to express our appreciation and thanks to the following people for their help and support during this project:

> Jodie Pavlica, PE, Wyoming Water Development Commission Project Manager and Kevin Boyce, PG, WWDC interim Project Manager; Jim Cochran, Jeff Geyer, and Rex Lockman with the Laramie County Conservation District; Tony Hoch and Martin Curry with the Laramie Rivers Conservation District; and Jim Pike, with the NRCS office in Cheyenne.

In additional, Dahlgren Consulting, Inc. would like to thank our sub-consultants for their dedication and efforts during this project.



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I hereby certify that this report was prepared by me and/or under my direct supervision and that I am a duly licensed Professional Engineer and Professional Geologist in the State of Wyoming.

Russell Dahlgren	Russell Dahlgren
PE No. 5718	PG No. 3292
June 21, 2018	June 21, 2018

South Plate River Watershed Study

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Chapter 1 – Introduction

1.1 Introduction

In 2015 the Laramie County Conservation District (LCCD) requested that the Wyoming Water Development Commission (WWDC) conduct the South Platte River Watershed, Level I Study. In 2016 the WWDC approved funding for the watershed study and following the selection process, contracted with Dahlgren Consulting, Inc. to provide technical and professional services for the South Platte River Watershed Study. Sub-consultants to the prime include WWC Engineering, Ayres Associates, InfoMaption, Nerbo Hydrology, McGrane Water Engineering, and Ecosystems Management. The project started in June 2016 with an initial introduction and scoping meeting. The final public meeting was held May 10, 2018.

A map of the South Platte River Watershed is shown on Figure 1.1. The watershed is located in southeast Wyoming within Laramie and Albany Counties and includes approximately 2035 square miles or 1,300,000 acres. The watershed is bounded on the north by the divide between the Horse Creek and Lodgepole drainages; the east and south by Nebraska and Colorado, respectively; and the west-southwest by the Dale Creek and Fish Creek drainages. The City of Cheyenne and the Towns and/or communities of Albin, Pine Bluffs, Carpenter, Burns, and Hillsdale lie within the watershed boundary.

Wyoming Water Development Commission Level I studies are preliminary analyses and comparison of development alternatives. Typical Level I studies include master plans, watershed improvement studies, and other water planning studies. More specifically, watershed studies are described as follows:

> *Watershed studies provide a detailed evaluation of an individual watershed. The studies may identify water development and system rehabilitation projects as well as address erosion control, flood control or other non-water development related environmental issues. Watershed improvement studies are an integral part of the Small Water Project Program, which has its own specific criteria. The studies may identify projects that may be eligible for the New Development, Rehabilitation, or Dam and Reservoir Programs.*

This Level I study of the South Platte River Watershed provides important information that the Laramie County Conservation District, the Laramie Rivers Conservation District, the local landowners, other citizens, and the WWDC can use in developing water resources and implementing conservation practices that address water and land resource concerns within the Watershed. The intent of this report, accompanied by the study's digital library and Geographic Information System (GIS) geodatabase, is to provide the results of the South Platte River Watershed Study.

North Crow Wetlands along North Crow Creek

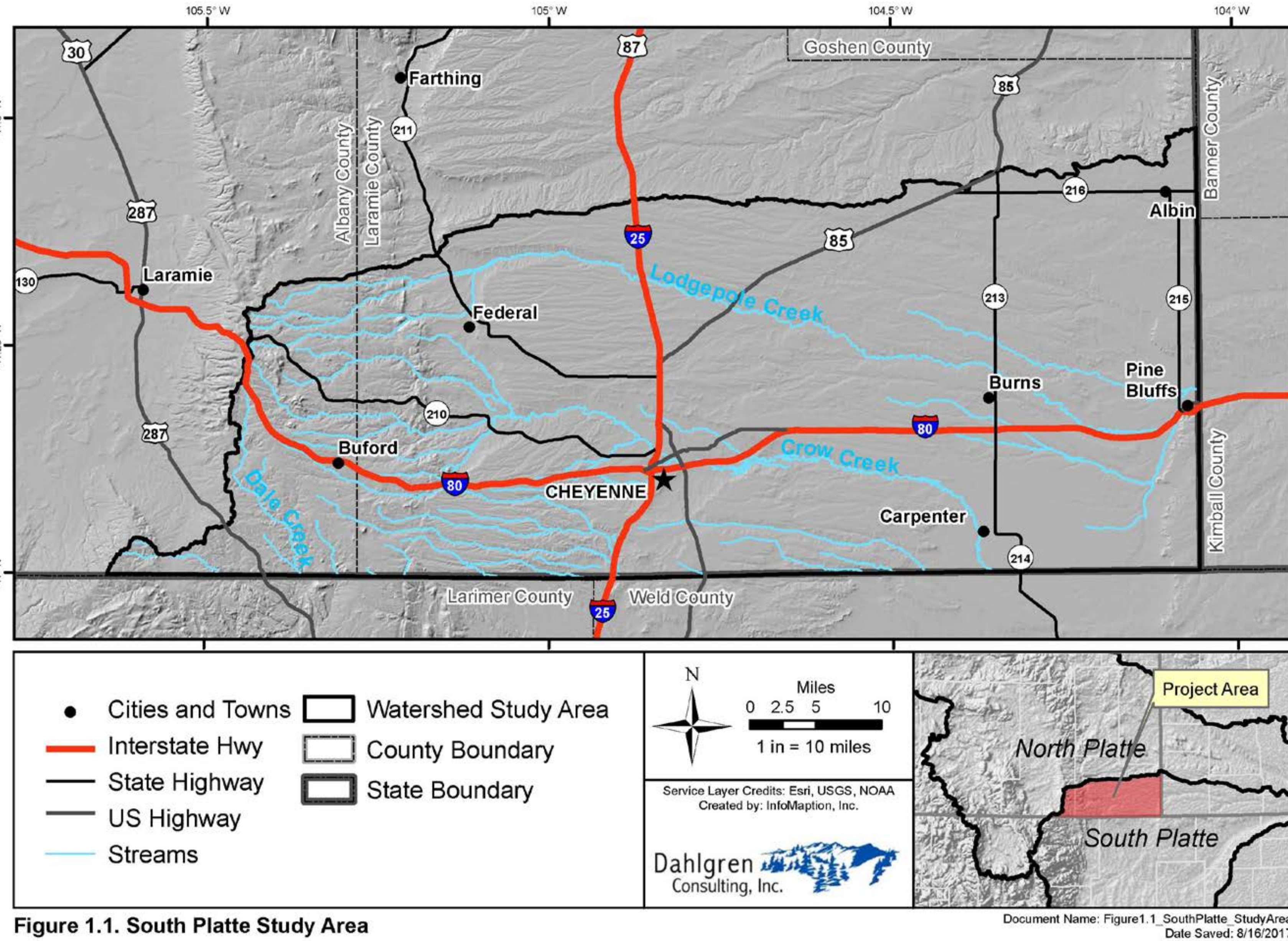


Figure 1.1. South Platte Study Area

As outlined in the Scope of Work for this project, the South Platte River Watershed Study (SPRWS), the following has been inventoried and summarized:

- Land ownership, land use, and cultural resources;
- Land cover and vegetation, including wetlands;
- Geology and groundwater resources;
- Climate;
- Surface water hydrology, including data concerning stream gages, and flood events;
- Surface water resources;
- Water use, including irrigation use and crops grown, municipal water use, industrial water use, and other uses;
- Trans-basin diversions and contributions to stream flow provided by the City of Cheyenne wastewater treatment plants;
- The estimated water supply, including both surface water and groundwater, is compared to the amount of water used in key areas in the watershed;
- Water quality issues, both surface water and groundwater quality; and
- Wildlife resources.

During the inventory and characterization effort of this study, special emphasis was devoted to:

- The analyses and evaluation of surface water hydrology and water supply in the Crow Creek and Lodgepole Creek sub-basins;
- Evaluation of the amount of irrigated land within the watershed and determining the source of supply for the irrigated land; and
- Review the existing estimates of the water budget for the watershed to provide updated estimates of the water budgets for the agricultural areas in eastern Laramie County.

The study has also developed a list of projects that can improve conditions in the watershed. The project team met with numerous landowners to discuss their project ideas. On site meetings with approximately 61 landowners were conducted during the watershed study, which resulted in a list of over 100 projects.

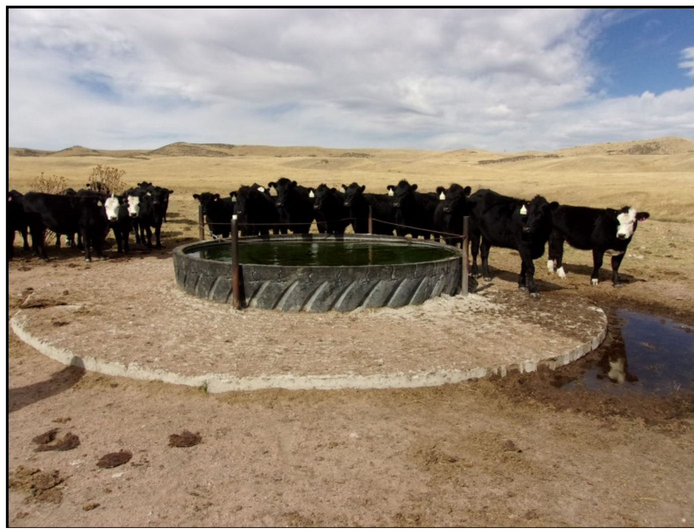
1.2 Small Water Projects Program

One of the most tangible benefits of a watershed study is that citizens working through their local Conservation Districts and other public entities, are eligible for project funding through the Wyoming Water Development Commission Small Water Project Program. The purpose of the WWDC Small Water Project Program (SWPP) is to participate with land management agencies and sponsoring entities by providing incentives and funding for improving watershed condition and function. Projects eligible for SWPP funding assistance include the construction or rehabilitation of small reservoirs, wells, solar platforms, pipelines and conveyance facilities, springs, wetland developments, environmental projects, irrigation works, windmills, rural community fire suppression systems, and recreational projects.

Significant changes to the Small Water Project Program were adopted by the Water Development Commission since this study was undertaken. The first change is that prior to the October 2017 changes, completion of a watershed study was a requirement before a conservation district or other local government entity was eligible for Small Water Project funding. However after these changes, a watershed study is not required to obtain funding for a small water project provided that there are demonstrated public benefit(s). Watershed studies may be used to identify public benefits at the project sponsors discretion.

The second major change is that there is no longer a maximum total project cost or “cap” for a Small Water Project. Prior to the 2018 Legislative Session, the maximum cost for a Small Water Project was $135,000. The WWDC will still provide a grant of up to 50% of the cost of a project; however, the maximum grant for any one project is still $35,000. Other funding sources can be used to pay for the balance of the project costs.

Small Water Projects can provide direct benefits to the Watershed for a relatively small investment from the State of Wyoming. The projects should improve watershed condition and function and provide benefit for wildlife, livestock, environment and recreational purposes. 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.



Stock Tank Located within the study area

The projects that were developed during the South Platte River Watershed Study are discussed in Chapter 5 of this report. These projects and other ideas presented in this report will help guide the Conservation Districts and landowners as they pursue opportunities to improve conditions within the Watershed.

1.3 Description of the Study Area

Figure 1.2 shows the major streams within the South Platte River Watershed. The SPRWS includes Lodgepole Creek, Crow Creek, and Lone Tree Creek and their tributaries. These streams originate in the Laramie Range and flow generally east and south into Colorado and Nebraska. On the west side of the Watershed Dale Creek flows generally south into Colorado, where it joins the Cache La Poudre River. Other smaller creeks, such as Boxelder Creek, Sand Creek and Fish Creek also flow south into Colorado and are tributaries of the Cache La Poudre River.

The headwater areas for Crow Creek and Lodgepole Creek, the two streams with the largest drainage areas within the SPRWS, lie within the Sherman Mountains in the Laramie Range. The elevations of the headwaters of these streams are slightly above 9000’. The length of Crow Creek is approximately 66 miles in Wyoming. Crow Creek flows into Colorado south of Carpenter at an elevation of approximately 5340’. Lodgepole Creek is approximately 84 miles long. It flows into Nebraska near Pine Bluffs at an elevation of approximately 4950’. The

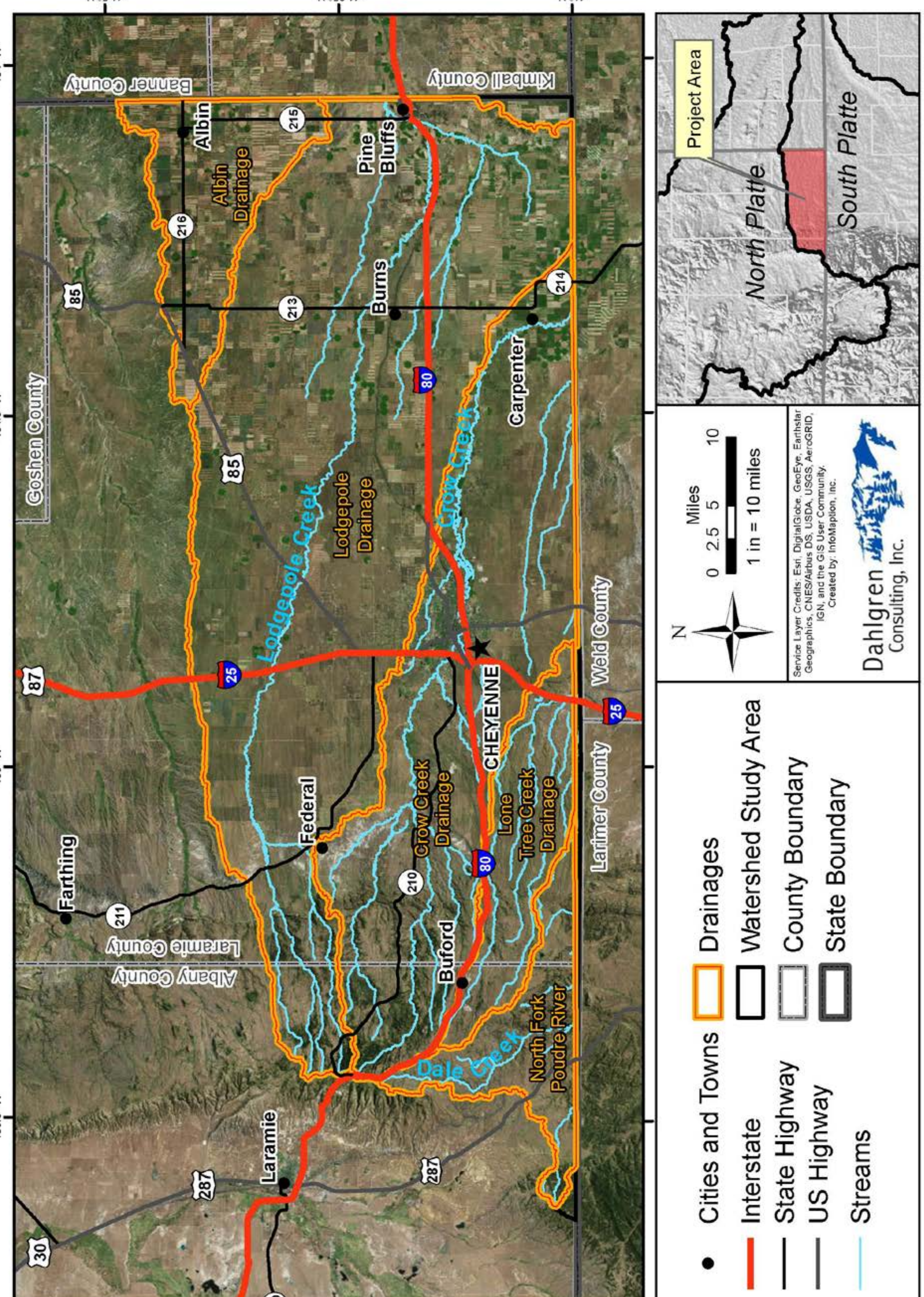


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Figure 1.2 Drainage Basins

headwaters of Dale Creek also are within the Laramie Range at an elevation of approximately 8500' and the creek is approximately 19 miles long. Dale Creek flows into Colorado northeast of Virginia Dale, Colorado at an elevation of approximately 7100'.

The South Platte Watershed is not noted for its large surface water flows. Historical, Crow Creek was perennial from the Laramie Mountains to near Arcola, which is approximately 18 miles east of Cheyenne (Section 8, T13N, R63W). Other streams that drain east from the Laramie Mountains are generally intermittent, alternately gaining water and losing water to groundwater, along their course. Dale Creek is perennial.

The SPRWS is unique among watersheds in Wyoming since it depends so heavily on groundwater as the water source.

Parts of the SPRWS lie within the Southern Rocky Mountains, Great Plains and Laramie Basin physiographic regions of the United States. The Laramie Range which extends along the western part of the watershed is part of the Southern Rocky Mountains. The Colorado Front Range divides near Cameron Pass into the Laramie Range and Medicine Bow Range. The Laramie Basin lies between the mountain ranges. The Laramie River, which flows north, is the principal stream through the Laramie Basin. However, the southern part of the basin is drained by Fish Creek and Dale Creek, which are part of the South Platte River Watershed. There are very subtle drainage divide between Willow Creek, which is a tributary to the Laramie River and Fish Creek which is part of the South Platte Watershed. Likewise, there is a subtle drainage divide between Harney Creek and Dale Creek, which flow into the Laramie River and South Platte, respectively.

South of Crow Creek, a remnant feature of tertiary sediments lap onto the Laramie Range and form the "gangplank". This feature allowed a relatively easy path to cross the mountains. The Union Pacific railroad, US Highway 30, the first transcontinental paved highway and I-80 generally follow the gangplank. The Great Plains are located east of the Laramie Mountains. The plains are an eastward sloping surface dissected by streams.

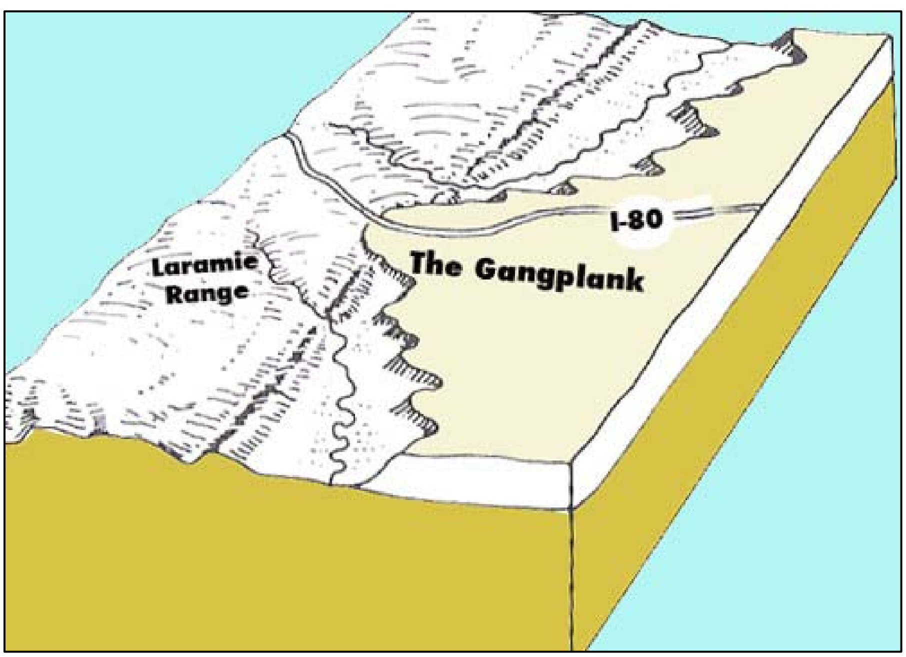

Figure 1.3: Map of the Gangplank

Casper Formation Outcrop Near the I-80 Summit

The founding of Cheyenne and history of the area is tied to the geography and water resources of the area. Cheyenne is located near the intersection of a north-south travel route along the east front of the Rocky Mountains and the gangplank that provided an east-west route from the Great Plains over the mountains.

On a military expedition in 1865, U.S. Army Gen. Grenville Dodge discovered the gangplank and identified nearby Crow Creek was a good water source. It was decided to build the railroad along this route. The Union Pacific railroad reached Cheyenne in 1867 and pushed west over the Laramie Range along the gangplank. Fort D.A. Russell was established along the north bank of Crow Creek in 1867 and Cheyenne celebrated its 150th birthday in 2017. An Army post named Fort Sanders was established in 1866 approximately 3 miles south of the present location of the City of Laramie. The City was founded in 1868 when the railroad reached it.

1.4 Institutional Issues in the South Platte River Watershed

1.4.1 Platte River Recovery Implementation Program

The South Platte River Watershed is not part of the 2001 Modified North Platte Decree. However, the SPRWS is upstream of critical habitat for several endangered species, specifically the critical habitat areas located along the central Platte River in Nebraska. Requirements in the Endangered Species Act (ESA) mandating the preservation of critical habitat and water for endangered species, including Whooping Cranes, Piping Plover, and Least Terns has impacted water management and development in the Platte River Basin since the 1970s.

The states of Wyoming, Nebraska, and Colorado entered into a cooperative agreement in 1997 for the Platte River Recovery Implementation Program (referred to as the "Program or PRRIP") with the U.S. Department of Interior. The States became interested in the Program when it became apparent that the ESA provided the U.S. Fish and Wildlife Service (USFWS) the authority to require replacement of existing streamflow depletions in the critical habitat area in the central Platte River in Nebraska. Also, the USFWS could assess depletion fees to acquire land for habitat in the Central Platte River.

The Program provides an alternative to the more restrictive measures provided in the ESA for irrigation, municipal, industrial, and other water uses in place on or before July 1, 1997. Without the Program, it is likely that restrictions for new water projects and for existing water projects would be required by the ESA, particularly for projects that require Federal permits or other action. Federal actions could include new permits (including renewals), funding, contracts, and easements and would require water users to replace and mitigate existing and proposed new depletions of water until the endangered species have recovered.

The goal of the Program is to provide approximately 150,000 acre-feet of water and 10,000 acres of habitat in the central Platte River. In addition, the states agreed to curtail new depletions that would impact the Program's goals.

The Wyoming State Engineer's Office North Platte River Coordinator is responsible for determining the depletions that are covered by the Plan, identifying new depletions that require mitigation, and approving mitigation plans required for new depletions. The following pertains to the South Platte River Watershed:

Existing Water Related Activities Baseline

Under Wyoming's Depletion Plan, the existing water related activities baseline for water leaving the SPRWS in Wyoming for most of the water use categories is zero. For several years prior to July 1, 1997, water passed the state lines only during some spring runoffs or large rainfall events. The only water use category that could impact these events would be the construction or enlargement of reservoirs to store what little natural flow is passing the state lines. Therefore, the benchmark for the SPRWS will be the existing reservoir capacity as of July 1, 1997, as evidenced by water rights and field inspections.

New Water Development Activities

If new reservoirs were proposed, they would likely fall under the federal nexus and a consultation with the FWS would be required. In the unlikely event that a reservoir is proposed that falls outside the federal nexus, Wyoming will complete a state evaluation of the depletions, in the manner consistent with the Program. Mitigation likely would be required for new development.

1.4.2 Laramie County Control Area

On September 2, 1981, the Laramie County Control Area (LCCA) was created. The LCCA covers the eastern two-thirds of Laramie County. The LCCA encompassed the Pine Bluffs-

Carpenter groundwater critical areas which had been established previously. The LCCA was established due to declining groundwater levels and to mitigate future potential for conflicts between groundwater users in the LCCA.

A map of the LCCA is shown on Figure 1.3. The LCCA extends north into the Horse Creek drainage, which is not part of this Watershed Study. Not all of the Crow and Lodgepole Creek drainages and none of the Lone Tree Creek drainage are included within the Control Area.

On April 1, 2015, the Wyoming State Engineer issued an order that imposes additional regulations in the LCCA. A fact sheet and map that summarizes the April 2015 Order is included in Appendix A of this report. The entire order and accompanying information can be found on the Wyoming State Engineer's Office web site http://seo.wyo.gov/ground-water/state-engineer-s-orders.

In summary, all but stock and domestic wells in the Control Area will need to be metered and the amount of water pumped from the wells must be reported; all wells in the Control Area must be adjudicated; and there are restrictions and limits on new wells. Also, April 2015 Order categorizes the Control area into "drawdown, conservation, and un-affected areas" and the High Plains aquifer is to be treated differently from the "underlying units."

In November 2019, the State Engineer will review the effects of the first three years of operation under the Order. The Order remains effective until rescinded, superseded, or modified by another order of the State Engineer or replaced by an *appropriator agreement.*

This last phrase is important, and the italics added for this report. The appropriators within the Control Area have the opportunity to develop a management plan or plans for the Control Area that are different than the April 2015 Order imposed by the State Engineer. The following is a copy of Wyoming Statute 41-3-915 (c);

> *Appropriators of underground water from a control area may agree to any method or scheme of control of withdrawals, well spacing, apportionment, rotation or proration of the common supply of underground water. The state engineer shall encourage and promote such agreements and supply the parties with information and advice. When the state engineer, with the advice of the control area advisory board, shall find that any such agreement, executed in writing and filed in his office, is consistent with the intent, purposes and requirements of this act, and would not be detrimental to the public interest or to the rights of other persons not parties to the agreement, he shall approve the agreement, and thereafter such agreement shall control, until terminated as hereinafter provided, in lieu of any order issued pursuant to subsection (a) of this section.*

1.4.3 2017 Wyoming State Engineer Decisions Concerning Crow Creek

In May and again in July 2017, the Wyoming State Engineer rejected water right applications that proposed to divert surface water from Crow Creek (refer to the Burnett Livestock applications, TF NOS. 36 5/158 and 36 6/145 and the Emmanuel Farms applications, TF Nos. 36 3/188 and 36 4/188). The reasons given for the rejections of these applications were that there was no un-appropriated water in the source of supply and that the proposed applications would impair or conflict with existing water rights. In the past the Wyoming State Engineers Office had considered the surface water in Crow Creek and the groundwater in the High Plains aquifer in this area as two separate sources of water However in the 2017 decision, the Wyoming State Engineer determined that the "surface waters of Crow Creek, downstream of

Cheyenne, are so interconnected with the groundwater supply in the High Plains Aquifer system proximal to Crow Creek as to constitute in fact one source of supply.:

The ramifications of these decisions have not yet been fully determined. However, it sees clear that future diversions of water from Crow Creek in the area downstream of Cheyenne will be reviewed and considered with the idea that the surface water and groundwater are interconnected. And it will likely be more difficult to obtain permits for proposed future surface water diversions from Crow Creek.

1.4.4 City of Cheyenne – Board of Public Utilities Facilities and Water Rights

The City of Cheyenne – Board of Public Utilities (BOPU) is a key entity in the South Platte River Watershed. The BOPU has the senior surface water right for 12,481 cfs from Crow Creek; it owns three major reservoirs with total capacity of 13,750 acre-feet; the BOPU has the ability to bring water from the Platte Basin into the Watershed; the BOPU obtains groundwater from 5 well fields; the BOPU operates the Sherrard Water Treatment plant and the Crow Creek and Dry Creek Wastewater Treatment plants; and the BOPU operates the Round Top Raw water or irrigation water system. In addition, the BOPU has the ability to pump water back from the wastewater treatment plants and to re-use some of this water.

A summary of the BOPU facilities and water use is contained in Chapter 3 of this report. Clearly, the BOPU has the ability to impact the watershed in a profound manner through operation and use of their facilities and their water rights.

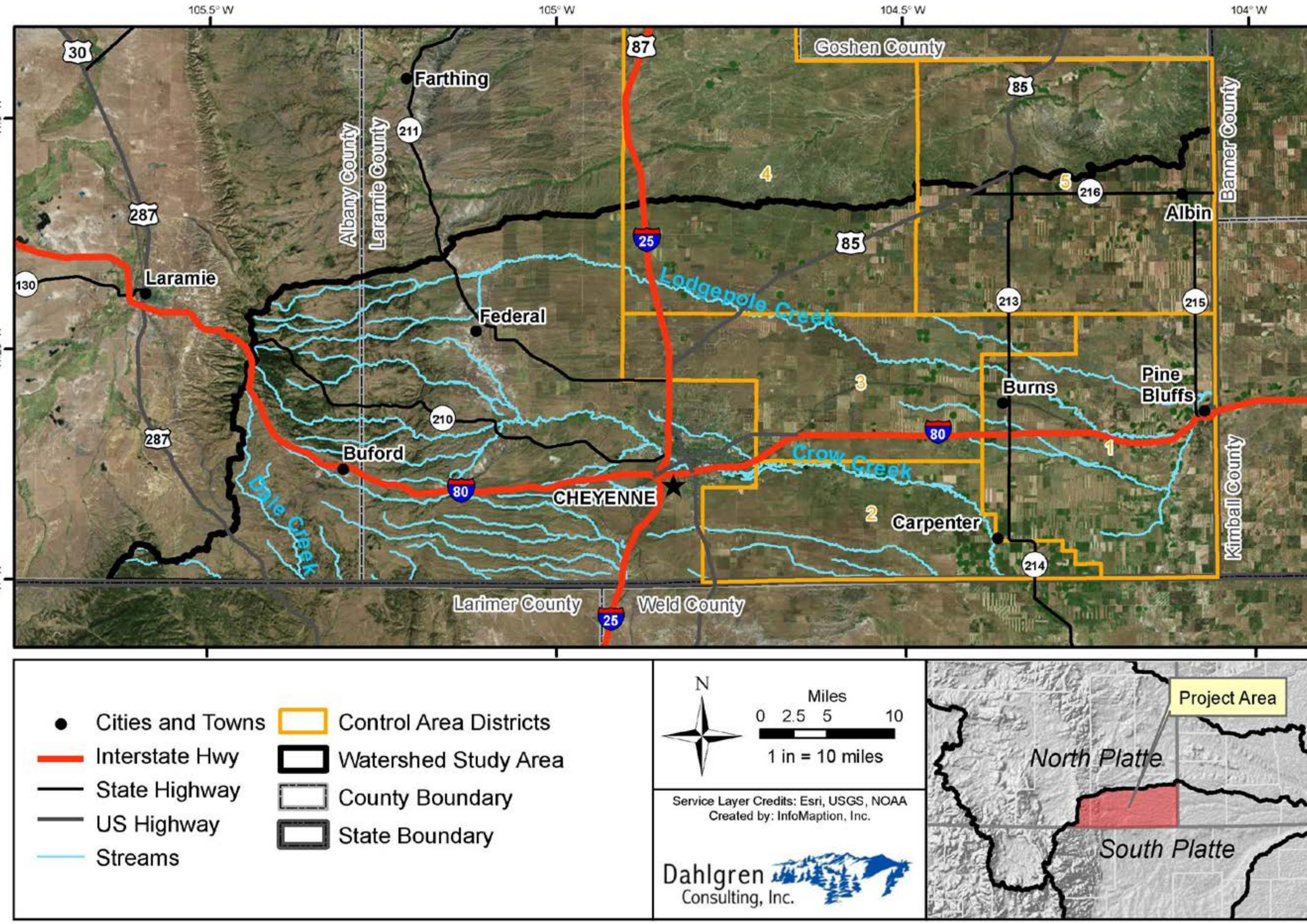

Figure 1.4: Laramie County Control Area in the SPRWS

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1.5 Key Issues in the South Platte River Watershed

The purpose of this Level I watershed study was twofold: a) to combine and collate as much of the available data and information into one report, and b) then to develop a comprehensive watershed management and rehabilitation plan that outlines potential water-development opportunities and other projects that could improve conditions within the Watershed.
To accomplish this effort, the following work was completed:

- Conduct public meetings, create a website, and other outreach efforts to inform residents and landowners of the watershed study;
- Solicit public participation in the watershed study;
- Evaluate the surface water resources;
- Inventory and describe water quality;
- Inventory existing major reservoirs and ditches;
- Evaluate and provide updated estimates of irrigated lands within the watershed and determine the source of the water for the irrigation, i.e. groundwater vs. surface water sources;
- Inventory other water uses within the watershed;
- Compare irrigation needs to the available water supply and prepare diagrams presenting this information;
- Review land use and vegetation;
- Review opportunities to improve water availability for livestock and wildlife;
- Prepare a watershed Management and Rehabilitation Plan that includes numerous small water projects;
- Prepare cost estimates for the various projects;
- Identify permits, easements, and clearances necessary for plan implementation.
- Identify potential sources of funding for the projects.

1.5 Report Organization

This organization of this report and the content of each chapter are presented below.

Chapter 1 – Report Introduction

Chapter 2 – Public Awareness Efforts and Project Meetings: documents the public meetings, open houses, website, and other public outreach efforts conducted during the project.

Chapter 3 – Inventory: provides an inventory and characterization of the study area and its resources.

Chapter 4 – Brule Formation: presents details of the geo-physical survey and investigations into the Brule Formation near Pine Bluffs, which was conducted using discretionary funds.

Chapter 5 – Project Inventory: describes the projects developed during this project. Cost estimates for most of the Small Water Projects developed during this study are included in the Appendix of this report.

Chapter 6 – Summary: summarizes numerous funding programs provided by various local, state and federal entities as well as private organizations. This information can be used to determine optimized funding strategies including partnering with multiple funding sources

Chapter 7 – Requirements: describes the permits, permitting process and agency contact information needed to construct the projects described in the Chapter 5.

Chapter 8 – Conclusions and Recommendations: Here we summarize the highlights of the Plan and make concise and feasible recommendations for further action on behalf of the WWDC and the LRCD.

Chapter 2 – Public Awareness Efforts & Project Meetings

2.1 Introduction

Shortly after the South Platte River Watershed Study got underway, Dahlgren Consulting's efforts to plan public meetings and encourage public involvement during the Study also began. These efforts included hosting Community Meetings, County Fair outreach, and traditional and social media efforts.

2.2 Public Awareness Efforts

Recognizing that public awareness and involvement were important to the success of the Study, Dahlgren Consulting's efforts to inform the public concerning the project focused on three venues:

- Direct mail campaigns,
- A public access website (https://www.SouthPlatteRiverWatershedStudy.org)
- And social media using Facebook as the primary social media platform (https://www.facebook.com/SouthPlatteRiverWatershedStudy/)

These media sites were established in August 2016 in preparation for the first of several Community Meetings discussed below. Also, the media sites were linked to the LCCD and WWDC sites in order to capitalize on their traffic and reach. The website also hosted a summary of the presentation for each Community Meeting.

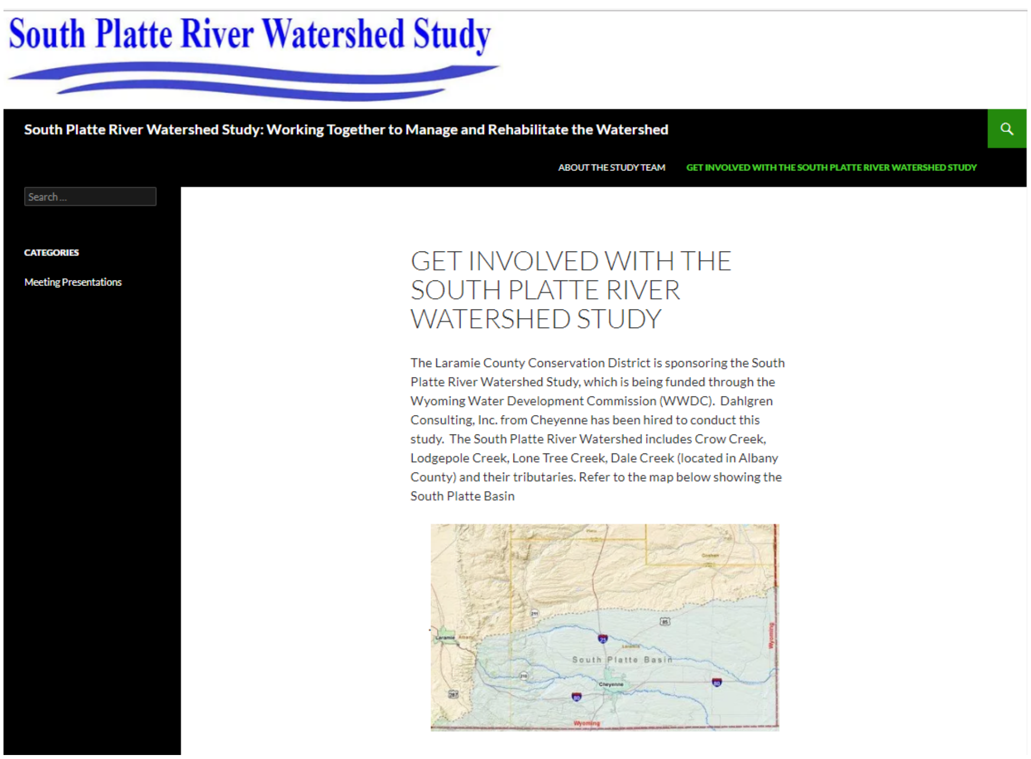


Figure 2.1: Screen Shot of Home Page found at https://www.SouthPlatteRiverWatershedStudy.org

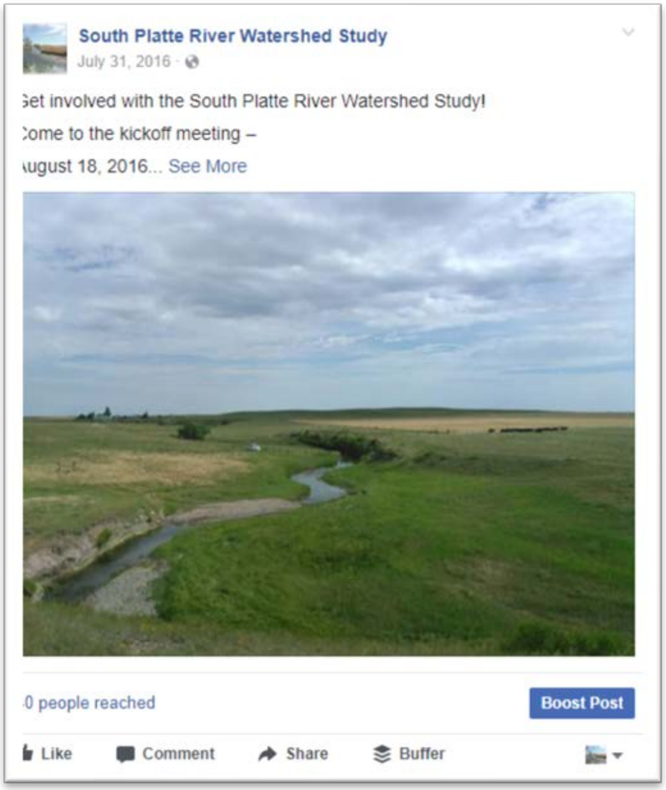


Figure 2.2 – Facebook Post and Reach Example

Figure 2.2 could be found at https://www.facebook.com/SouthPlatteRiverWatershedStudy/. It will be unpublished based upon the social media platforms rules.

Dahlgren Consulting also partnered with the LCCD to introduce the study by participating in the 2016 Laramie County Fair. Dahlgren Consulting provided information and materials during the Fair and had staff attend the Fair sit with the Conservation District at their booth.

2.3 Community Meetings

Four community meetings were held during the Study. The meetings were announced across the variety of media platforms discussed above, by direct mailings of post cards, and newspaper ads.

The Community Meetings typically included formal presentations by the Dahlgren Consulting staff with support from the Conservation Districts staff and the WWDC staff. The meeting presentations can be viewed on the Watershed Study website.

The first public meeting for the South Platte River Watershed Study was held on August 18, 2016 at the Cheyenne Public Library, from 4 to 7 P.M. The meeting was advertised through the Cheyenne Tribune Eagle, Pine Bluffs Post, and brochures were available for a week at the Laramie County Fair.

A second public meeting was held on September 19, 2016 at the Wyoming Water Development Commission. The meeting was advertised through the Cheyenne Tribune Eagle, and post cards were mailed to all landowners of at least 160 acres in Laramie County. This was a successful outreach, with over 40 participates attending the meeting.

On September 28, 2016, a third public meeting was held at the Albany County Fairgrounds, in Laramie Wyoming. The meeting was advertised through the Laramie Boomerang, KOWB radio, Laramie Live's website, the Laramie Rivers Conservation District Facebook page, and post cards were mailed to all landowners of at least 160 acres in the South Platte Watershed within Albany County.

Photo shows the public meeting in Burns, WY

Pine Bluffs Post

News Sports Opinion Obituaries Calendar Classifieds Church

Final meeting held for watershed study

By Gary Collins
Pine Bluffs Post

Share Tweet 0 Comments

February 2, 2017

Gary Collins/Pine Bluffs Post
Russ Dahlgren, of Dahlgren Consulting, addressed a crowd of 20 landowners and government officials in the Burns Community Meeting Room, Wednesday, Jan. 25 about the South Platte River Watershed Study.

The Town of Burns Community Meeting Room was the setting Wednesday, Jan. 25 at 1:30 p.m. for the fourth and final in a series of public forums for the South Platte River Watershed (SPRW) Study. Dahlgren Consulting conducted the study. The Laramie County Conservation District (LCCD) was the sponsor and it was funded by the Wyoming Water Development Commission (WWDC).

There were 20 citizens and government officials in attendance.

The meeting was opened by Jim Cochran, Managing Director of the LCCD who after a brief introduction turned the meeting over to Russ Dahlgren of Dahlgren Consulting.

"The Laramie County Conservation District (LCCD) asked for this project, so that residents and citizens in the South Platte Watershed District (SPWD) would have opportunities for projects that we can do," Dahlgren said.

An initial area of study is an inventory of the watershed.

"The watershed inventory is looking at land use, looking at geology soils, looking at hydrology, we're looking at water use, water systems, irrigation, reservoirs, that can be surface reservoirs," Dahlgren said.

Most Popular

Gators, bed fairies, c...
Gary Collins

Their Royal Highness o...
Gary Collins

Seven Times Champions
Becky Christofferson

First Time Champs
Jimmie Earls

Zitek is Perfect
Jimmie Earls

Figure 2.3 Article in the Pine Bluffs Post

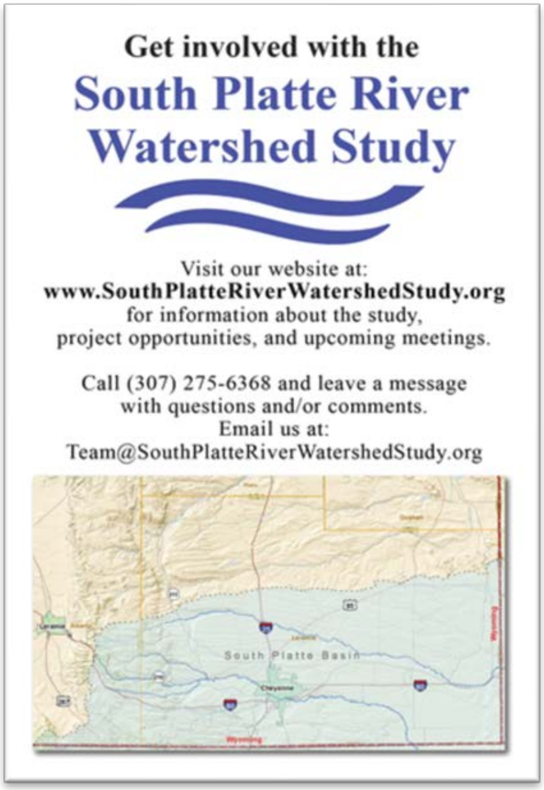
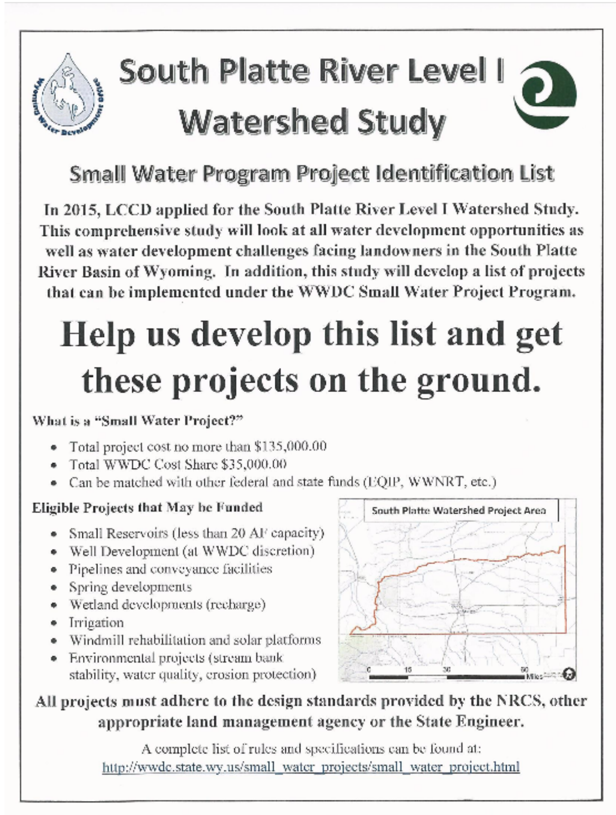


Figure 2.4 The front side of the postcards mailed to landowners

Figure 2.5 Newspaper ad in the Laramie Boomerang

The final public meeting was held in Burns, Wyoming on January 25, 2017. Approximately 25 landowners participated in this final public meeting for the study. The Pine Bluff's Post newspaper covered the Burns meeting and the article in the February 2, 2017 edition of the paper is shown as Figure 2.3 above.

The LCCD also supported the outreach effort by adding information concerning the study to their website and by creating a flyer specifically for the South Platte Watershed Study efforts (Figure 2.6).



South Platte River Level I Watershed Study

Small Water Program Project Identification List

In 2015, LCCD applied for the South Platte River Level I Watershed Study. This comprehensive study will look at all water development opportunities as well as water development challenges facing landowners in the South Platte River Basin of Wyoming. In addition, this study will develop a list of projects that can be implemented under the WWDC Small Water Project Program.

Help us develop this list and get these projects on the ground.

What is a "Small Water Project?"

- Total project cost no more than $135,000.00
- Total WWDC Cost Share $35,000.00
- Can be matched with other federal and state funds (EQIP, WWNRT, etc.)

Eligible Projects that May be Funded

- Small Reservoirs (less than 20 AF capacity)
- Well Development (at WWDC discretion)
- Pipelines and conveyance facilities
- Spring developments
- Wetland developments (recharge)
- Irrigation
- Windmill rehabilitation and solar platforms
- Environmental projects (stream bank stability, water quality, erosion protection)

All projects must adhere to the design standards provided by the NRCS, other appropriate land management agency or the State Engineer.

A complete list of rules and specifications can be found at:
http://wwdc.state.wy.us/small_water_projects/small_water_project.html

Figure 2.6 LCCD Watershed Study flyer

2.4 Scoping Meetings and Coordination Meetings

Scoping meetings and coordination meetings were coordinated with assistance from Dahlgren Consulting, LCCD and WWDC, with staff attending each meeting. These meetings were held at either the LCCD and/or WWDC offices to ensure both agencies' interests and concerns were being address by the study team throughout the study period.

Dahlgren Consulting also reached out to the Laramie Rivers Conservation District (LRCD) to discuss lessons learned from other watershed studies and learn more about the Albany County portion of the South Platte River Watershed area.

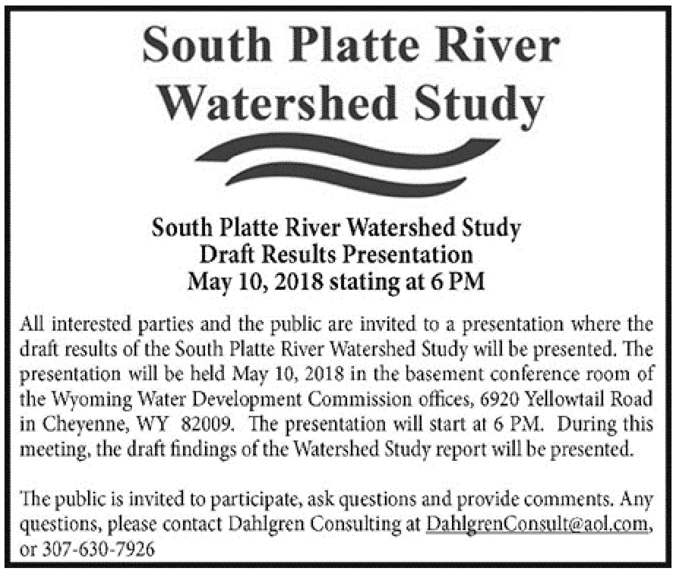
2.6 Site Visits

The Dahlgren Consulting project team met with over 61 landowners during site visits at the landowner's residence or property to review and discuss watershed concerns. Staff from the Conservation Districts often coordinated and facilitated these site visits. During the site visits potential projects for inclusion in the management plan for the Watershed were discussed and evaluated. The WWDC Small Water Projects Program was often a primary interest of the landowner.

Throughout the watershed study, the Conservation Districts' staff, local ranchers and farmers, and other residents demonstrated extensive knowledge and valuable insight about the watershed. Because of the willingness of landowners to share information and insight, the study team was able to incorporate this knowledge and experience into the study and provide a more effective inventory of the watershed and more thorough management plan.

2.7 Draft Results Public Meeting and Comments

The final public meeting to review the project was held on May 10, 2018. Ads were placed in the local newspapers, one in the Cheyenne paper and one in the Pine Bluffs paper (refer to Figures 2.7 below, which is the ad run in these papers for this meeting).



South Platte River Watershed Study

South Platte River Watershed Study
Draft Results Presentation
May 10, 2018 stating at 6 PM

All interested parties and the public are invited to a presentation where the draft results of the South Platte River Watershed Study will be presented. The presentation will be held May 10, 2018 in the basement conference room of the Wyoming Water Development Commission offices, 6920 Yellowtail Road in Cheyenne, WY 82009. The presentation will start at 6 PM. During this meeting, the draft findings of the Watershed Study report will be presented.

The public is invited to participate, ask questions and provide comments. Any questions, please contact Dahlgren Consulting at DahlgrenConsult@aol.com, or 307-630-7926

Figure 2.7 Newspaper ad for the Study Results Presentation Meeting

The May 10th meeting presented a summary of the approximately 107 projects that were developed during the Watershed Study and discussed the highlights of the Watershed Inventory effort, including land use, climate, surface water, irrigation and other water uses, flora and fauna, and groundwater. Following the presentation there was a questions and answers period.

Chapter 3 - Watershed Inventory

Section 3.1 Introduction

This chapter of the report discusses the work done during Task 3 of the Watershed Study, i.e. the Watershed Inventory. The effort done during the Watershed Inventory is one of the keys of the South Platte River Watershed Study. A thorough and complete inventory and characterization of the watershed leads directly to the Rehabilitation and Management Plan and to development of Small Water Projects.

A substantial amount of data is available concerning the South Platte Watershed. Much of this data has been compiled and summarized in this report. This chapter contains information concerning:

- Land ownership, land use, and cultural resources;
- Land cover and wetlands;
- Climate;
- Surface water hydrology, including data concerning stream gages, estimates of the surface water supply and discussion of flood events;
- Water quality;
- Wildlife resources;
- Geology and groundwater resources, and;
- Estimated water use, including irrigation and crops, municipal water, industrial water, and other uses. Trans-basin diversions are described in this section of the report.

The estimated water supply, including both surface water and groundwater, is compared to the amount of water used in key areas in the watershed. Estimated water budgets for the agricultural areas in eastern Laramie County were developed.

Maps, figures and tables that illustrate this information have been prepared and are included in this chapter.

The South Platte River Watershed Study (SPRWS) includes the following sub-basins or sub-watershed areas delineated by Hydrologic Unit Codes (HUC) 8:

- Cache La Poudre
- Crow Creek
- Lone Tree-Owl
- Lower Lodgepole
- Sidney Draw
- Upper Lodgepole

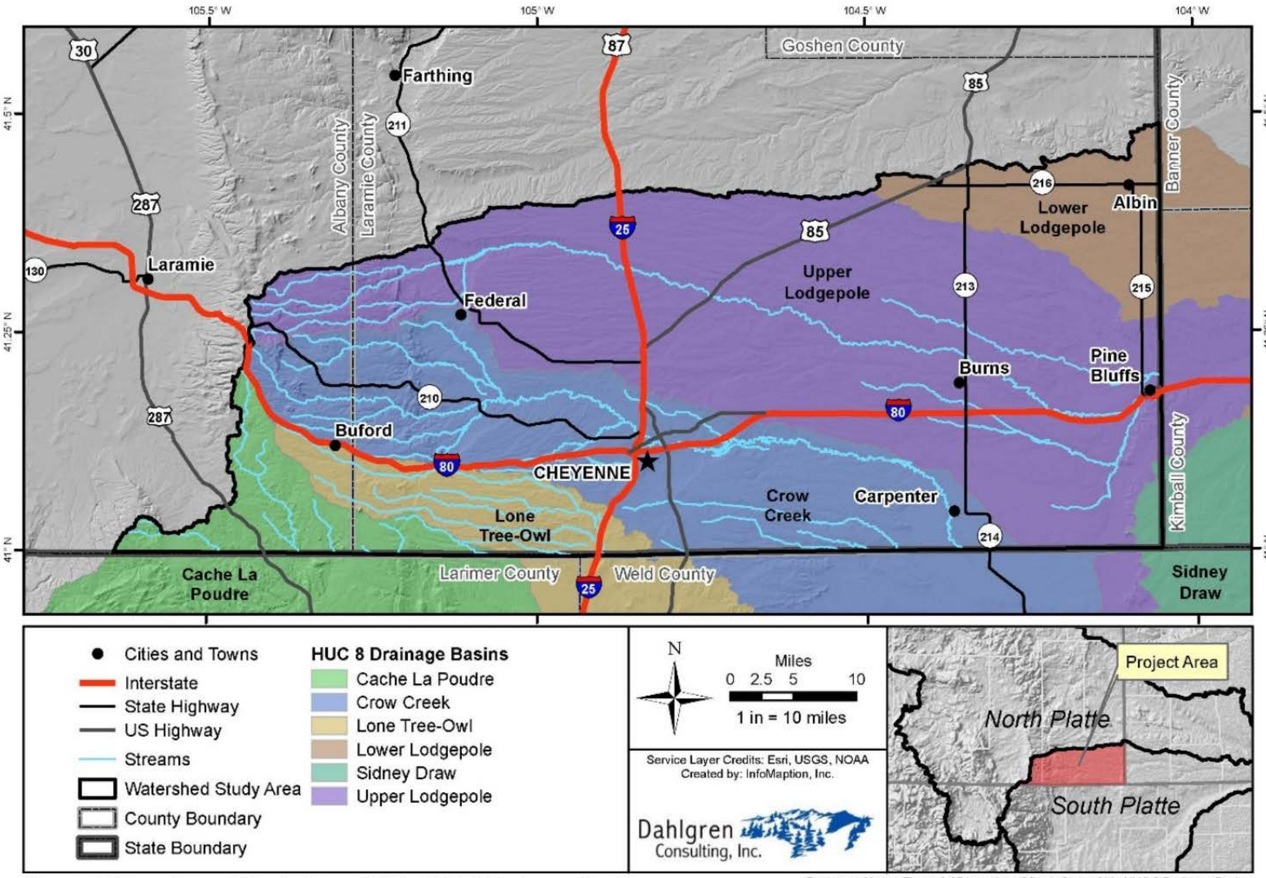


Figure 3.1 Location of Study Area within HUC 8 Drainage Basins

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Section 3.2 Data Collection, Geographic Information System (GIS), and Digital Library

An abundance of land and water resources data in the form of both spatial and non-spatial information was available to support the South Platte River Watershed Study (SPRWS). The GIS team objectively sought out data from several sources and compiled the data into a digital library. In addition, the GIS team created numerous datasets from field observations, mapping, digitizing from relevant base maps (both aerial and satellite imagery), mapping of proposed projects, and by mapping relevant information only available in tabular formats. Metadata was also developed for each dataset created to explain the source of the dataset and how it was compiled. The compilation of all datasets was organized in an ESRI file geodatabase to support the Study. All GIS data was submitted with the Watershed Study report.

This GIS data was used throughout the Study to provide visual reference explaining the characteristics, key elements, problem areas, water development opportunities and existing infrastructure of the watershed.

Data Collection and Management

Compilation of Existing Data and Information:

A variety of data and information was gathered, developed, and compiled for use within the South Platte Watershed Study. The GIS team referenced previous watershed studies to help determine possible sources for applicable data. A considerable amount of public domain data and information was gathered from government entities at the local, state and federal levels. In many instances, these organizations were contacted to obtain or verify data. In other cases, data was available for download from public sites and included metadata that explained the source of the data. Much of the compiled data came from the following government entities:

- Laramie County Conservation District
- Laramie County
- Albany County
- Wyoming State Engineers Office (SEO)
- Wyoming Water Development Commission (WWDC)
- Wyoming Department of Environmental Quality (WDEQ)
- Wyoming State Geological Survey (WSGS)
- Wyoming Game and Fish Department
- Wyoming Geographic Information Science Center (WyGISC)
- Wyoming Oil and Gas Commission (WOGCC)
- U.S. Department of Agriculture (USDA)
    - Natural Resource Conservation Service (NRCS)
    - US Forest Service (USFS)
- US Census Bureau (USCB)
- US Department of the Interior (USDI)
    - US Geological Survey (USGS)
    - Bureau of Land Management (BLM)
    - US Fish and Wildlife Service (USFWS)

Geographic Information Systems

The GIS data that was acquired and developed for the study was compiled into a geodatabase storage structure, allowing for easy organization and reduced digital storage space. The data was organized into feature datasets and corresponding feature classes. All of the datasets were projected into the Universal Transverse Mercator (UTM), Zone 13 North, US Feet coordinate system using the North American Datum 1983 (NAD83). Any data that was not acquired in this projection was re-projected using the tools in ESRI's ArcCatalog software, version 10.5. Many datasets were clipped to the area of the study in order to reduce required storage space and drawing time.

ESRI's ArcGIS version 10.5 was used throughout the study to develop datasets, perform analyses, interpret and visualize analysis results, convert tabular data to a spatial format, and generate figures to support the Study. For each figure created for the Study, an ArcMap map document (.MXD) was created and saved with relative paths to the data sources within the file geodatabase. Table 3.1 outlines the scheme used to organize the spatial data within the geodatabase used for this study.

Raster Datasets:

- Albany_NAIP_2015
- Aqsens100
- GAP_Vegetation_Classifications
- Laramie_NAIP_2015
- Project_Area_Basemap
- Project_Area_Shaded_Relief

Table 3.1 SPRWS GIS Geo Database Scheme

Feature Dataset	**Feature Class**	**Feature Dataset**	**Feature Class**
Administrative	Albany_Co_Parcels	Hydrology_ Climate	Dundy_Co_Precipitation_1981_to_2010
	Counties		NOAA_Weather_Stations
	Counties_Co		Precipitation_1981_to_2010
	Federal_Land_SP		Precipitation_1981_to_2010_clipped
	FEMA_S_Fld_Haz_Ar	Irrigation_ Structures	Irrigated_Lands_2016_ByWatershed
	Historical_trailsgeo		LC_Facilties
	Laramie_Co_Parcels		LC_Facilties_Clipped
	Larimie_Co_Control_Area		NineTownships_Irrigation
	Larimie_Co_Control_Area_Clipped		Point_of_Diversion
	Mapbook_Index1		Point_of_Diversion_Clipped
	NRCS_Conservation_Easements_Points_WY		Res2
	NRCS_Conservation_Easements_Polygons_WY		SEO_Irrigation_Wells
	Platted_Subdivisions_LC_Clip	Land_Use	BLM_Boundaries
	PLSS_First_Division		BLM_Grazing_Allotments
	PLSS_Second_Division		Land_Ownership
	PLSS_Townships		Landfill_Locations
	Primary_Roads_100k_TL		Mine_Permits_Clipped
	Primary_Roads_Simplified_Template		Oil_Gas_Permits_Clipped
	Sections24k		Orphan_Sites
	South_Platte_AOI_Clipped		USFS_District_Boundaries
	South_Platte_Basin_Boundary		USFS_District_Boundaries_Clipped
	South_Platte_Watershed_Clipped_to_State		WSGS_OilGas_Fields_2016
	SPRWS_Townships	Proposed_Projects	Belvoir_Ranch_Boundary
	State_Boundaries		Environmental
	States_Clipped		Exist_Stock_Tank
	TL_All_Roads_SP		Existing_Ditch
	TL_RR_Clipped		Existing_Pipeline
	Tr24k		Fence_Line
	WY_Cities_Minimized		Headgate
	Wyoming_Counties		Pipeline
Cultural	CRMStat		Project_Locations
	Rfo_sma		Solar_Pump

Feature Dataset	Feature Class	Feature Dataset	Feature Class
Geology_Soils	Bedrock_Geology_500k	Proposed_Projects Continued	Spring
	Bedrock_Geology_500k_Clipped		Sprinkler
	BedrockGeology_100k_VerPloeg_and_Boyd		Stock_Reservoir
	BedrockGeology_100k_VerPloeg_and_Boyd_LaramieCo		Stock_Tank
	Faults_500k		Well_Electric
	Faults_VerPloeg_and_Boyd		Well_Solar
	Geology_Delineation	Utilities	CellularTowers
	Landslides		FCC_ASR
	Precambrian		FCC_MST
	Soilmu_a_wy_SPRWS_merged_1		Gas_Plant
	SSURGO		High_Voltage_Transmission_Lines
	Structural_Basins_Clipped		Natural_Gas_Liquid_Pipelines
	Surficial_Geology_500k_Clipped		Natural_Gas_Liquid_Pipelines_Clipped
	WY_Faults_dd		Powerplant
	WY_STATSGO2_Soils		Substations
Groundwater	Active_Monitoring_Wells_LaramieCo		Wind_Projects
	Major_Reservoir_Locations		Wyoming_Pipelines
	Major_Reservoirs	Wildlife	Core4_072915_final
	Permitted_Stock_Reservoirs		Diamond_Creek_Tributaries
	Saturated_Thickness_Ogallala		Elk_Migration_Clip
	Select_Reservoirs		ElkCrucialRange
	SEO_Adjudicated_Stock_Wells		ElkHuntAreas_Clip1
	SEO_Stock_Wells		ElkPartutionAreas
	SEO_Wells_SP		FCH_Charadrius_melodus_exceptGreatLakes_20090519
	WDEQ_2014_Assessed_Streams_Clipped		Iowa_Darter_SPRWS_Clip_Diss
	WellHeaders_20170615		Key_Nongame_Wildlife_Areas_Riparian
Hydrography	Major_Streams_WY		Key_Nongame_Wildlife_Areas_Upland
	NHD_Flowlines_1018		Key_Nongame_Wildlife_Areas_Upland_clip
	NHD_Flowlines_1019		Mdr12cr
	NHD_Flowlines_Named		Mexican_Spotted_Owl_Critical_Habitat_2004
	NHD_Line_1018		MooseHuntAreas_Clip
	NHD_Line_1019		MuleDeerHuntAreas_Clip
	NHD_MedRes_Waterbodies_MajorWater		Orangethroat_Darter_SPRWS_Clip_Diss
	NHD_Point_1018		Plains_Killfish_SPRWS_Clip_Diss
	NHD_Point_1019		Plains_Topminnou_SPRWS_Clipp_Diss_1
	NHD_Springs_Seeps		Sghab_Select
	NHD_Waterbodies_1018		Stream_Classificaions
	NHD_Waterbodies_1019		Terrestrial_Crucial_SPRWS
	Temorary_Stream_Gauge_Locations		Terrestrial_Enhance_SPRWS
	USGS_GaugesII_Sept_2011		USFS_Lands_SPRWS
	USGS_SEO_Gauging_Stations		Ute_Ladies_tresses_WYNDD
	USGS_Stream_Gauge_Locations		WhitetailedDeerHuntAreas_Cli
	Watershed_South_Platte_WY		Wildlife_Habitat_Management_Areas
	Watersheds_SP_NP_HUC4		WYNDD_Species_Occurances
	WSB_HUC_10_Drainage_Basins_SP_Clip		WyomingCurrentRange2015
	WSB_HUC_12_SP_Clip		
	WSB_HUC_4_North_South_Platte		
	WYWetlandComplexes_TN2010_clip		

Section 3.3 Land Ownership, Land Use, and Cultural Resources

This section of the report describes the land ownership, usage and and cultural resources within the South Platte River Watershed.

There are approximately 2035 square miles or 1,302,400 acres within the South Platte Watershed. As shown in Figure 3.2 (presented below) 1,813 square miles (sq.mi) or approximately 89 percent is located within Laramie County and the other 222 sq.mi or approximately 11 percent is located in Albany County.

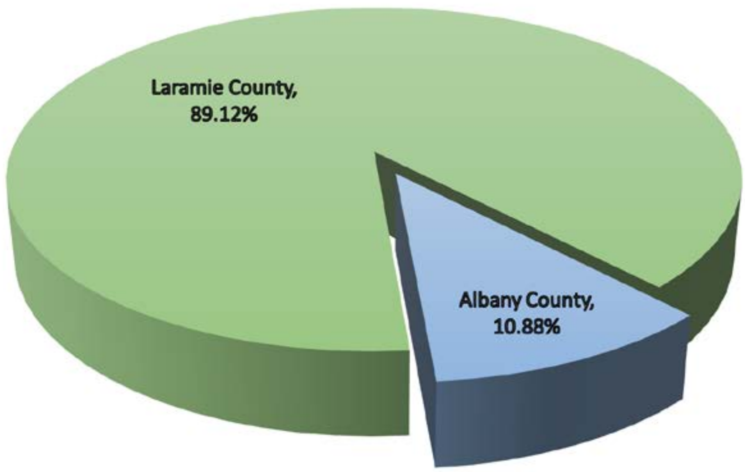

Figure 3.2 Chart showing the percentage of the Watershed in Laramie and Albany Counties

3.3.1 Land Ownership

The SPRWS is somewhat unusual compared to other areas in Wyoming, because the vast majority of the land, i.e. 85.5%, is privately owned. The State of Wyoming owns 7.3 % of the land, the Federal government owns 5% of the land, and Local government owns 2.2 % of the land (Table 3.2, Figures 3.3 and 3.4). This data is summarized in the table and figures below.

Table 3.2 - Land Ownership

County	Private Ownership (sq.mi)	%	Federal Ownership (sq.mi)	%	State Owned (sq.mi)	%	Local Government (sq.mi)	%
Laramie	1609		22		137		45	
Albany	130		80		12		0	
Total	1739	85.5%	102	5.0%	149	7.3%	45	2.2%

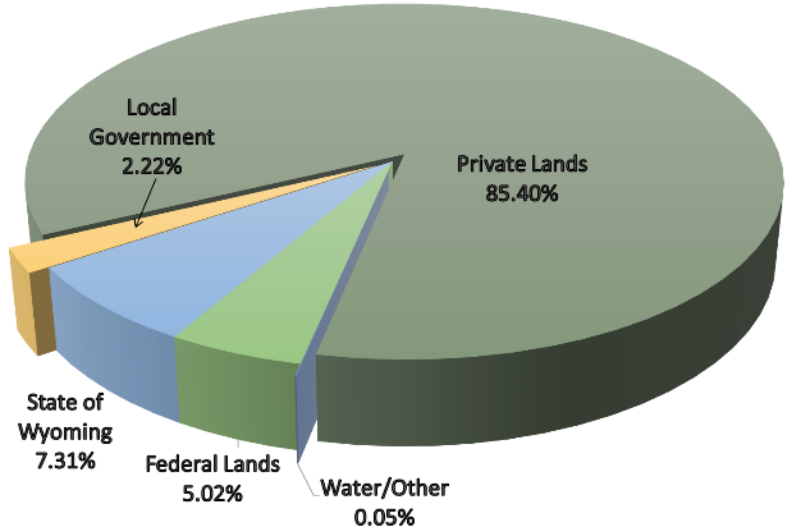

Figure 3.3 Chart showing Land Ownership

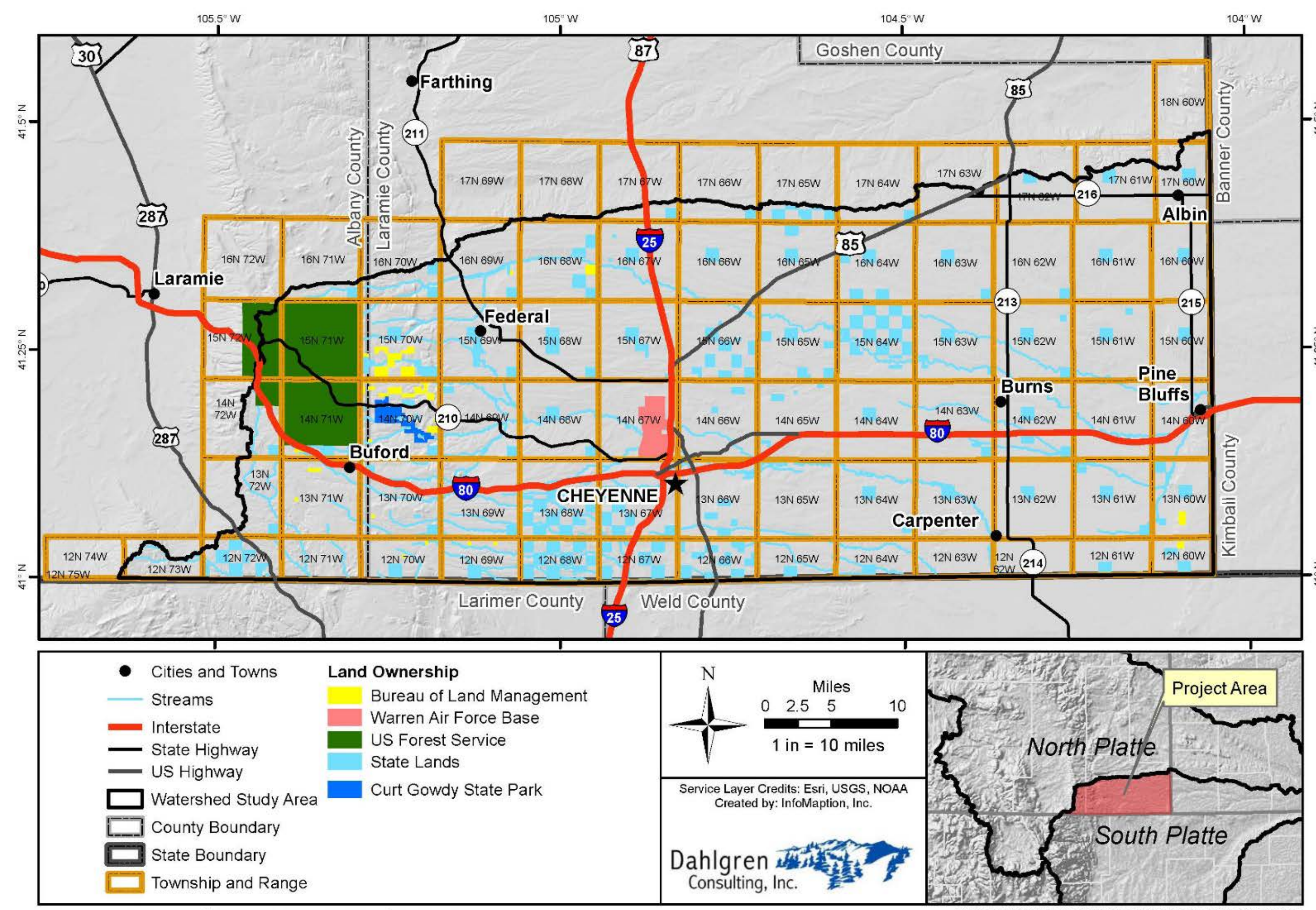

Figure 3.4 Land Ownership within Study Area

Document Name: Figure 3.2 Land Ownership within Study Area
Date Saved: 12/14/2017

3.3.2 Land Use
(Transportation, Communication, Energy Infrastructure, Mines, and Subdivisions)

Key transportation and communication infrastructure in the watershed, including the primary roads, railroads, and communication towers are shown on Figure 3.5 (Infrastructure Features). Two interstate highways, I-80 and I-25 cross the watershed, as well as several other State and US highways. Numerous other county roads support the watershed area but are not shown. Additionally, the Union Pacific and Burlington-Northern railroads cross the watershed.

Figure 3.6 (Power Generation and Transmission Lines) shows the power plants, windfarms, electrical sub-stations, and major power transmission lines. The Cheyenne Prairie Generating Station, which opened in 2014, is a 132-Megawatt (MW) gas fired power plant. The power plant is located east of Cheyenne, near the I-80 and Campstool Road intersection. The Happy Jack and Silver Sage Wind Farms are located along Happy Jack Road (Highway 210) west of Cheyenne. Combined these wind farms have a generating capacity of approximately 71.4 MW with a total of 34 wind turbines at the two wind farms.

Laramie County is becoming an important oil and gas producing area. Figure 3.7 (Active Oil and Gas Fields) shows the oil fields within the SPRWS. Table 3.3 shows the oil, gas, and water produced in 2016. This data was obtained from the Wyoming Geologic Survey and Oil and Gas Conservation Commission.

Table 3.3 - 2016 Oil and Gas Production by Field within the Watershed

Oil or Gas Field	Oil (bbls)	Gas (mcf)	Water (bbls)
ARCOLA	2,433	6	1,532
BORIE	30,595	0	241,514
CHIVINGTON	4,810	0	85,866
DALE NORTH	1,499	0	0
FAIRWAY	672,202	611,726	911,455
GOLDEN PRAIRIE	28,323	6,877	53,351
LINDBERG EAST	1,726	0	19,059
PINE BLUFFS	2,789	0	293
PINE BLUFFS SOUTH	454	0	4,336
POLO	508	0	0
SILO	1,132,659	828,808	1,246,430
HORSE CREEK	11,504	2,555	160,417
TOTAL	**1,878,000**	**1,447,420**	**2,564,000**

It is interesting to observe the amount of water produced as a by-product of the oil and gas production. 2,564,000 barrels equals approximately 330 acre-feet. The produced water is likely not suitable for most uses due to its poor quality.

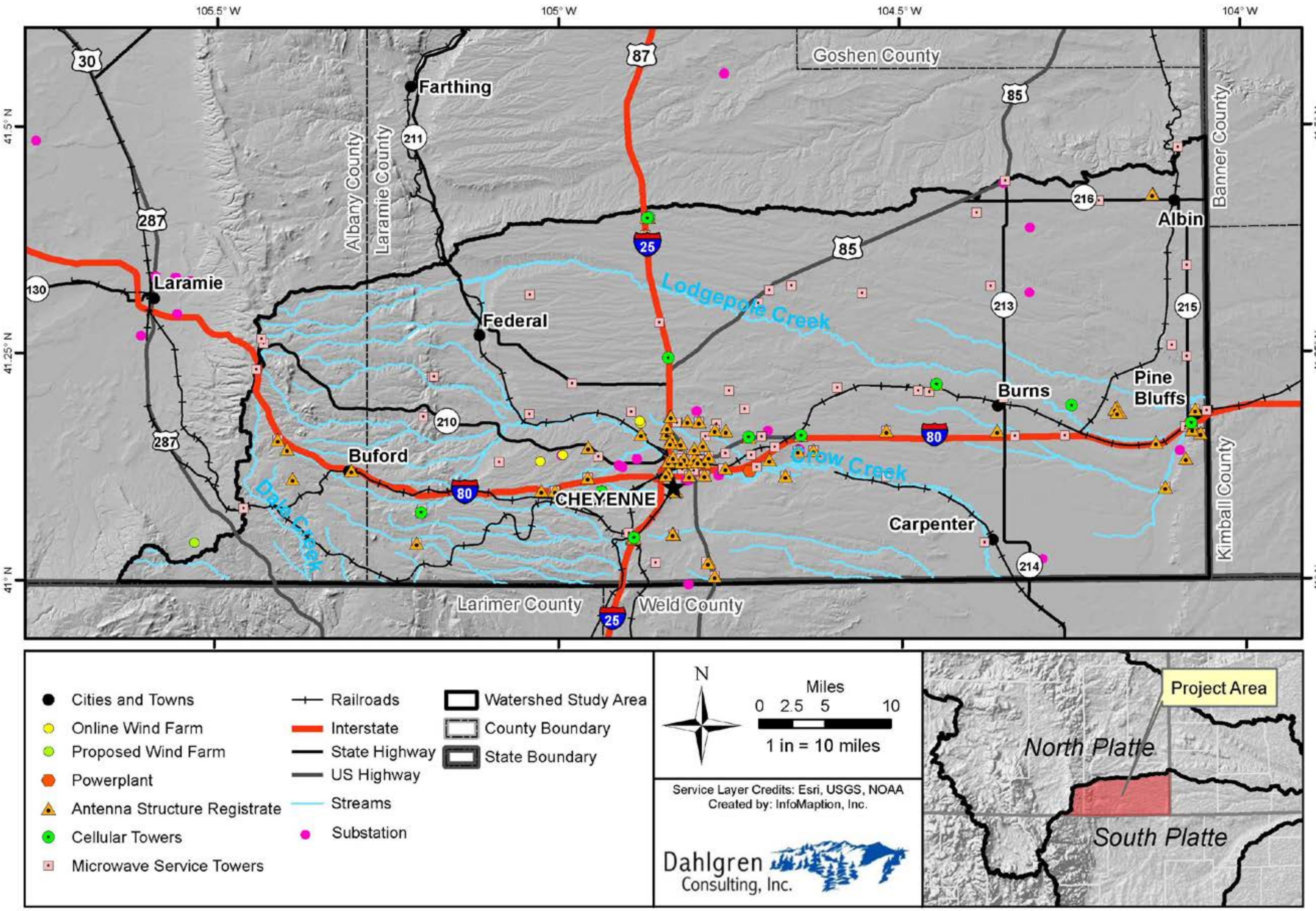

Figure 3.5 Infrastructure Features

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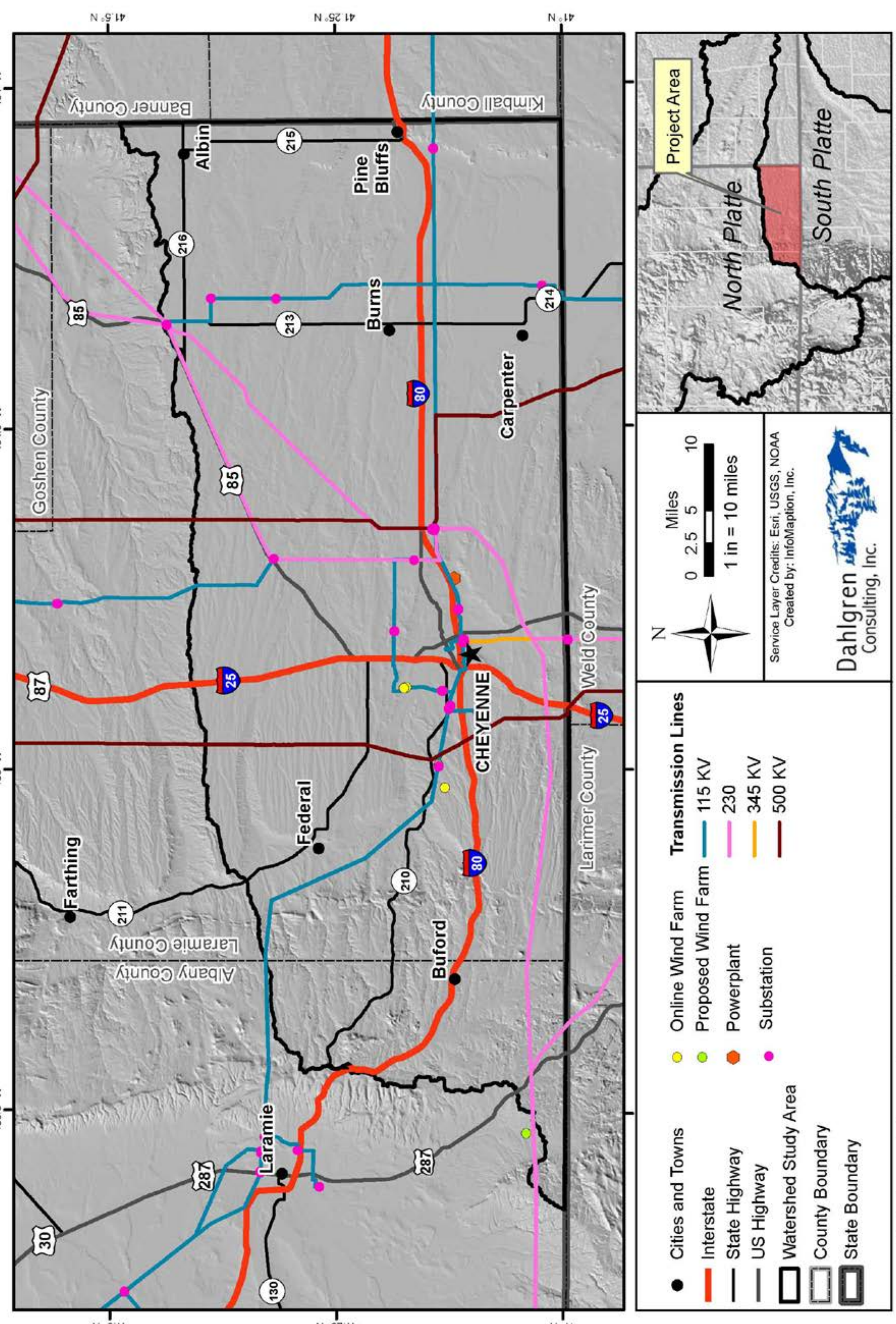

Figure 3.6 Power Generation and Transmission Lines

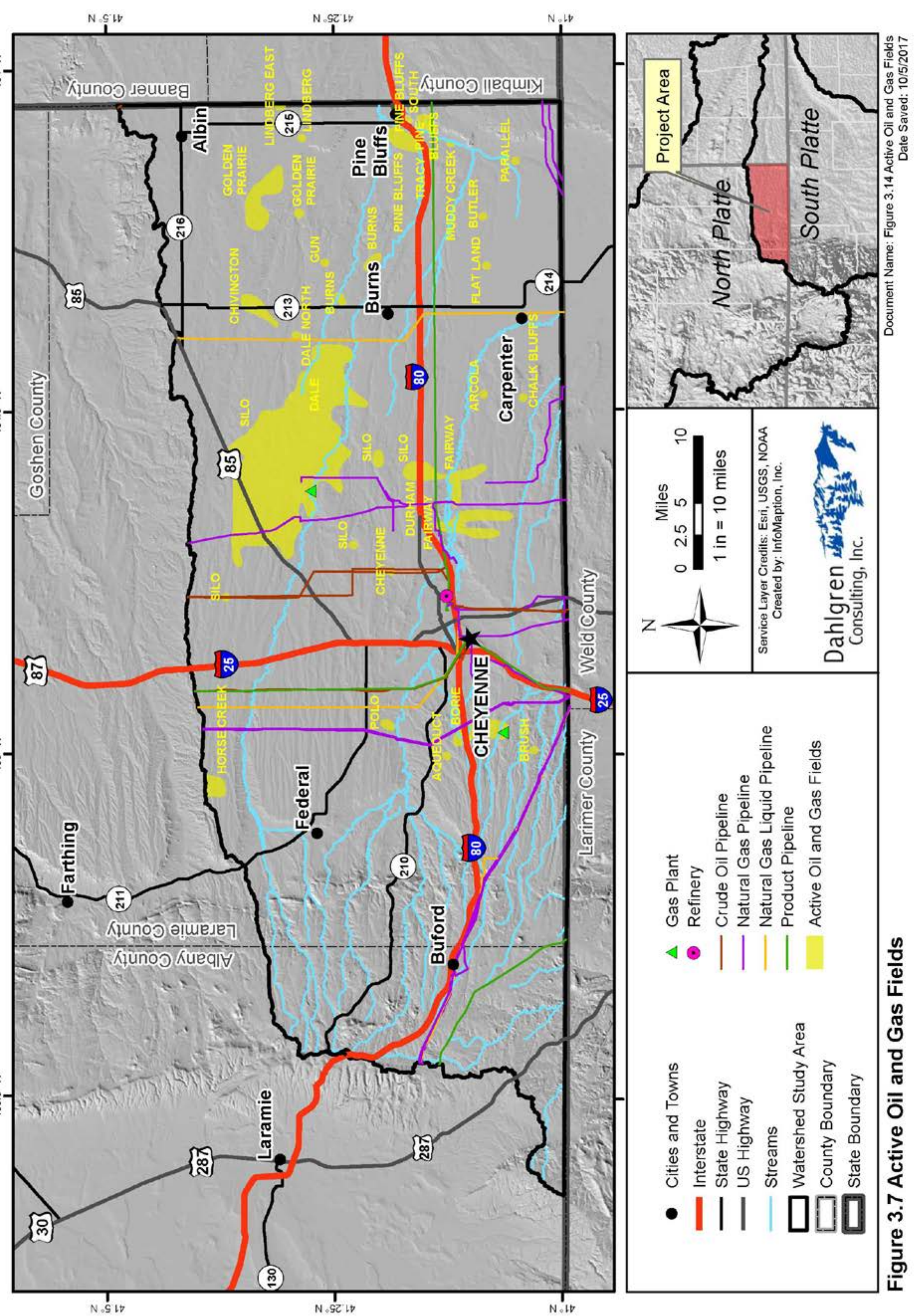

Figure 3.7 Active Oil and Gas Fields

Another and perhaps overlooked impact from oil and gas development is the amount of water being used in Laramie County for oil well drilling and development. Some of the water used for oil and gas drilling and development purposes is obtained from new wells; however, the vast majority of the water used in Laramie County is obtained from existing sources, both surface water sources and existing wells. A temporary water use agreement (TWUA) is an instrument submitted to and approved by the Wyoming State Engineer's Office, which allows water to be temporarily transferred or changed from its existing use to another use. In almost all cases, the oil and gas company purchases the water obtained via a TWUA.

Data obtained from the Wyoming State Engineer's Office shows that from January 1, 2013 to December 31, 2016, approximately 15,050 acre-feet of water was transferred from its original use (typically irrigation use) to oil and gas purposes. Assuming that the price paid for the water that has been transferred via a TWUA is $0.25 per 42 gallon barrel ($1939.58 per acre-foot); the value of the 15,000 +/- acre-feet of water that has been transferred from irrigation to oil and gas use is $29,100,000. The $0.25 per barrel price for water is an approximate average cost based on numerous conversations Dahlgren Consulting has had with oil and gas operators and with irrigators and landowners from 2010 through 2018. This value should be considered a "rule of thumb" or typical cost. Often the water contract between a landowner (appropriator) and the oil and gas company specifies a base price, which is paid whether or not any water is used, and then a royalty price paid for the amount of water actually used.

The price of water varies based on its availability (i.e. the number or wells and/or the amount of surface water that can be transferred or changed to oil and gas use) and the oil and gas activity (i.e. the demand for water). It should also be mentioned that there is significant interest in obtaining water in Wyoming from Wyoming appropriators for use in Colorado.

The Cheyenne Holly Frontier Refinery, which has a capacity of 52,000 barrels of crude oil per day, is within the Watershed. The refinery is located in south east Cheyenne, just north of I-80. Crude oil is purchased from local producers and is also imported via the Express Pipeline from Canada.

Figure 3.8 (Permitted Mines) shows the mines permitted through the Wyoming Department of Environmental Quality (DES) within the Watershed. There is a total of 48 permitted mines and 44 of the mines are sand and gravel quarries. Laramie County Public Works is the owner of 31 mines, all of which are sand and gravel quarries. The other mines include the granite quarry at Granite Canyon, near the I-80 and Harriman Road interchange (this mine has two permits); the Pete Lien limestone quarry south of Laramie, and one quartzite quarry.

Figure 3.9 (Subdivision Growth in Laramie County) shows the growth of subdivisions in Laramie County. The rural ranchette type of development that has occurred and is continuing around Cheyenne certainly is a major land use and land planning consideration. Impacts on natural resources such as wildlife habitat, open spaces, and groundwater are associated with this type of development.

The WWDC funded North Cheyenne Level I Master Plan (States West, 1993) identified three issues relating to water supplies from individual wells in the North Cheyenne area.

(http://library.wrds.uwyo.edu/wwdcrept/Cheyenne/North_Cheyenne-Master_Plan_Level_I_Project-Final_Report-1993.html)

In the opinion of Dahlgren Consulting, this report remains a pertinent resource concerning the rural subdivision development near Cheyenne. Individual domestic wells and individual septic systems are the typical water supply and wastewater systems for rural subdivisions near Cheyenne. The issues discussed in the North Cheyenne study are common and pertinent to other rural subdivisions in Laramie County and other area of the watershed. These issues include:

- The impetus for the North Cheyenne Level I study is declining groundwater levels in the Tertiary aquifer.
- The second issue is possible degradation of the groundwater quality due to septic systems.
- And the third issue is physical deterioration of wells and pumps.

3.3.3 Cultural Resources

The Wyoming State Historic Preservation Office (SHPO) catalogs important cultural areas within the state into a central database. Because cultural resource sites are vulnerable to unauthorized artifact collection and other harmful disturbances, the SHPO disseminates only generalized information on the location of cultural resources within a particular area. This information includes the number of sites within each public land survey section (PLSS) that are eligible for inclusion in the National Register of Historic Places, as well as some general attributes of individual sites. More specific details, such as the presence/absence of resources at a given site, may be obtained from the SHPO or land management agencies on a case-by-case basis.

Figure 3.10 (Wyoming State Historical Preservation Office Documented Cultural Resource Sites) shows the SHPO documented cultural resource sites in the SPRWS. The most common are frontier and pioneer culture sites centered around Cheyenne, and Native American sites distributed across the study area. Cultural resource sites are protected to various degrees by federal, state, and local regulations and guidelines. These regulations may restrict or otherwise impact potential water projects and developments, particularly on federal and state lands. Coordination with the SHPO and management agencies should occur at the early stages of proposed developments to identify and address potential conflicts.

Overland Historic Trail – Potential BLM Area of Critical Environmental Concern

The BLM Rawlins Field Office has designated a small portion of the watershed study area as a potential Area of Critical Environmental Concern (ACEC). The potential ACEC in the project area represents the Overland Historic Trail, which crosses the southwestern corner of the watershed study area in Albany County (Figure 3.12) The Overland Trail was an important east-west corridor for migration and commerce, as well as a historic Pony Express route, for much of the 19^{th} century. Evidence of the trail remains in the form of wagon ruts, waystation sites, and archaeological artifacts (BLM 2008).

Designated ACECs are BLM administered lands where special management attention is needed to protect specific resources; potential ACECs are areas recognized by the BLM as meeting at least one criterion for possible ACEC designation, but not yet officially designated (BLM 2007, 2008).

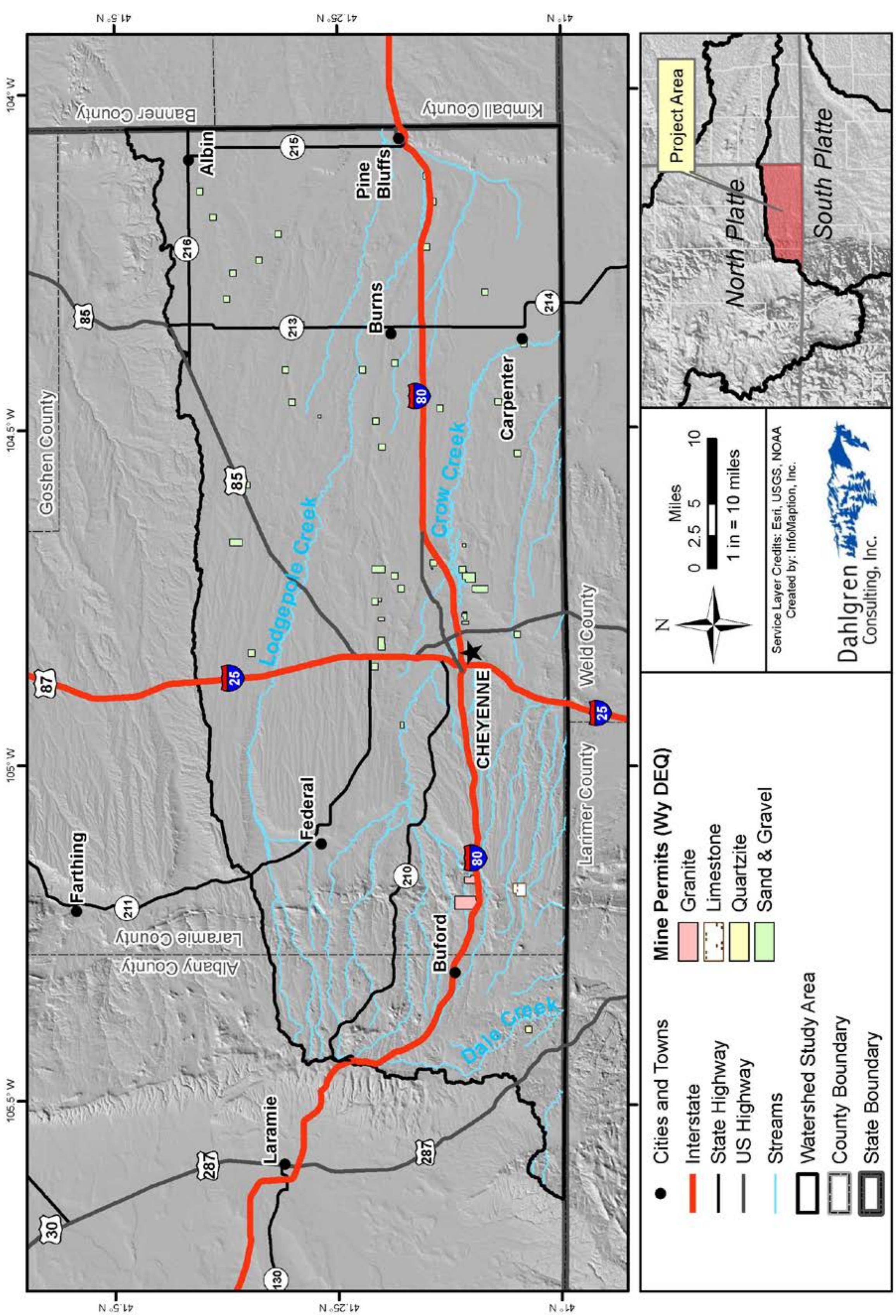

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Figure 3.8 Permitted Mines

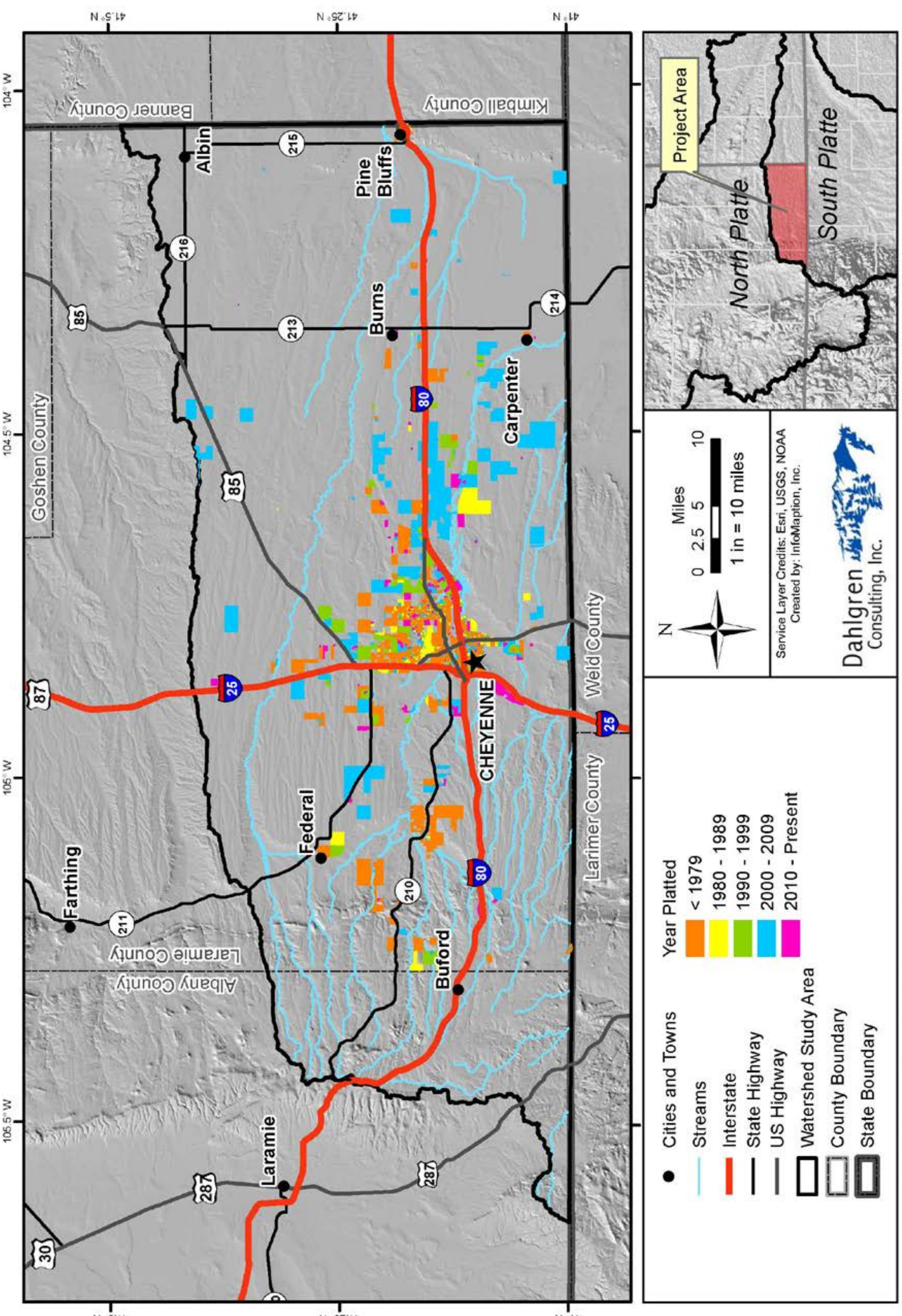

Figure 3.9 Subdivision Growth in Laramie County

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Date Saved: 10/9/2017

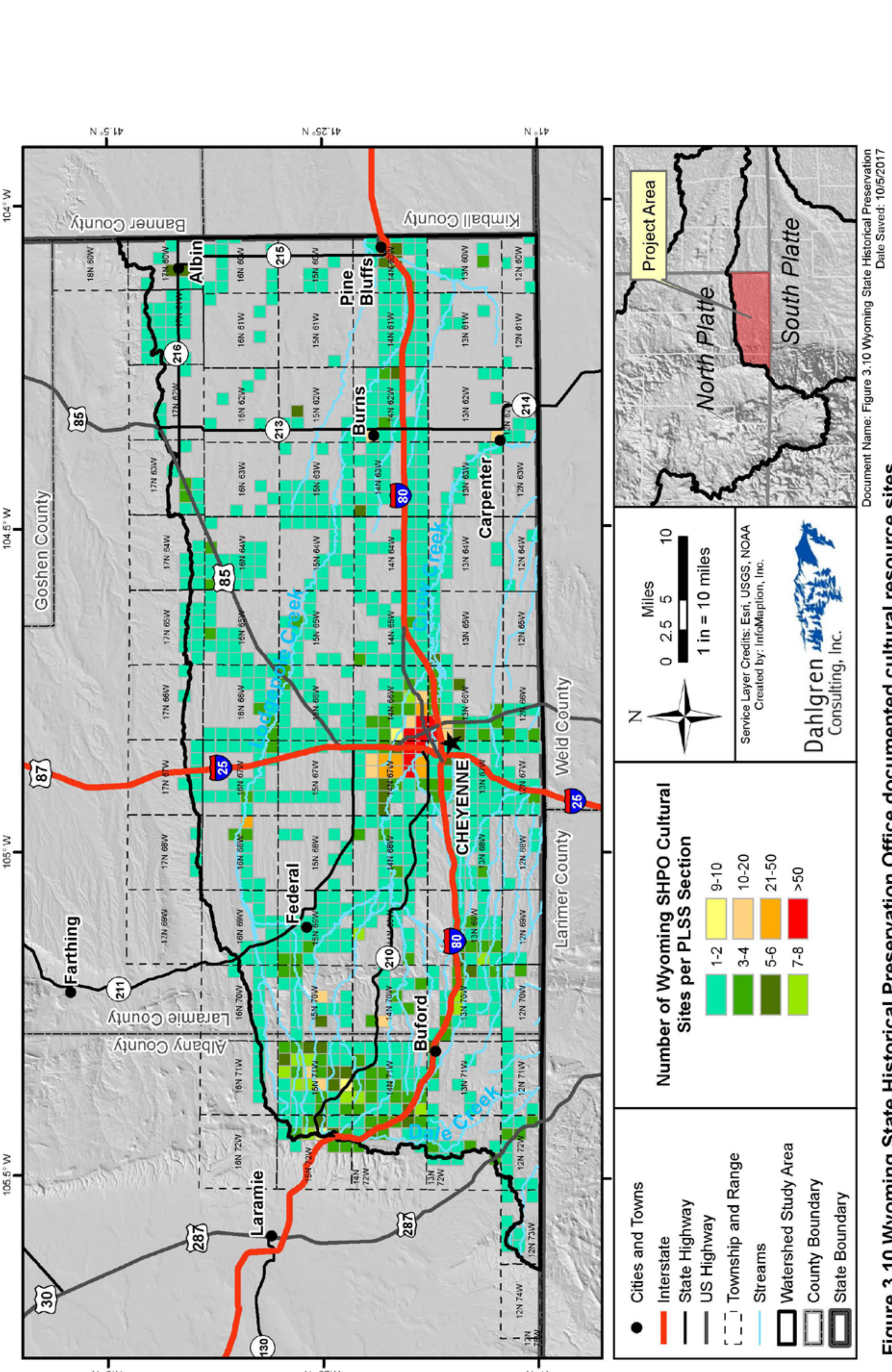


Figure 3.10 Wyoming State Historical Preservation Office documented cultural resource sites within the watershed study area.

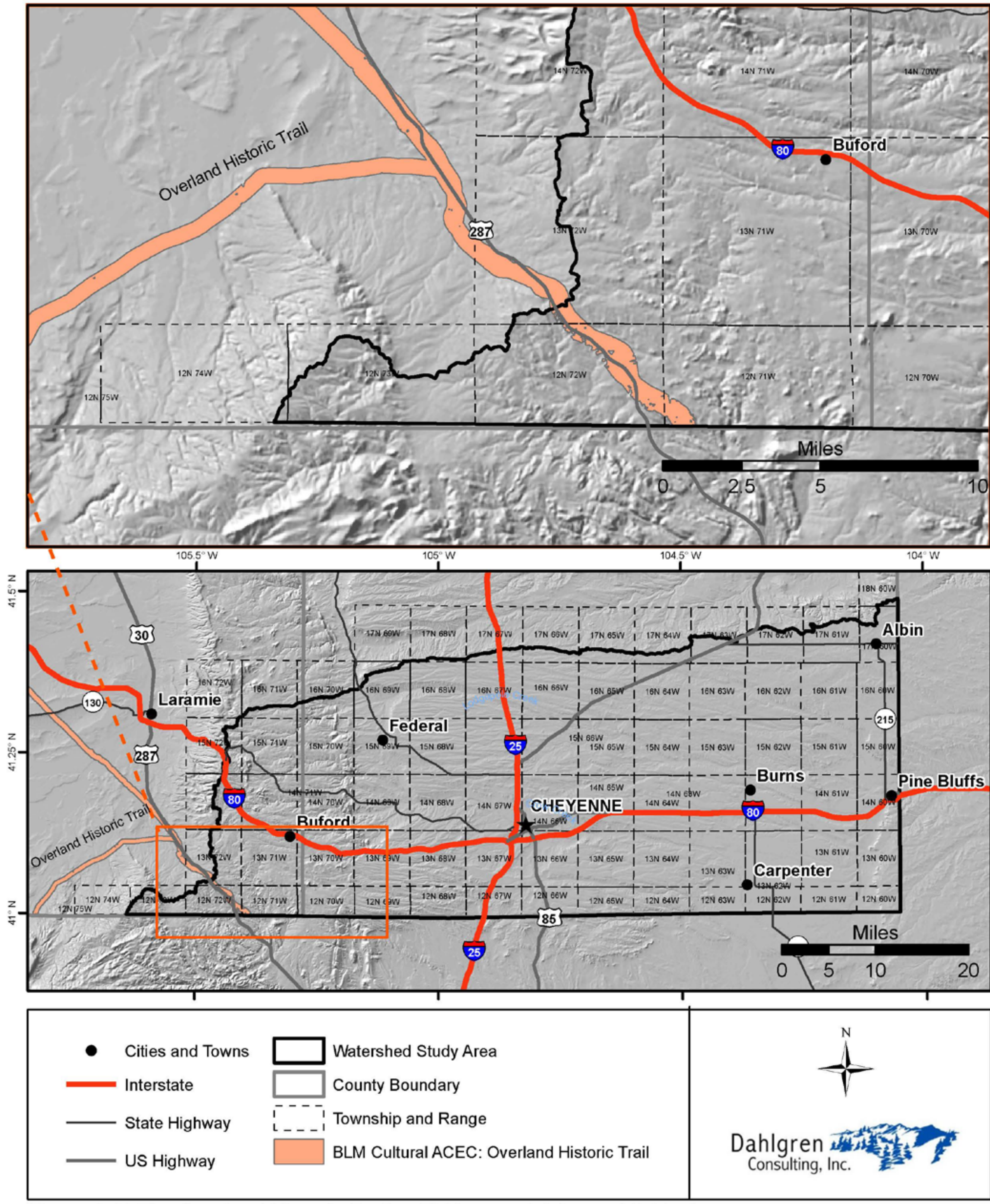


Figure 3.11 The Overland Historic Trail, a BLM potential Area of Critical Environmental Concern (ACEC) within the watershed study area.

Document Name: Figure 3.11 Area of Critical Evironmental Concern
Date Saved: 10/5/2017

Section 3.4 Land Cover and Wetlands

This section of the report describes the land cover and vegetation, weeds and wetlands, within the South Platte River Watershed.

3.4.1 Land Cover and Vegetation Classification

Datasets representing land cover and vegetation classifications are used to describe the dominant ecosystems and plant community types within a specified area, at various spatial scales and levels of precision. Land cover and land use classifications divide areas into generalized ecological categories, such as *Deciduous Forest* and *Cultivated Crops*. Vegetation classifications describe areas in more precise detail, organizing sites with similar vegetation into hierarchical, progressively finer categories, which are typically based on groups of commonly co-occurring species and environmental variables (such as elevation, geology, and climate).

The land cover Deciduous Forest, for example, may be subdivided into specific classes of deciduous forest, such as 'Cottonwood / Willow Riparian Forest' and 'Rocky Mountain Aspen Woodland'. Several national spatial datasets are available to describe land cover and vegetation conditions within the watershed study area. These are described in the following sections of this report.

National Land Cover Dataset

The National Land Cover Dataset (NLCD) was used to analyze the most generalized land cover classifications that occur in the watershed study area (Homer et al. 2015). The NLCD divides land cover across the U.S. into 16 broad categories, using Landsat imagery and data provided by a consortium of federal agencies. Because NLCD classifications are very general and presented at 30-meter resolution, they can mask important distinctions between sites. However, this same broad-brush approach also

provides a straightforward, easily-interpretable representation of the conditions and overall makeup of the watershed study area.

The South Platte River Watershed study area contains 15 of the 16 NLCD land cover classifications. The NLCD land cover information is summarized in Table 3.4 and shown on Figure 12.

Approximately 854,054 acres (65.6 percent) of the Watershed is classified as Grassland/Herbaceous land cover, 217,706 acres (16.7 percent) as Cultivated Crops, 108,946 acres (8.4 percent) as Shrub/Scrub, 40,083 acres (3.1 percent) as Evergreen Forest. The remainder of the Watershed is classified as developed areas, wetlands, mixed forest, and other land cover classifications with limited extents.

<u>USGS GAP Analysis Program</u>

A more precise representation of vegetation within the watershed study area is available via the USGS GAP Analysis Program (GAP, USGS 2016). The GAP system enables vegetation to be categorized at a very fine scale: the most detailed GAP vegetation level (GAP Level 3) splits the U.S. into 580 potential vegetation classes, wherein similar plant communities influenced by similar ecological processes are grouped together as a class. The data used to create GAP classes is derived from Landsat imagery, in conjunction with digital elevation model datasets (which incorporate elevation, landform, aspect, and other geospatial features). The study area contains 105 GAP Level 3 classes, though the bulk of the study area is dominated by a small subset of these (refer to Figure 3.13):

- *Western Great Plains Shortgrass Prairie*,
- *Northwestern Great Plains Mixed grass Prairie*,
- *Pasture / Hay*,
- *Western Great Plains Foothill and Piedmont Grassland*,
- *Inter-Mountain Basins Big Sagebrush Steppe*, and
- *Inter-Mountain Basins Big Sagebrush Shrubland*.

Brief descriptions of each dominant vegetation class are presented in Appendix B.1 (Gap Vegetations Class Descriptions and Ecological Site Descriptions) of this report. These descriptions are adapted from the NatureServe descriptions of GAP Ecological Systems Classifications (NatureServe 2009).

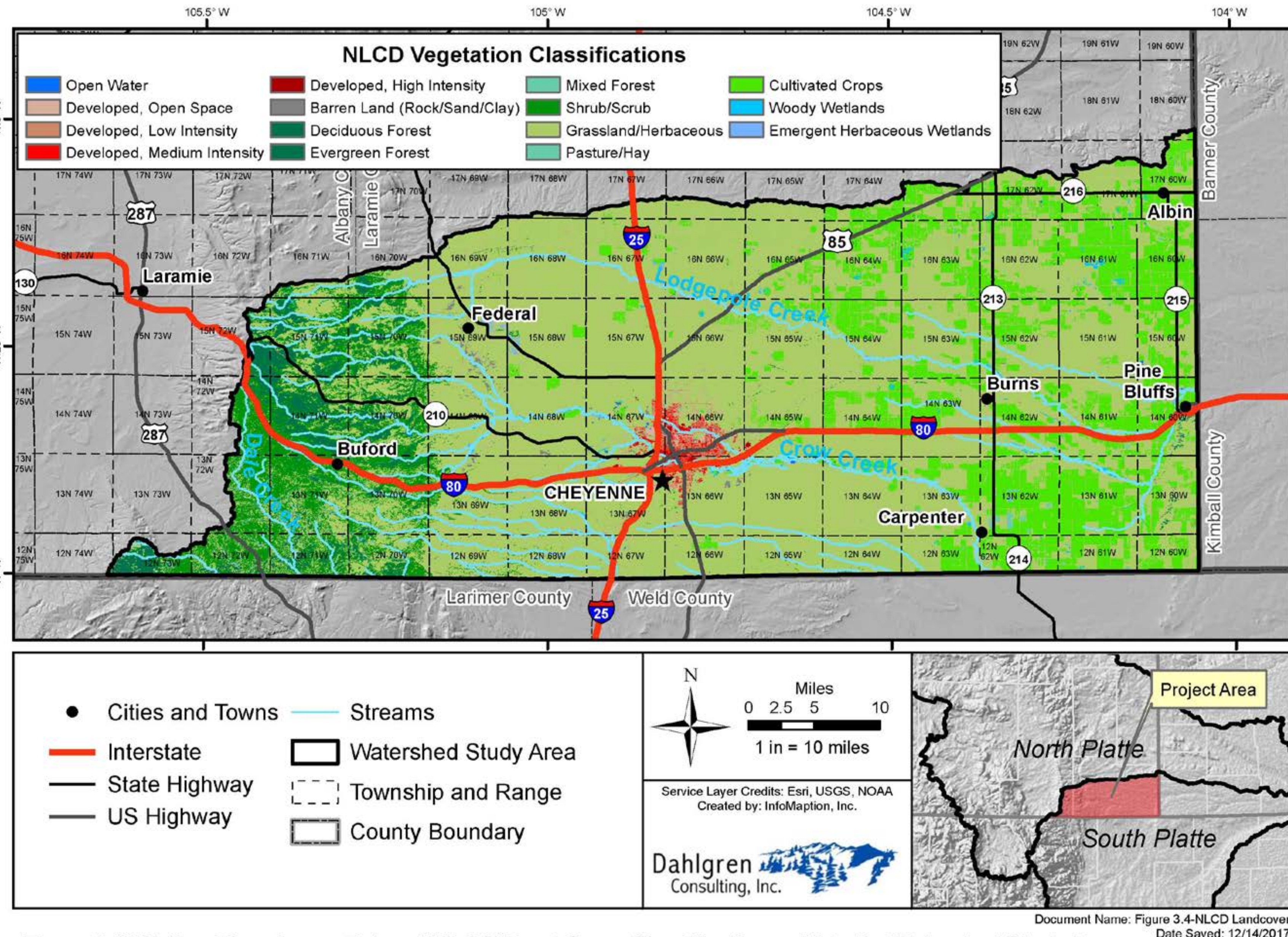


Figure 3.12 National Landcover Dataset (NLDC) Land Cover Classifications within the Watershed Study Area

Table 3.4 – National Land Cover Dataset

NLCD Classification	Description	Area (acres)	Percent of Study Area
Grassland / Herbaceous	Gramanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation cover. These areas are not subject to tilling but are used for grazing.	854,054	65.6
Cultivated Crops	Production of annual crops and also perennial woody crops. Crops accounts for greater than 20 percent of total vegetation. This class also includes land being tilled.	217,706	16.7
Shrub / Scrub	Shrubs less than 16 feet tall with canopy typically greater than 20 percent of total vegetation. This class includes shrubs and trees in early successional stages or stunted from environmental conditions.	108,946	8.4
Evergreen Forest	Trees greater than 16 feet tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.	40,083	3.1
Developed, Open Space	A mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of cover. These areas commonly include large-lot, single-family housing units, parks, golf courses, and vegetation planted in developments for recreation, erosion control, or aesthetics.	38,289	2.9
Developed, Low Intensity	A mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 49 percent of total cover. These areas commonly include single-family housing units.	10,760	0.8
Woody Wetlands	Forests or shrublands account for greater than 20 percent and the soil is periodically covered with water.	8,942	0.7
Emergent Herbaceous Wetlands	Perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically covered with water.	8,816	0.7
Developed, Medium Intensity	A mixture of constructed materials and vegetation. Impervious surfaces account for 50 to 79 percent of the total cover. These areas commonly include single-family housing units.	6,078	0.5
Barren Land (Rock/Sand/Clay)	Bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other earthen material. Vegetation accounts for less than 15 percent of total.	3,181	0.2
Pasture / Hay	Grasses, legumes, or mixtures planted for livestock grazing or the production of seed or hay crops on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.	1,867	0.1
Developed, High Intensity	Highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of total cover.	1,770	0.1
Open Water	Open water, usually less than 25 percent cover of vegetation or soil	1,061	0.1
Forest, Other	Forested areas, individually composing less than 0.1 percent of the study area.	847	0.1

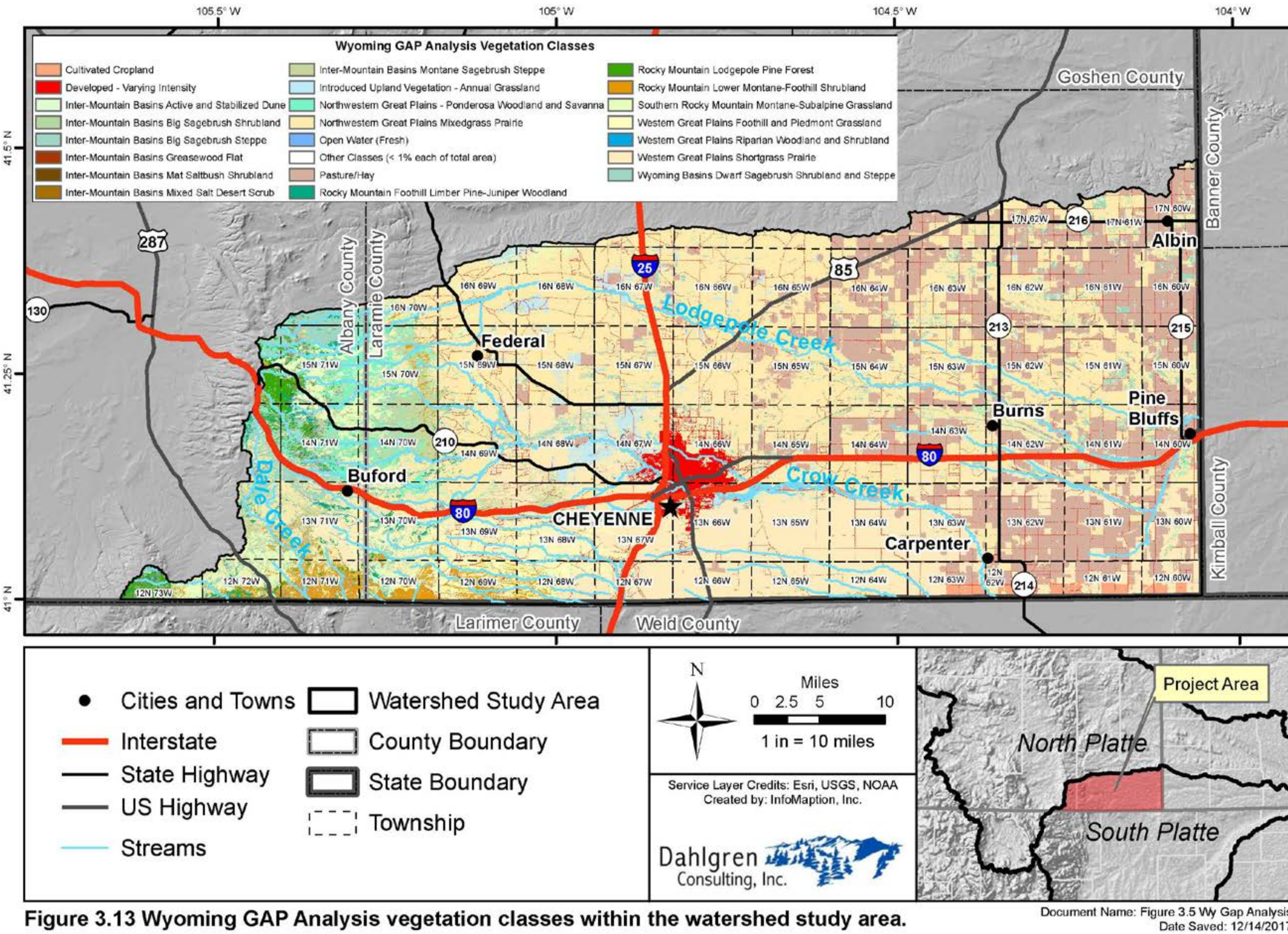


Figure 3.13 Wyoming GAP Analysis vegetation classes within the watershed study area.

Ecological Site Descriptions

The environmental factors experienced by a given site, such as its climate, elevation, soils, hydrology, historic vegetation, and disturbance regimes, largely determine the site's key ecological characteristics. Two sites situated closely on the landscape may be differentiated by variations in the environmental factors they experience. For example, a change in soil type may dramatically change the ecological characteristics between two adjacent sites. Conversely, sites separated in space are often ecologically similar if they experience the same suite and intensity of environmental factors. Ecological sites may thus be categorized according to commonly co-occurring arrangements of soil type, elevation, hydrology, landform, and other such factors.

Specific arrangements of environmental factors that differentiate and describe an ecological site are termed Ecological Site Descriptions (ESD). ESDs are compiled from a wide range of data collected over many years of monitoring by the NRCS (National Resources Conservation Service), BLM, USFS, USGS, and other research entities, and are cataloged in a database maintained by the NRCS.

The full profile of an ESD typically includes the following (adapted from Caudle et al. 2013 and the NRCS):

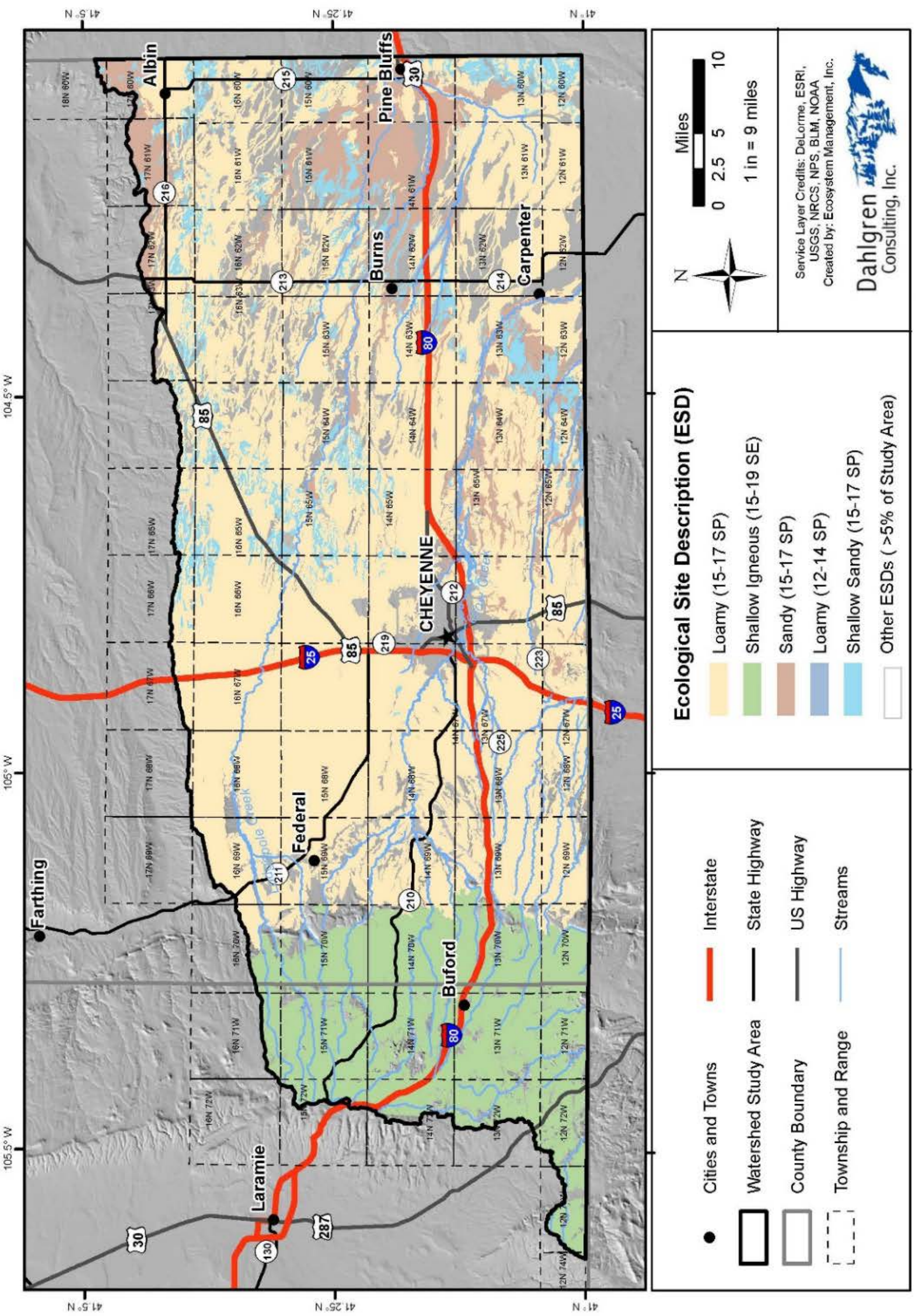
- *Biotic and abiotic characteristics that differentiate the site (i.e., climate, physiographic, soil characteristics, plant communities);*
- *Data used to define the distinctive properties and characteristics of the sites;*
- *Ecological dynamics including how changes in climate, disturbance processes, and management can affect the site;*
- *Site interpretations, including management alternatives for the site and its natural resources;*
- *Supporting information, including relevant literature and data sources*

Like other ecological characteristics, the plant community of a particular site is largely driven by the environmental factors the site experiences. An ESD may include multiple plant communities, which may be alternately favored by changing conditions, such as grazing intensity or drought. An ESD is thus able to describe the plant community and species composition that a site is likely to support under a given set conditions and predict how particular land uses or management strategies may alter the plant community. Range managers and landowners can use ESDs to evaluate current range conditions, compare current species composition with what the site is capable of growing, and identify practices that will favor management objectives.

At a given ecological site, a specific plant community is referred to as its reference or Historic Climax Plant Community (HCPC). The HCPC describes the final-stage successional plant community of the site under historical conditions, and typically exhibits the greatest productivity of any successional community supported by the site (Caudle et al. 2013). The HCPC can be used as an indicator of potential site productivity, by comparing the HCPC to the site's current plant community.

ESD information for the SPRWS was obtained from NRCS web soil survey data from Albany and Laramie Counties (NRCS 2016a). The watershed contains 30 ESDs, which together comprise approximately 98 percent of its total area. The remaining area is either open water and/or land un-classified into an ESD category (including missing data).

The five most extensive ESDs make up approximately 88 percent of the total area in the watershed, and one ESD – Loamy (15-17 SP) – comprises 54 percent of the watershed (refer to Figure 3.14 and Table 3.5 below).



Document Name: Figure 3.6 NRCS Ecological Site Descriptions (ESD)
Date Saved: 12/14/2017

Figure 3.14 NRCS Ecological Site Descriptions (ESD) within the watershed study area.

Table 3.5 **-** NRCS Ecological Site Descriptions (ESD) Within the SPRWS

Ecological Site Abbreviation	Ecological Site ID	Area (Acres)	Percent of Study Area
Loamy (15-17 SP)	R067XY222WY	706,450	54.2
Shallow Igneous (15-19 SE)	R049XA160WY	172,624	13.4
Sandy (15-17 SP)	R067AY250WY	102,950	8.0
Loamy (12-14 SP)	R067AY122WY	91,748	7.1
Shallow Sandy (15-17 SP)	R067XY266WY	67,364	5.2
Gravelly (15-17 SP)	R067XY212WY	29,582	2.3
Igneous (15-19 SE)	R049XY116WY	21,006	1.6
Shallow Loamy (15-17 SP)	R067XY262WY	17,184	1.3
Rocky Hills (15-17 SP)	R067XY234WY	17,045	1.3
Subirrigated (15-19 SE)	R049XY174WY	9,029	0.7
Very Shallow (15-17 SP)	R067XY276WY	7,807	0.6
Saline Subirrigated (15-17 SP)	R067XY242WY	7,240	0.6
Subirrigated (15-17 SP)	R067XY274WY	7,033	0.5
Loamy Plains	R067BY002CO	6,416	0.5
Clayey (15-17 SP)	R067XY204WY	4,471	0.3
Rocky Hills (15-19 SE)	R049XY134WY	3,243	0.3
Loamy(15-19 SE)	R049XY122WY	1,919	0.1
Lowland (15-17 SP)	R067XY228WY	1,057	0.1
Sandstone Breaks	R067BY056CO	869	0.1
Shallow Loamy (15-19 SE)	R049XY162WY	805	0.1
Sandy Plains	R067BY024CO	780	0.1
Loamy (10-14 SE)	R034XY322WY	474	< 0.1
Rocky Hills (10-14 SE)	R034XY334WY	171	< 0.1
Coarse Upland (15-19 SE)	R049XY108WY	110	< 0.1
Salt Meadow	R067BY035CO	61	< 0.1
Loamy Overflow (15-17 SP)	R067XY226WY	53	< 0.1
Gravel Breaks	R067BY063CO	51	< 0.1
Limestone Breaks	R067BY060CO	31	< 0.1
Riverwash		429	< 0.1
Pits, Mines		339	< 0.1

Descriptions of the HCPC for each of the five dominant ESDs in the study area are presented in Appendix B.1 (Gap Vegetations Class Descriptions and Ecological Site Descriptions) of this report.

3.4.2 Targeted and Undesirable Vegetation

Numerous non-native, invasive, noxious, or otherwise undesirable plant species occur within the watershed study area. These species are considered undesirable by landowners and land managers due to their negative impacts on ecosystem integrity, biological diversity, and forage conditions for livestock and wildlife. Undesirable plant species may be either native or non-native. Non-native species generally have greater capacity to disrupt native ecosystems and grazing lands. Non-native plants that become invasive often lack natural controls via herbivory and disease, exhibit colonization and growth strategies that favor rapid spread (particularly in disturbed sites) and thrive under drought conditions or in degraded soils (Van Kleunen et al. 2010, Vila et al. 2011). The consequences of invasive plant encroachment for native ecosystems can be severe, and colonization of grazing lands by invasive or undesirable plant species can significantly reduce forage quality, stocking capacity, and land value.

The State of Wyoming maintains a Designated Weed List under the Wyoming Weed and Pest Control Act (WWPCA), representing species considered to be detrimental, destructive, injurious, or poisonous (Wyoming Department of Agriculture 2016a). These species are shown in Table 3.6, but not all species on this list currently occur in the watershed study area. The WWPCA provides the State with the authority to regulate and manage any species present on the statewide Designated Weed List.

The study area includes both the Albany and Laramie County weed and pest control districts, each of which also maintains a list of declared weeds, specifically targeted for management within the district's boundaries. Table 3.7 shows the list of these weeds in Albany County and Table 3.8 shows the list of these weeds in Laramie County (Wyoming Department of Agriculture 2016b).

Weed and pest control districts provide site inspections, funding, and assistance with herbicide application and other mitigation strategies for landowners and municipalities to combat weed outbreaks. Under the WWPCA, county weed and pest control districts may inspect properties for declared weeds, and require landowners to take action to eradicate infestations.

It is important to note that numerous invasive or undesirable plant species occur within the study area that are not present on any of these lists, including problematic and highly invasive species such as Russian thistle (Salsola sp.) and buffalobur (Solanum rostratum). Efforts to control the spread of such species are beneficial but may not receive support from local or state weed control agencies.

Table 3.6 - Wyoming Designated Weed List

Scientific Name	Common Name
Agropyron repens	Quackgrass
Arctium minus	Common burdock
Cardaria draba and Cardaria pubescens	Hoary cress (whitetop)
Carduus nutans	Musk thistle
Carduus acanthoides	Plumeless thistle
Centaurea diffusa	Diffuse knapweed
Centaurea maculosa	Spotted knapweed
Centaurea repens	Russian knapweed
Chrysanthemum leucanthemum	Ox-eye daisy
Cirsium arvense	Canada thistle
Convolvulus arvensis	Field bindweed
Cynoglossum officinale	Houndstongue
Elaeagnus angustifolia	Russian olive
Euphorbia esula	Leafy spurge
Franseria discolor	Skeletonleaf bursage
Hyoscyamus niger	Black henbane
Hypericum perforatum	Common St. Johnswort
Isatis tinctoria	Dyers woad
Lepidium latifolium	Perennial pepperweed
Linaria dalmatica	Dalmatian toadflax
Linaria vulgaris	Yellow toadflax
Lythrum salicaria	Purple loosestrife
Onopordum acanthium	Scotch thistle
Sonchus arvensis	Perennial sowthistle
Tamarix sp.	Saltcedar / Tamarisk
Tanacetum vulgare	Common tansy

Table 3.7- Albany County Declared Weeds.

Scientific Name	Common Name
Bromus tectorum	Cheatgrass
Delphinium geyeri	Plains larkspur / Geyer larkspur
Oxytropis sp.	Locoweed

Table 3.8 - Laramie County Declared Weeds.

Scientific Name	Common Name
Aegilops cylindrical	Jointed goat grass
Cenchrus incertus	Sandbur
Delphinium geyeri	Plains larkspur / Geyer larkspur
Echium vulgare	Viper’s bugloss
Glycyrrhiza lepidota	Wild licorice
Heterotheca villosa	Hairy goldenaster
Opuntia polyacantha	Plains pricklypear
Tribulus terrestris	Puncturevine
Verbascum thapsus	Common mullein

3.4.3 Wetlands

The U.S. Fish and Wildlife Service (USFWS) compiles and maintains the National Wetlands Inventory (NWI), a system for mapping and classifying wetland sites within the United States. The NWI classifies wetlands into distinct categories, according to their hydrologic, vegetative, and soil characteristics. These characteristics are determined primarily via aerial and Landsat imagery, as well as field site visitations. Geospatial NWI data identifies approximately 17,910 acres of wetland within the study area, comprising approximately 1.5 percent of its total area.

Figure 3.15 shows the wetlands within the watershed. The majority of NWI wetlands in the study area are quite small relative to the size of the study area. Smaller wetlands may be easily overlooked in this figure. Further, the extent of wetlands, particularly emergent wetlands and pond complexes, may change dramatically from wet years to dry years. Given these considerations, more precise delineation wetlands via field inspections will be beneficial during the planning stages of projects.

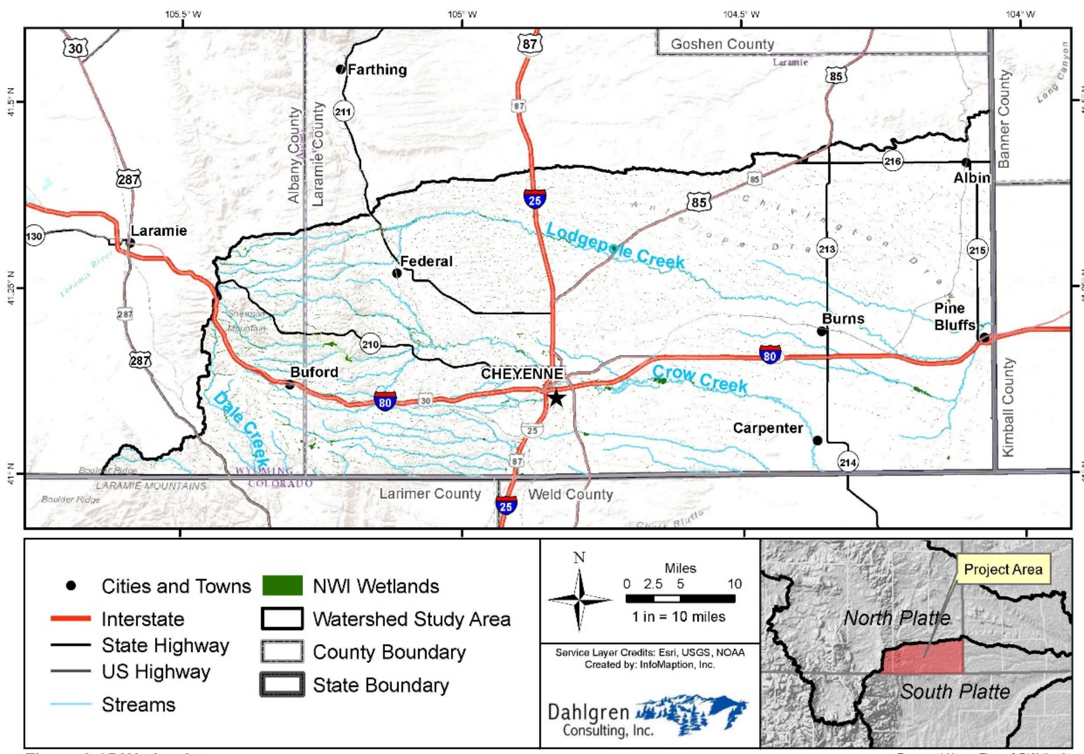


Figure 3.15 Wetlands

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Figure 3.16 is a larger scale or more detailed map showing the wetlands near Cheyenne only. This figure illustrates that wetlands are present, even though these wetlands are not well shown in Figure 3.15. The GIS data prepared for this Study has the mapped wetland data and larger scale maps can be prepared using this data.

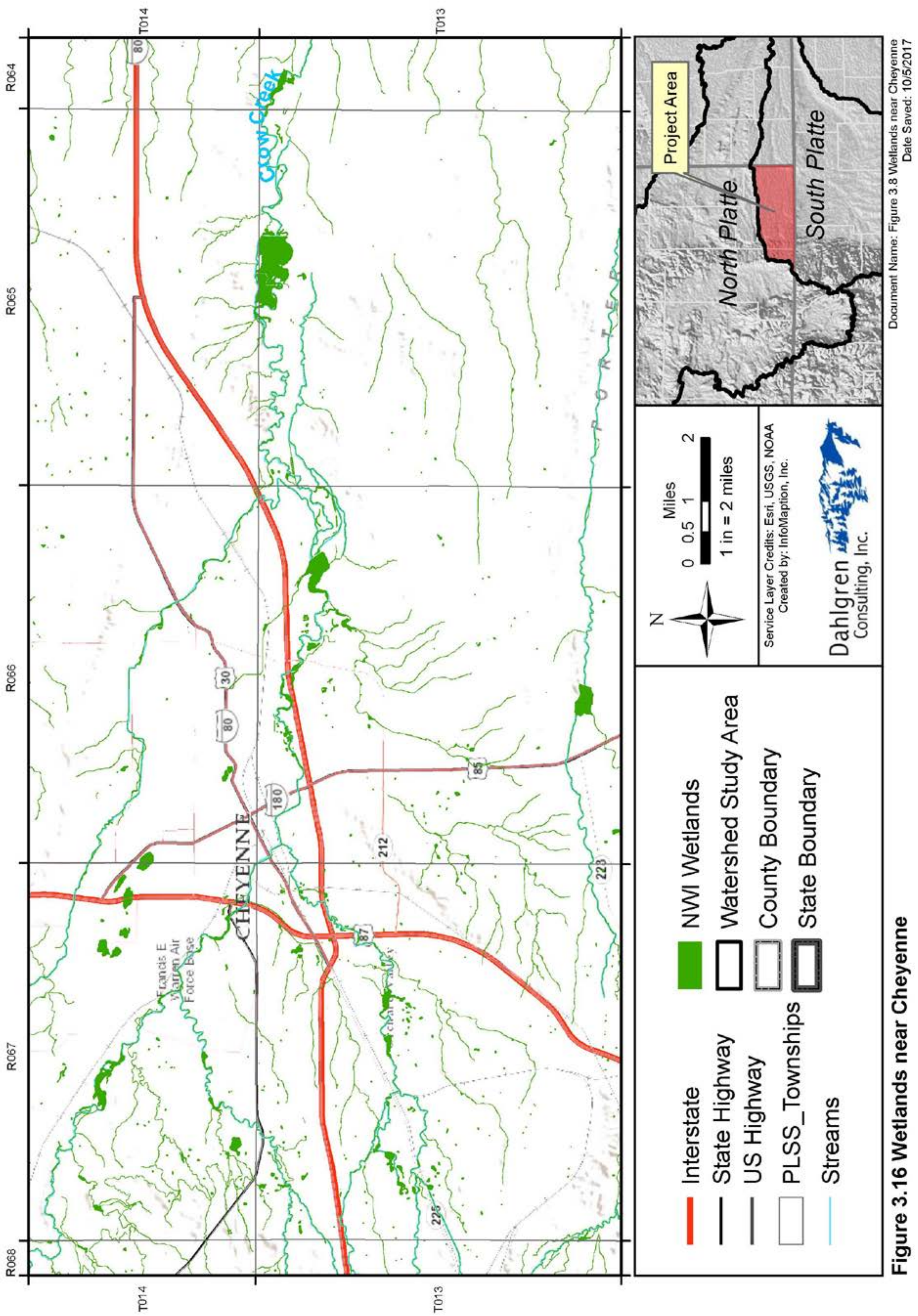


Figure 3.16 Wetlands near Cheyenne

Most wetlands are associated with major creeks, such as Crow Creek, Lodgepole Creek, and Lone Tree Creek, and the tributaries of these creeks. All wetlands in the study area can be classified into five general National Wetland Inventory categories:

- *Riverine,*
- *Freshwater Emergent Wetland,*
- *Freshwater Forested / Shrub Wetland*,
- *Freshwater Pond,* and
- *Lake.*

Table 3.9 summarizes the data concerning the wetlands within the Watershed. Riverine and freshwater emergent wetlands are the dominant NWI categories in the study area.

Table 3.9 - Summary of NWI Wetland Categories in the Watershed Study Area.

Wetland Type	Area (acres)	% of Total Wetland Area
Riverine	8,930	49.8
Freshwater Emergent Wetland	6,190	34.6
Freshwater Forested / Shrub Wetland	1,200	6.7
Freshwater Pond	920	5.1
Lake	670	3.7
Total	**17,910**	**100.0**

The Nature Conservancy (TNC), in partnership with USFWS and Wyoming Game and Fish Department (WGFD), has delineated 222 major clusters of wetlands across Wyoming, described as “wetland complexes” (Copeland et al. 2010). Wetland complexes are groups of multiple wetlands situated in relatively close proximity. Wetland complexes, particularly those composed of wetlands that vary in characteristics such as size, hydrology, chemistry, depth, and vegetation community, often support unusually high levels of biological diversity and species abundance, and provide critical habitat for many species. Because of this broad ecological importance, wetland complexes are common targets for conservation efforts.

All or part of four mapped wetland complexes occur within the watershed study area (Figure 3.10). The numerical wetland complex ID presented in Copeland et al. (2010) is shown and represented in Table 3.10. Copeland et al. (2010) categorized wetland complexes according to numerous indices, such as overall condition, biological diversity, and vulnerability. Profiles of each wetland complex in the watershed study area, drawn from Copeland et al. (2010), are presented in Table 3.10.

Table 3.10 - Wetland Complexes within the Watershed Study Area

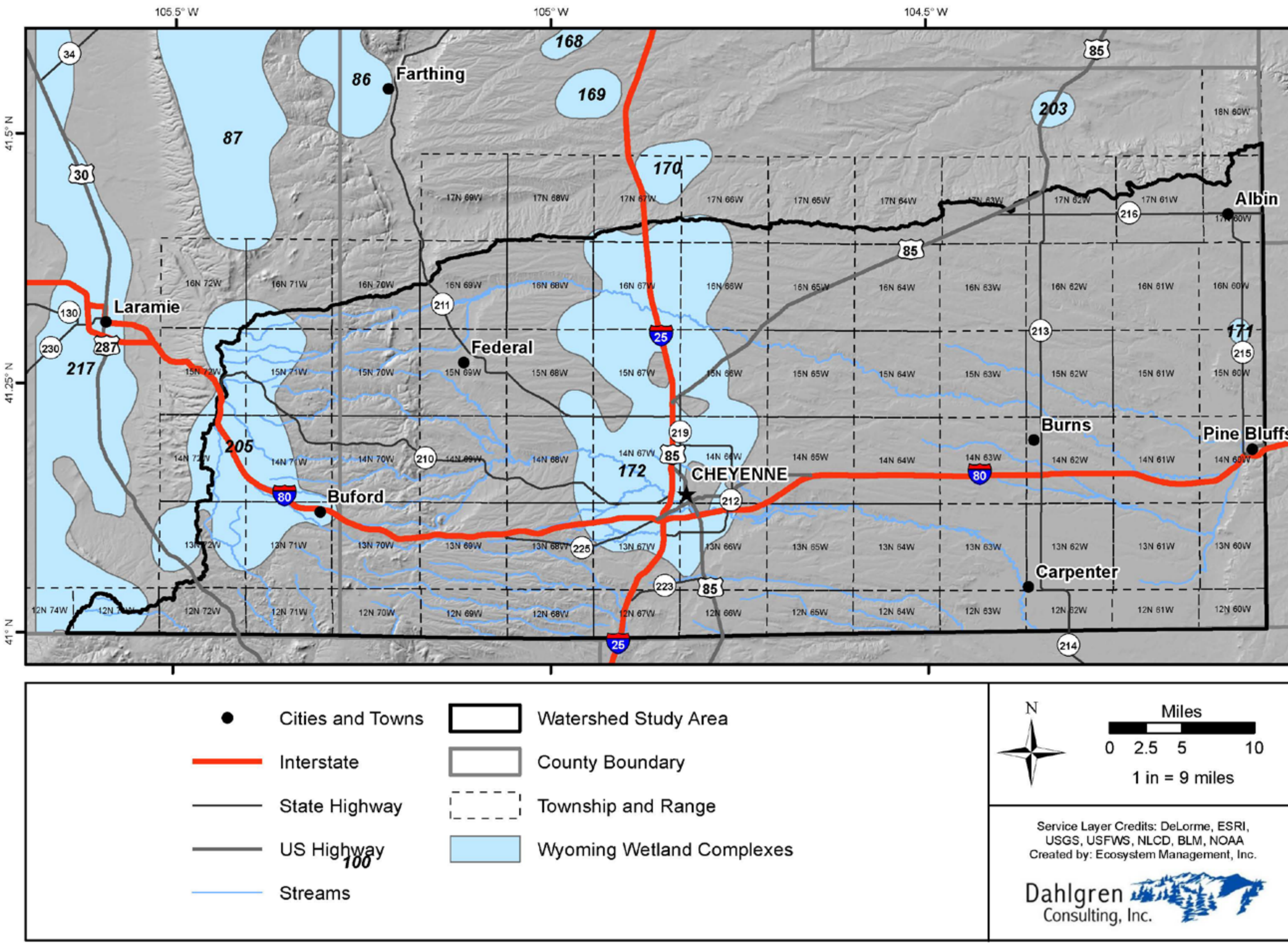
Wetland Complex ID No.	Wetland Density	Overall Condition	Biological Diversity	Vulnerability
171	medium-low	Low	high	low
172	medium-low	Low	medium-high	medium
205	medium-low	Fair	medium	low
217	medium-high	Fair	low	medium

The Wyoming Joint Ventures Steering Committee (WJVSC; WJVSC 2010) identified 31 of Wyoming’s wetland complexes as ‘priority complexes,’ based on their high biological diversity scores as estimated in Copeland et al. (2010). A subset of these priority complexes were also deemed ‘primary focus complexes,’ due to significate potential for wetland habitat improvement projects in these areas (Wyoming Joint Ventures Steering Committee, 2010). Between 2010 and 2020, the WGFD will emphasize these primary focus complexes when planning and implementing wetland improvement projects (WJVSC 2010). One of the four wetland complexes in the watershed study area (complex 217, Laramie Plains) was classified by WJVSC (2010) as a primary focus complex. The Laramie Plains wetlands complex is located in the extreme southwestern corner of the watershed study area (refer to Figure 3.17).

The U.S. Army Corps of Engineers (USACE) classifies wetlands into seven relatively coarse, watershed-scale categories, based on hydrological and geomorphic wetland characteristics. The USACE describes these hydrogeomorphic classifications below (adapted from Smith et al. 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. Water source refers to the location of water just prior to entry into the wetland. Hydrodynamics refers to the energy level of moving water, and the direction that surface and near-surface water moves in the wetland.*

The seven wetland categories utilized by USACE are depressional, lacustrine fringe, tidal fringe, slope, riverine, mineral flat, and organic flat. Depressional, lacustrine fringe, slope, and riverine wetlands occur within the study area. (Descriptions of these USACE wetland categories are contained in Appendix B.2 of this report.)



Document Name: Figure 3.9 Wetland complexes within the watershed study area
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Figure 3.17 Wetland complexes within the watershed study area; from Copeland et al. (2010).

Section 3.5 U.S. Endangered Species Act Protected Species and Critical Habitats

3.5.1 U.S. Endangered Species Act Protected Species and Critical Habitats

The U.S. Endangered Species Act (ESA), administered by the USFWS, is intended to protect and recover vulnerable species and their habitat. Under the ESA, species may be classified as ‘endangered,’ ‘threatened,’ or ‘candidate.’ An ‘endangered’ classification designates the species as in danger of extinction throughout all or a significant portion of its range. Species classified as ‘threatened’ have the possibility to become endangered within the foreseeable future. Species classified as ‘candidate’ are those in consideration for listing as endangered or threatened under the ESA.

The ESA provides a number of protections for listed species. It requires federal agencies to ensure that any actions they execute, permit, or fund are not likely to jeopardize the survival of listed species or damage critical habitat. Official consultation with the USFWS regarding ESA protections is typically required prior to any land management actions that are executed by federal agencies, take place on federal lands, or involve federal funds or permits. It is usually the responsibility of the project manager, proponent, or executor to initiate consultation with USFWS. If federal agencies, lands, permits, or funds are not involved in a proposed action, prior consultation with the USFWS on ESA protections is typically not required. Projects undertaken on private land, for example, are not likely to be subject to USFWS review prior to initiation. However, the ESA does stipulate legal restrictions for endangered species on private property, including prohibitions against killing, hunting, collecting, harassing, possessing, or otherwise harming listed species.

Table 3.11 lists species protected under the ESA that are known to occur in the watershed study area, have the potential to occur within its boundaries, or warrant ESA protections due to potential downstream impacts from activities within study area. Listed or candidate species include 4 birds, 4 mammals, one amphibian, two fish, one insect, and 4 plants (USFWS 2016a, b). Brief accounts of those species that may have potential to influence water development projects in the watershed study area are presented in Section 3.5.3.

3.5.2 – Critical Habitats

When a species is proposed for listing under the ESA, the USFWS determines if there are specific geographic areas essential to the conservation of the species. If such areas exist, USFWS may designate them as critical habitat. A critical habitat may include areas that support populations or are not occupied by the species but are considered essential to its recovery. Within critical habitat boundaries, federal agencies are required to make special efforts to protect the ecological characteristics of these areas and the features that make them essential for the conservation of the listed species. Under the ESA, the USFWS must be consulted prior to any actions within critical habitat that require federal agency involvement, funding, or authorization. The purpose of this consultation is to prevent damage to critical habitat for listed species. It is important to note that designated critical habitats generally have little impact on actions that do not involve federal agencies. Projects undertaken on private land within the boundaries of critical habitat for a listed species, for example, typically do not require USFWS consultation.

The USFWS frequently attempts to reach Wildlife Extension Agreements (WEA) with private landowners rather than designating critical habitat on private land. Under a WEA, a landowner partners with USFWS to accomplish specific conservation goals for the species in question, guided by a project plan developed by the USFWS. These agreements, which may provide USFWS funding for management practices benefitting the listed species, are intended to reduce conflicts with landowners over the ESA and critical habitat designation.

Only one species, the Colorado butterfly plant (section 3.5.3.5 below), has designated critical habitat within the watershed study area (USFWS 2005). Five sites (or 'Units') exist, all of which are narrow riparian corridors buffering Lodgepole Creek, Lone Tree Creek, and Diamond Creek and its tributaries (Figure 3.18). Communication with the USFWS during the early planning stages of any projects proposed within or adjacent to these areas will minimize the potential for conflicts. Critical habitat has also been designated near, but outside, the watershed study area for the Mexican Spotted Owl and Preble's Meadow Jumping Mouse.

Table 3.11 Protected Species Known to Occur in the SPRW Area

Species	ESA Status	Occurrence in Study Area	Comments
Least Tern	Endangered	No	No occurrence within the study area; potential impacts would be limited to downstream effects on populations outside the watershed. Small water projects and other limited water developments are unlikely to impact this species. The nearest population occurs on the Platte River in central Nebraska.
Piping Plover	Endangered	No	No occurrence within the study area; potential impacts would be limited to downstream effects on populations outside the watershed. Small water projects and other limited water developments are unlikely to impact this species. The nearest population occurs within the Platte River watershed in southeastern Colorado and Nebraska.
Whooping Crane	Endangered	No	No occurrence within the study area; potential impacts would be limited to downstream effects on populations outside the watershed. Small water projects and other limited water developments are unlikely to impact this species. Whooping cranes occur in the wild in only three locations, the nearest of which is in Wisconsin.
Mexican Spotted Owl	Threatened	Potential	The study area is near the northern edge of this species' range; suitable habitat is limited to portions of the Laramie mountains. Habitat is old growth / mature coniferous and mixed forests, associated with canyons and cliffs near water. This habitat is uncommon in the project area, but proposed projects in forested habitat should be examined for impacts on this species.
Black-footed	Endangered: *Experimental*	Potential	This species is not likely to occur in the study area. Reintroduced populations, designated as *Experimental,*

Species	ESA Status	Occurrence in Study Area	Comments
Ferret	, *Non-Essential*		*Non-Essential* under the ESA, exist immediately south of the watershed in Colorado. Dispersal into the study area from these populations is possible but is unlikely to have yet occurred.
Canada Lynx	Threatened	Potential	Habitat for this species is limited to portions of the Laramie mountains. Suitable habitat is closely tied to the abundance of preferred prey (snowshoe hares), which typically favor disturbed and sub-climax forest communities with dense cover, such as recovering burned areas or clearcuts. This habitat is not extensive in the project area, but proposed projects in forested habitat should be examined for impacts on this species.
North American Wolverine	Proposed Threatened	Potential	Habitat for this species is limited to portions of the Laramie mountains; preferred habitat is high-elevation alpine areas near timberline, but this species ranges widely and also utilizes other mountainous habitats. Small water projects and other developments associated with this watershed study are unlikely to impact this species.
Preble's Meadow Jumping Mouse	Threatened	Yes	This species inhabits mature grassland / meadow sites adjacent to perennial flowing water, with well-developed vegetation but little canopy cover. This habitat is uncommon in the study area, but water development projects should be examined for potential impacts to this species. No designated critical habitat exists in the study area.
Wyoming Toad	Endangered	No	This species is known from only a small area of Albany County southwest of the study area. Occurrence within the study area is improbable; water development projects related to this watershed study are not expected to impact this species.
Pallid Sturgeon	Endangered	No	No occurrence within the study area; potential impacts would be limited to downstream effects on populations outside the watershed. Small water projects and other limited water developments are unlikely to impact this species. The nearest population occurs within the Missouri River near its confluence with the Platte.
Greenback cutthroat Trout	Threatened	No	No occurrence within the study area. The historic range of this species likely included a small portion of the South Platte watershed in Wyoming, but current range is dramatically reduced. This species is not recognized by USFWS or WYGFD as occurring in the watershed study area.
Western Prairie Fringed Orchid	Threatened	Potential	Occurrence is unlikely within the study area; the nearest known population occurs in central Nebraska. Habitat is calcium-rich meadows, marshes, oxbows, and other wetlands. Potential impacts on this species should be evaluated for proposed projects occurring in suitable habitat with appropriate soils. Surveys should coincide with the flowering period (June – August).
Ute Ladies'-	Threatened	Yes	This species has been documented in the study area. Habitat is waterway margins, wet meadows, oxbows, and

Species	ESA Status	Occurrence in Study Area	Comments
Tresses			other mesic / riparian sites in a variety of soils. Modification of riparian habitat has been identified as a threat to this species. Potential impacts should be considered for proposed projects occurring in suitable habitat. Surveys should coincide with the flowering period (July-September).
Colorado Butterfly Plant	Threatened	Yes	This species has been documented in the study area, and critical habitat has been designated at five locations within the watershed. Nine *Wildlife Extension Agreements* (WEAs) between USFWS and private landowners occur for this species within the watershed. Habitat is wet or mesic sites such as floodplain meadows and oxbows, along streams active within their floodplain areas. Potential impacts should be considered for proposed projects occurring in suitable habitat, or for projects associated with critical habitat or WEAs. Surveys should coincide with the flowering period (June-October).
North Park Phacelia	Endangered	No	No occurrence within the study area; this species is found only in northern Jackson County in Colorado within a single 10 square mile area. Small water projects and other developments associated with this watershed study are unlikely to impact this species.

3.5.3 Endangered Species Identified within the Study Area

3.5.3.1 Black-footed Ferret

The black-footed ferret was classified as federally endangered in 1967 (USFWS 1967). The species inhabits open prairie, plains, grasslands, and desert scrub habitats in association with prairie dog towns. Black-footed ferrets are extremely rare; only several hundred individuals currently exist in the wild, and no ferrets are known to occur in the watershed study area. However, reintroduced populations have been established to the west of the study area in Shirley Basin, and immediately south of the study area in Soapstone Natural Area of Larimer County, Colorado. It is unlikely that ferrets have dispersed into the study area from either of these reintroduction sites (USFWS 2015a). Considerable distance and habitat barriers separate the study area and the Shirley Basin population, and the Soapstone population is small and only recently established. Since the onset of ferret reintroduction efforts, dispersal from 24 reintroduction sites across the western U.S. to adjacent areas has been slow and fairly limited (USFWS 2013). Nonetheless, future expansion of this species into the watershed study area is possible. The USFWS considers all black-footed ferrets in Wyoming to originate from reintroduced populations, and thus classifies ferret populations statewide as ‘Experimental, Non-Essential’ under Section 10(j) of the ESA (USFWS 2015a). Such populations are not granted many of the protections normally provided by the ESA, and exist under considerably reduced regulatory restrictions, allowing agencies, landowners, and stakeholders to generally proceed with normal activities within and around the reintroduction area (USFWS 2012). The goal of this designation is to provide greater management flexibility for reintroduced populations, ideally reducing conflicts and weakening barriers to population recovery.

3.5.3.2 Preble's Meadow Jumping Mouse

This species was listed as federally threatened in 1998 (USFWS 1998); this status was reviewed and upheld in 2011 (USFWS 2011). It inhabits mature riparian meadow habitats with little woody vegetation: highly productive foraging sites where wetland vegetation reaches its full growth potential. Rich forage allows individuals to accumulate the fat deposits required for their unusually long winter hibernation. These sites are typically found only in association with perennial flowing water. In addition, individual jumping mice also need intact upland areas (areas up gradient and beyond the floodplain of rivers and streams) for nesting and hibernation (USFWS 1998). Most water sources within the watershed study area are unsuitable for this species due to these highly specific habitat requirements.

Little is known about the current patterns of occurrence and distribution of the Preble's Meadow Jumping Mouse in the watershed study area. However, the species has been recently captured within the watershed study area, and much of the South Platte River drainage is within the species' historical range (USFWS 2016c, Beauvais 2001). Populations could be realistically expected to exist within the study area. The most recent USFWS Recovery Plan (USFWS 2016c) for the Preble's meadow jumping mouse emphasizes the watershed study area as an important region for the species' long-term recovery goals. The Plan specifically identifies four major hydrologic unit sub-basins within the study area (Lodgepole Creek, Crow Creek, Lone Tree Creek, and Cache la Poudre River) for Preble's meadow jumping mouse recovery. Within each of these hydrologic unit sub-basins, the USFWS plans to perform surveys for this species in suitable habitats from 2017 to 2019, with the goal of locating three distinct populations in each. If these populations are found, they will be monitored and targeted for growth under a broader, range-wide species recovery strategy (USFWS 2016c).

No designated critical habitat for the Preble's meadow jumping mouse exists in the study area. However, critical habitat does occur to the south of the study area along the North Fork of the Cache la Poudre River in Larimer County, Colorado (USFWS 2005a).

Impacts on the Preble's meadow jumping mouse should be considered for water developments proposed in mature riparian meadow sites. Proposed projects on federal lands may require USFWS consultation to avoid conflicts with this species.

3.5.3.3 Mexican Spotted Owl

The Mexican Spotted Owl was listed as federally threatened in 1993 (USFWS 1993). This species typically inhabits mature mixed-conifer, pine-oak, and canyon habitats and is often associated with steep slopes and cliff/canyon complexes. High canopy closure and tree density is an important component in breeding and wintering habitat, along with proximity to water. There is also a preference for habitat containing large, downed or standing woody debris and snags. Winter habitat includes lower-elevation piñon–juniper forests and mixed, uneven-aged coniferous forests. Such areas are unlikely to be used during nesting and breeding season unless they are associated with canyons (USFWS 2004). Potential habitat for this species in the study area is limited to the Laramie Mountains associated with the headwaters of the major streams within the watershed. The grasslands and shrublands that dominate the study area are not suitable habitat for the Mexican Spotted Owl. No designated critical habitat for this species exists in the watershed (USFWS 2004).

3.5.3.4 Wyoming Toad

The Wyoming toad is an extremely rare species, recognized as the most endangered amphibian in North America. The toad was listed as federally endangered in 1984 (USFWS 1984). It is known to occur in the wild only within Mortensen Lake National Wildlife Refuge and two nearby private land sites in Albany County; these populations are the result of reintroductions from a captive breeding program. The historic range of the Wyoming toad is very small, including only ponds, marshes, floodplains and other wet sites associated with the Laramie River in Albany County. It was once common, but populations crashed dramatically in the 1970’s. The exact causes of this decline are not known, though chytrid fungus, aerial spraying of pesticides, disease, and habitat alteration likely played a role (USFWS 2015b). All known populations of this species are outside the watershed study area. Due to the extreme rarity of this species and its limited geographic range, it is unlikely that projects associated with this study will impact the Wyoming toad.

3.5.3.5 Colorado Butterfly Plant

This perennial herb is an endemic species to the South Platte watershed and a species of key concern to this watershed study. It is listed as federally threatened, has designated critical habitat within the watershed study area, and is only found near flowing water (USFWS 2000, 2005b). To minimize the potential of ESA conflicts over this species, water developments or other projects undertaken in the study area should be carefully examined at early stages for potential impacts on the Colorado butterfly plant. Official consultation with the USFWS with respect to this species may be required for some projects, particularly those involving federal agencies, lands, funding, or permits.

The Colorado butterfly plant is a member of the evening primrose family found only on the shortgrass prairie plains of southeastern Wyoming, northeastern Colorado, and possibly western Nebraska. It grows in moist soils associated with mesic or wet floodplain meadows, along streams with active floodplains and limited channelization. All known populations occur at elevations between 5,000-6,400 feet (USFWS 2000). Plants typically grow in clusters of individuals a short distance above the active stream channel. Suitable habitat is generally open, with limited competing vegetation.

Individuals of the Colorado butterfly plant are short lived, but produce tall reddish stems that are 2-3 feet in height and distinctive when present. Flowers of this species are small (0.25 – 0.5 inches) but also distinctive, with light-red sepals and white petals that become pink or red with age. Multiple flowers are typically present on each plant during its flowering period. Non-flowering plants consist of a basal rosette lacking a stem, with oblong, hairless leaves 1–7 inches long. To be effective, surveys for the Colorado butterfly plant must be conducted during its flowering period, which occurs between June–October (USFWS 2000).

The USFWS has designated five areas within the watershed study area as critical habitat for the Colorado butterfly plant (USFWS 2005b), within critical habitat units 5, 6, and 7 for this species (Figure 3.18). Unit 5 consists of 902 acres along 12.7 miles of western Lodgepole Creek (Figure 3.19); Unit 6 consists of two separate reaches of eastern Lodgepole Creek, totaling 378 acres along 5.2 miles (Figure 3.20); and Unit 7 consists of 486 acres along 7.6 miles of Lone Tree Creek, Diamond Creek, and tributaries of the latter (Figure 3.21). All units are within Laramie County, and are primarily constituted by private lands with some Wyoming state lands present. In surveys conducted by USFWS and other researchers since 2000, populations of the Colorado butterfly plant have been regularly found in each unit. Surveys have also reliably documented the four 'primary constituent elements' (PCEs) required for critical habitat designation in this species (PCEs represent the key features of suitable habitat for the plant; USFWS 2005b).

The USFWS has identified similar conservation concerns and management targets for the Colorado butterfly plant within each critical habitat unit inside the study area (USFWS 2005b). These include (1) encouraging grazing practices that benefit the plant, in some areas increased grazing may help to maintain appropriate levels of open habitat, whereas reduced grazing in other areas would relieve herbivory pressure on the species, (2) water management that maintains adequate surface or subsurface flows in streams associated with critical habitat, and (3) noxious weed control and suitable herbicide use. Habitat fragmentation due to urban and residential development is a potential concern for Unit 7 (USFWS 2005b).

The study area also includes nine distinct Wildlife Extension Agreements (WEAs) between private landowners and the USFWS for the Colorado butterfly plant (Reeves 2016). Under a WEA, landowners partner with USFWS to accomplish specific conservation goals for a listed species. These agreements, which may include USFWS funding for management practices benefitting the listed species, are intended to reduce conflicts with landowners over the ESA and avoid critical habitat designation on private land. All WEAs in the study area for the Colorado butterfly plant are near to or adjoining a critical habitat unit.

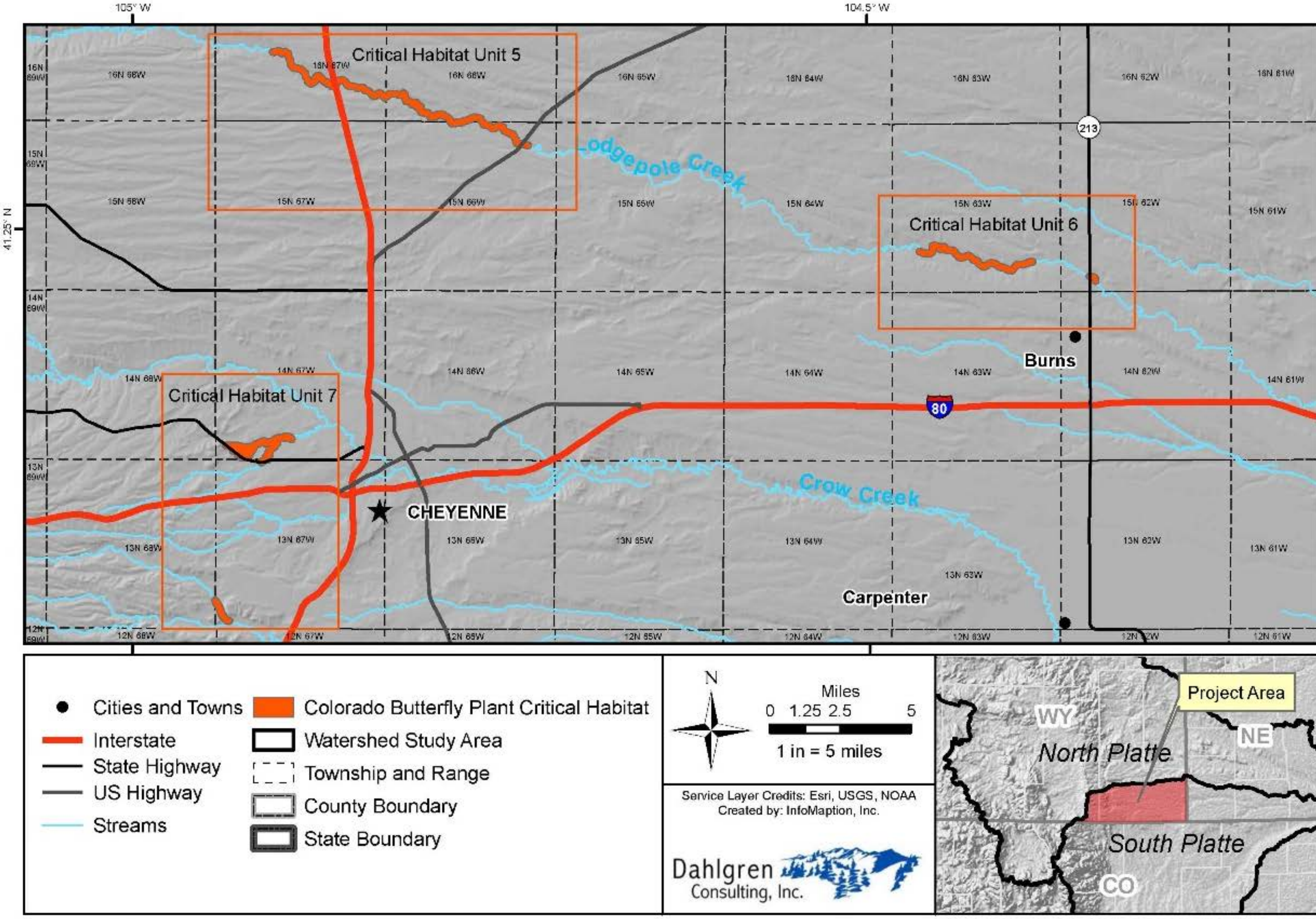

Figure 3.18 Designated critical habitat for the Colorado butterfly plant (Gaura neomexicana var. coloradensis) in the watershed study area.

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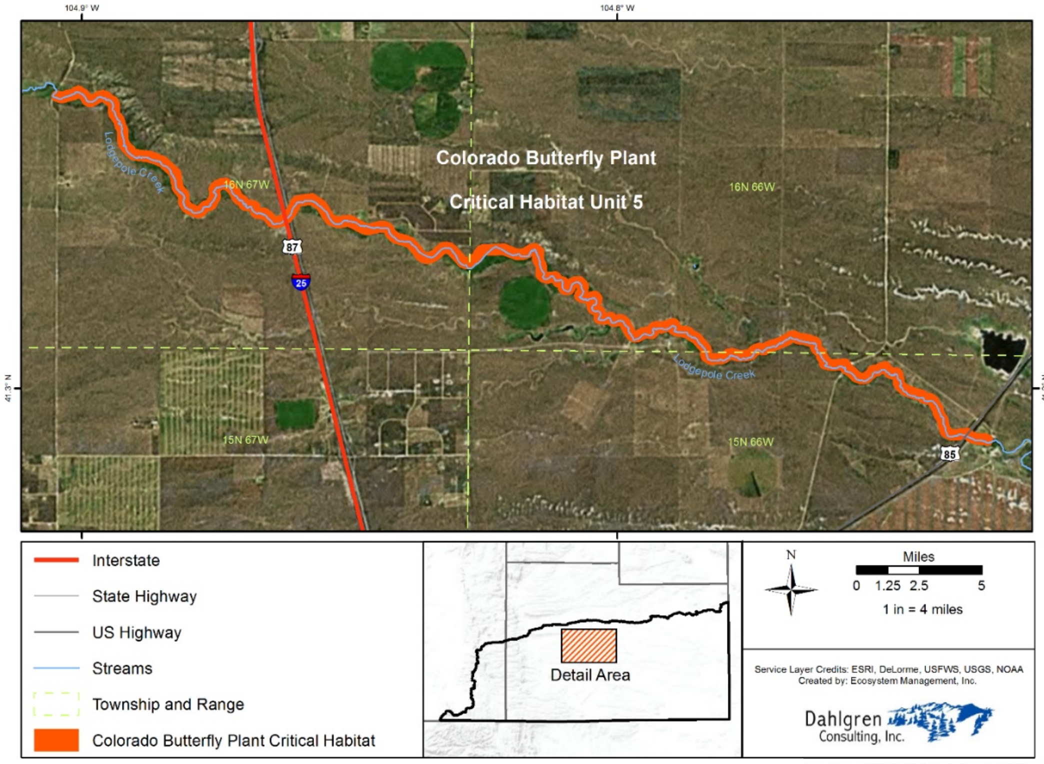

Figure 3.19. Colorado butterfly plant (Gaura neomexicana var. coloradensis) Critical Habitat Unit 5 along Lodgepole Creek.

ument Name: SPRWS_CO Butterfly Plant_Unit 5_EMI
Date Saved: 12/11/2016

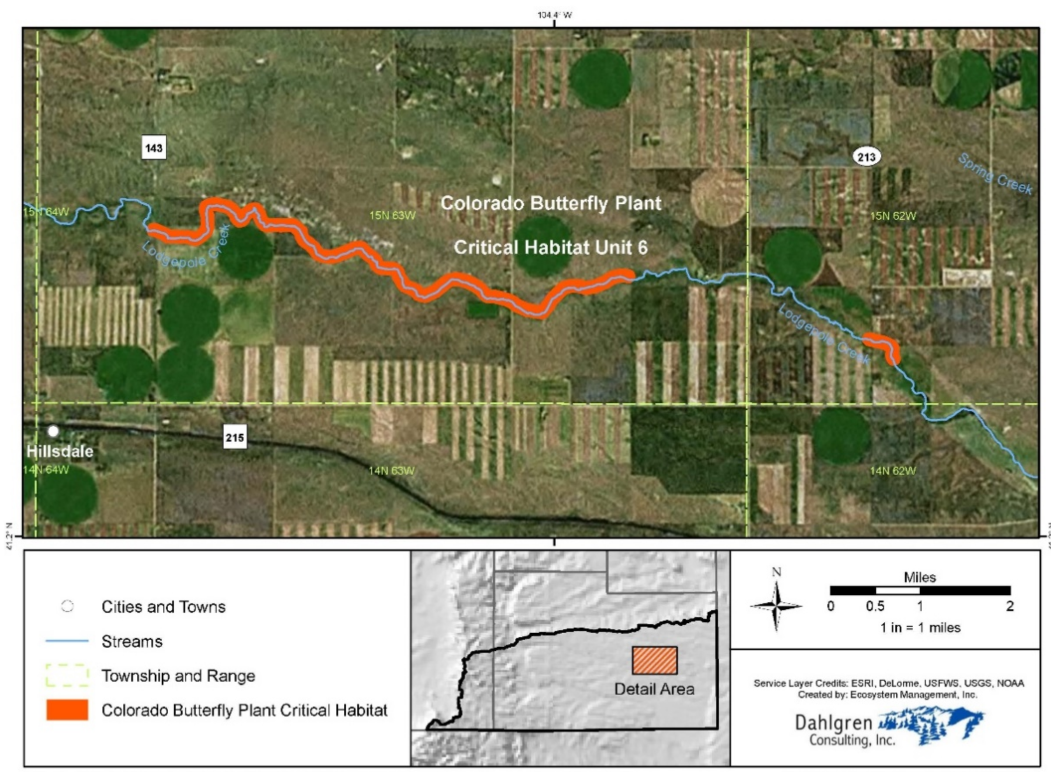

Figure 3.20. Colorado butterfly plant (Gaura neomexicana var. coloradensis) Critical Habitat Unit 6 along Lodgepole Creek.

Document Name: SPRWS_CO Butterfly Plant_Unit 6_EMI
Date Saved: 3/28/2017

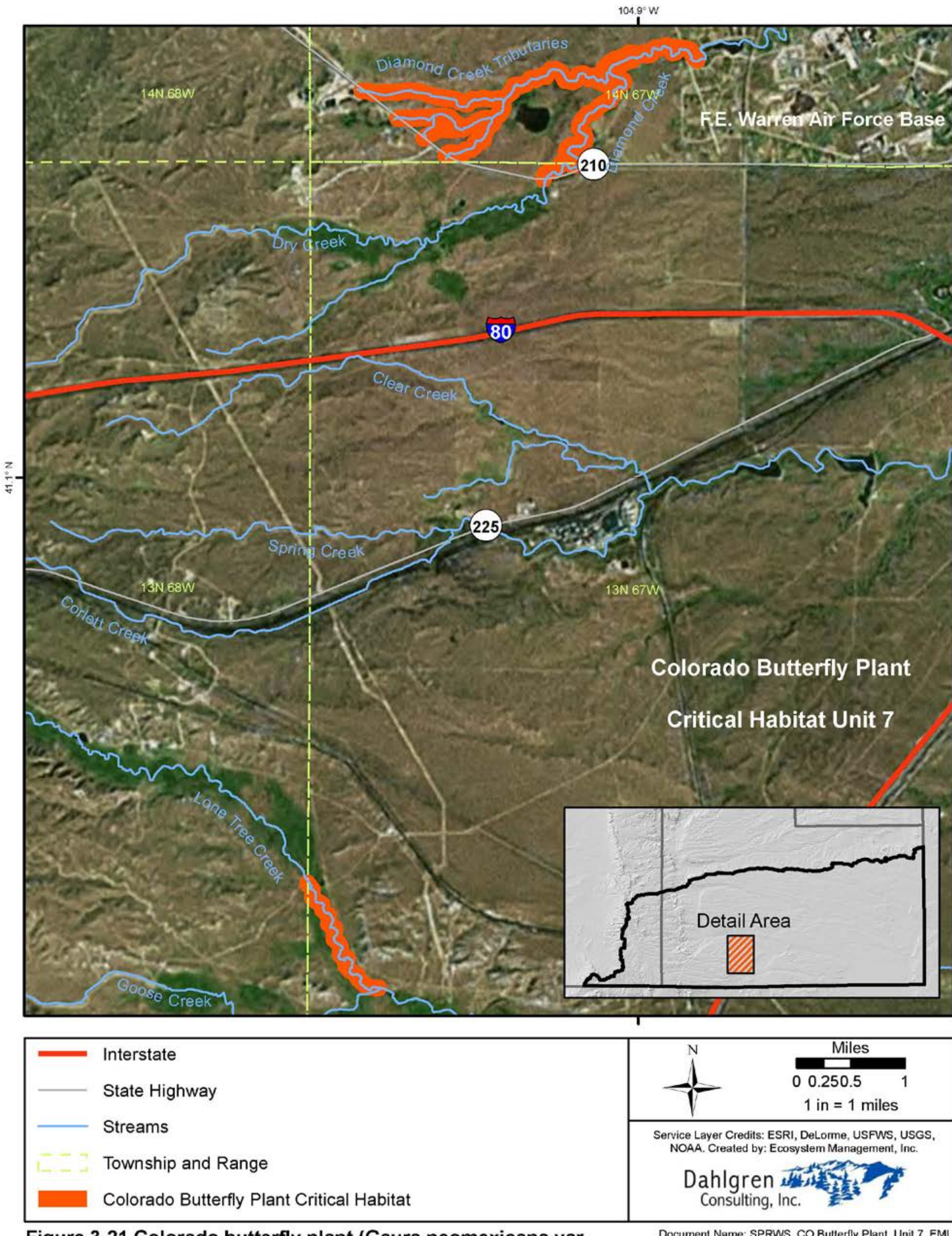

Figure 3-21 Colorado butterfly plant (Gaura neomexicana var. coloradensis) Critical Habitat Unit 7 along Lone Tree and Diamond Creeks.

Document Name: SPRWS_CO Butterfly Plant_Unit 7_EMI
Date Saved: 8/2/2017

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3.5.3.6 Ute Ladies'-Tresses

The Ute ladies'-tresses orchid is also a species of key concern to this watershed study. It was listed as federally threatened in 1992, and typically grows in moist, open sites associated with water (USFWS 1992). While no designated critical habitat exists for this species in the watershed study area, potential habitat is common, and surveys have detected multiple populations of this species in Laramie County and Platte County immediately to the north of the study area (Heidel 2007). Proposed projects in the study area that are associated with wetlands, meadows, floodplains, or previously documented populations of this species, should be carefully examined at early stages for potential conflicts with Ute ladies'-tresses. Official consultation with the USFWS on this species may be required for projects involving federal agencies, lands, funding, or permits.

Ute ladies'-tresses typically occupies moist soils associated with riparian corridors, including subirrigated meadows, floodplains, streamsides, oxbows, irrigation ditch margins and other mesic sites. Consistent soil moisture throughout the summer is likely an important component of suitable habitat. In general, the species grows in open grass or forb dominated sites but may also be found in riparian woodlands (USFWS 1995). The known elevation range for Ute ladies'-tresses in Wyoming is 4,650–5,420 feet (Heidel 2007).

Ute ladies'-tresses is a perennial herb of the orchid family, which reaches 8-20 inches in height. Mature individuals have erect stems with a tapering inflorescence that supports large number of showy, ivory-white flowers. Individual flowers are small and arrayed in a distinctive spiral pattern around the inflorescence. Ute ladies'-tresses typically blooms from July–September; the typical peak flowering period in Wyoming populations is mid-August (Heidel 2007). To be effective, surveys should be conducted within this flowering period.

The Wyoming Natural Diversity Database (WYNDD) classifies the precise location of Ute ladies'-tresses populations in the state as sensitive data, due to the high risk of illegal collection for this unique orchid. As such, population locations of this species within the watershed are shown only at the township level (Figure 3.22).

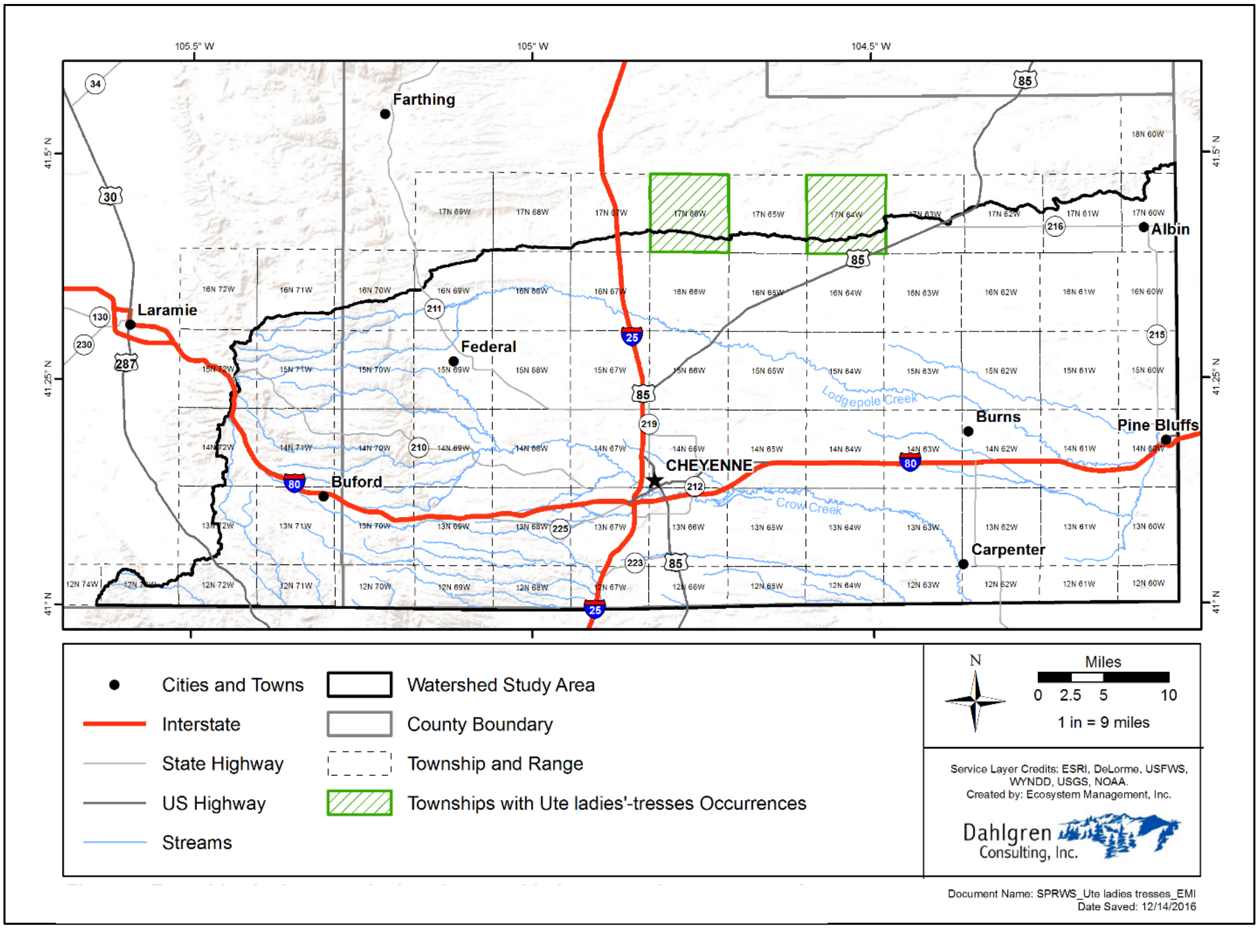

Figure 3.22. Townships with Documented Occurrences of Ute Ladies'-Tresses in the SPRWS (*Spiranthes diluvialis*). Precise population locations are classified as sensitive data by WYNDD.

3.5.4– Downstream Federally Listed Species

Four of the federally listed species shown in Table 3.11 (least tern, piping plover, whooping crane, and pallid sturgeon) have little or no potential to occur in the watershed study area itself but occur downstream in the broader Platte or Missouri River watersheds and are considered vulnerable to upstream activities. Small water projects and other developments related to this watershed study are not likely to impact these species, but USFWS consultation may be required for reservoirs or larger-scale projects.

3.5.5 – Species of Special Concern: Greater Sage-Grouse

In 2015, the USFWS concluded that the Greater Sage-Grouse does not warrant protection under the ESA, a decision owed largely to a major initiative by a diverse set of stakeholders to protect the species and its habitat. Listing of this species under the ESA could have significant impacts on land management practices across the western U.S. (Manier et al. 2013). The effort to preclude ESA listing included the development and implementation of sage-grouse management plans in 11 western states, voluntary, multi-partner efforts to protect millions of acres of habitat on private lands, cooperation with industry groups to reduce impacts, and unprecedented collaboration between federal, state, non-profit, and private sector scientists to provide data for management. Preventing ESA listing for the Greater Sage-Grouse is a critical management priority for the state of Wyoming (State of Wyoming Executive Department 2015).

Habitat for the Greater Sage-Grouse in the watershed study area is very limited, because sagebrush habitat itself is uncommon (Figure 3.23). The WGFD places greatest emphasis on protecting this species in designated sage-grouse Core Management Areas, none of which occur within the study area. General sage-grouse habitat, as mapped by the WGFD and BLM, occurs in only a very small portion of the northwest study area. No active leaks are known within the study area (BLM 2008). Therefore, potential impacts to the Greater Sage-Grouse or its habitat are not likely to be a concern for most projects related to this watershed study. However, projects occurring within sagebrush dominated areas, or in mapped habitat for this species, should be evaluated during early stages for possible conflicts with the Greater Sage-Grouse and associated regulations.

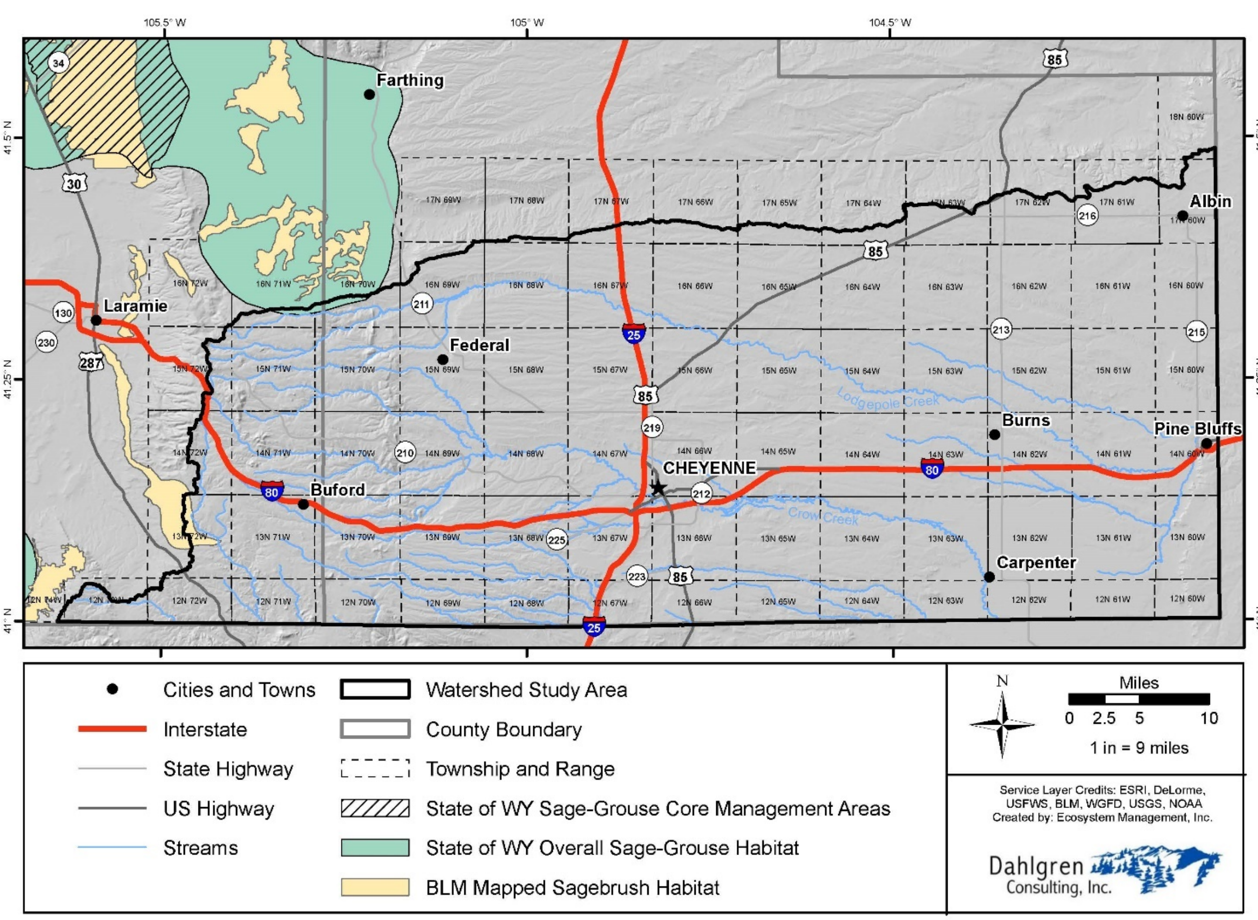

Figure 3.23 Sagebrush habitat, overall range, and WGFD Core Management Areas for the greater sage-grouse (Centrocercus urophasianus) in and surrounding the watershed study area.

Document Name: SPRWS_Sage Grouse_EMI
Date Saved: 3/28/2017

3.5.6.1 – U.S. Forest Service and BLM Sensitive Species

The U.S. Forest Service (USFS) and/or the BLM Wyoming Rawlins Field Office (BLM RFO) classify certain species that occur within the watershed study area as 'sensitive' or in need of special management consideration. The USFS catalogs sensitive species by Forest Regions and defines sensitive species as "plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: (a) significant current or predicted downward trends in population numbers or density, and/or (b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution" (USFS 2003). The BLM defines sensitive species as "species that could easily become endangered or extinct in the state… including (a) species under status review by the USFWS… (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" (BLM 2008).

Table 3.12 lists USFS Region 2 and BLM RFO sensitive species that may occur in the watershed study area, based on habitat requirements and known species ranges. Because the USFS Region 2 and BLM RFO sensitive species lists cover broad geographic areas, some species from these lists lack habitat or range overlap with the watershed study area and are not shown. Protections and management guidelines should be considered for sensitive species on BLM and USFS lands, and proposed developments should be assessed at the early stages for potential conflicts with these species.

Some of the species shown in Table 3.12 are classified by the USFS as Management Indicator Species (MIS). These species serve as biological reference points and are considered indicators of the overall condition of their habitats and ecological communities. The USFS conducts regular MIS monitoring to gain insight into the impacts of forest management activities, tracking trends in MIS abundance and distribution in order to detect potential broader changes within ecological communities. The USFS defines MIS as "...plant and animal species, communities, or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent" (USFS 2003).

3.5.6.2 – State of Wyoming Species of Concern

The Wyoming Natural Diversity Database (WYNDD), a research unit of the University of Wyoming, catalogs information about species that are rare, sensitive, or of conservation concern in the state, and cooperates with WGFD to prioritize conservation of these species. The WYNDD organizes species of concern into two general categories, 'Tracked' and 'Watched'. Species designated by WYNDD as 'Tracked' are vulnerable to extirpation at the global or state level due to factors such as small population size, restricted distribution, specialized habitat requirements, habitat loss, or sensitivity to disturbance. 'Watched' species are believed to be currently secure but may be vulnerable to future declines due to limited distribution; many 'Watched' species are regional or state endemic species with relatively small overall ranges. Species listed in Table 3.12 as 'Tracked' or 'Watched' by WYNDD have been documented in the watershed study area; occurrence data for these species was obtained via consultations with WYNDD (WYNDD 2016).

Table 3.12 Species classified as protected or sensitive by the USFWS, BLM, USFS, and WYNDD within the watershed study area.
Some species may presented here have only potential to occur in the study area. MIS = *Management Indicator Species*, U.S. Forest Service Medicine Bow National Forest; SOLC = *Species of Local Concern*, U.S. Forest Service Medicine Bow National Forest.

Common Name	Scientific Name	ESA Listing Status	BLM Status	USFS Status	WYNDD Status
Amphibians					
Tiger Salamander	*Ambystoma mavortium*				Watched
Boreal Toad	*Anaxyrus boreas - Eastern Clade*		Sensitive	Sensitive	Tracked
Wyoming Toad	*Bufo baxteri*	Endangered	Sensitive	Sensitive	Tracked
Plains Leopard Frog	*Lithobates blairi*			Sensitive	
Columbia Spotted Frog	*Lithobates luteiventris*			Sensitive	
Northern Leopard Frog	*Lithobates pipiens*		Sensitive	Sensitive	Tracked
Southern Rockies Wood Frog	*Lithobates sylvaticus - Southern Rockies*			Sensitive	Tracked
Plains Spadefoot	*Spea bombifrons*				Tracked
Great Basin Spadefoot	*Spea intermontana*		Sensitive		
Birds					
Northern Goshawk	*Accipiter gentilis*		Sensitive	Sensitive, MIS	Tracked
Clark's Grebe	*Aechmophorus clarkii*				Tracked
Boreal Owl	*Aegolius funereus*			Sensitive	
Cassin's Sparrow	*Aimophila cassinii*			Sensitive	
Baird's Sparrow	*Ammodramus bairdii*		Sensitive		Tracked
Grasshopper Sparrow	*Ammodramus savannarum*			Sensitive	Tracked
Sage Sparrow	*Amphispiza belli*		Sensitive		
Golden Eagle	*Aquila chrysaetos*				Watched
Short-eared Owl	*Asio flammeus*			Sensitive	Tracked
Burrowing Owl	*Athene cunicularia*		Sensitive	Sensitive	Tracked
Ring-necked Duck	*Aythya collaris*				Watched
American Bittern	*Botaurus lentiginosus*			Sensitive	
Bufflehead	*Bucephala albeola*				Watched
Common Goldeneye	*Bucephala clangula*				Watched
Ferruginous Hawk	*Buteo regalis*		Sensitive	Sensitive	Tracked

Common Name	Scientific Name	ESA Listing Status	BLM Status	USFS Status	WYNDD Status
Chestnut-collared Longspur	*Calcarius ornatus*			Sensitive	Tracked
Wilson's Warbler	*Cardellina pusilla*			MIS	
Canyon Wren	*Catherpes mexicanus*				Watched
Greater Sage-Grouse	*Centrocercus urophasianus*		Sensitive	Sensitive	Tracked
Chimney Swift	*Chaetura pelagica*				Watched
Piping Plover	*Charadrius melodus*				Watched
Mountain Plover	*Charadrius montanus*		Sensitive	Sensitive	Tracked
Black Tern	*Chlidonias niger*			Sensitive	Tracked
Northern Harrier	*Circus cyaneus*			Sensitive	
Black-billed Cuckoo	*Coccyzus erythropthalmus*				Tracked
Northern Bobwhite	*Colinus virginianus*				Watched
Olive-sided Flycatcher	*Contopus cooperi*			Sensitive	Watched
Trumpeter Swan	*Cygnus buccinator*		Sensitive	Sensitive	
Tundra Swan	*Cygnus columbianus*				Watched
Black Swift	*Cypseloides niger*			Sensitive	
Bobolink	*Dolichonyx oryzivorus*				Tracked
Snowy Egret	*Egretta thula*				Watched
Hammond's Flycatcher	*Empidonax hammondii*				Watched
Merlin	*Falco columbarius*				Watched
Peregrine Falcon	*Falco peregrinus*		Sensitive	Sensitive	Tracked
Common Loon	*Gavia immer*			Sensitive	Tracked
Northern Pygmy-Owl	*Glaucidium gnoma*				Tracked
Bald Eagle	*Haliaeetus leucocephalus*		Sensitive	Sensitive	Tracked
Harlequin Duck	*Histrionicus histrionicus*			Sensitive	Tracked
Caspian Tern	*Hydroprogne caspia*				Tracked
Dark-eyed Junco	*Junco hyemalis*				Tracked
White-winged Junco	*Junco hyemalis aikeni*				Tracked
White-tailed Ptarmigan	*Lagopus leucura*			Sensitive	
Loggerhead Shrike	*Lanius ludovicianus*		Sensitive	Sensitive	Tracked
California Gull	*Larus californicus*				Watched
Ring-billed Gull	*Larus delawarensis*				Watched
Black Rosy-Finch	*Leucosticte atrata*				Tracked
Brown-capped Rosy-Finch	*Leucosticte australis*				Tracked
White-winged Crossbill	*Loxia leucoptera*				Watched
Eastern Screech-Owl	*Megascops asio*				Watched
Lewis's Woodpecker	*Melanerpes lewis*			Sensitive	Tracked
Lincoln's Sparrow	*Melospiza lincolnii*			MIS	
Long-billed Curlew	*Numenius americanus*		Sensitive	Sensitive	Tracked
Black-crowned Night-Heron	*Nycticorax nycticorax*				Watched

Common Name	Scientific Name	ESA Listing Status	BLM Status	USFS Status	WYNDD Status
Sage Thrasher	*Oreoscoptes montanus*		Sensitive		Watched
Virginia's Warbler	*Oreothlypis virginiae*				Tracked
Flammulated Owl	*Otus flammeolus*			Sensitive	
Osprey	*Pandion haliaetus*				Watched
Blue Grosbeak	*Passerina caerulea*				Watched
American White Pelican	*Pelecanus erythrorhynchos*				Tracked
Cassin's Sparrow	*Peucaea cassinii*			Sensitive	Watched
Red-necked Phalarope	*Phalaropus lobatus*				Watched
Rose-breasted Grosbeak	*Pheucticus ludovicianus*				Watched
Black-backed Woodpecker	*Picoides arcticus*			Sensitive	
American Three-toed Woodpecker	*Picoides dorsalis*			Sensitive, MIS	
White-faced Ibis	*Plegadis chihi*		Sensitive		Tracked
Purple Martin	*Progne subis*			Sensitive	
American Avocet	*Recurvirostra americana*				Watched
Golden-crowned Kinglet	*Regulus satrapa*			MIS	Watched
McCown's Longspur	*Rhynchophanes mccownii*			Sensitive	Tracked
Townsend's Warbler	*Setophaga townsendi*				Watched
Eastern Bluebird	*Sialia sialis*				Watched
Pygmy Nuthatch	*Sitta pygmaea*				Tracked
Williamson's Sapsucker	*Sphyrapicus thyroideus*				Tracked
Dickcissel	*Spiza americana*				Watched
Brewer's Sparrow	*Spizella breweri*		Sensitive	Sensitive	Watched
Clay-colored Sparrow	*Spizella pallida*				Watched
Mexican Spotted Owl	*Strix occidentalis*	Threatened	Sensitive	Sensitive	
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus columbianus*		Sensitive	Sensitive	
Fishes					
Iowa Darter	*Etheostoma exile*				Watched
Orangethroat Darter	*Etheostoma spectabile*				Tracked
Plains Topminnow	*Fundulus sciadicus*			Sensitive	Watched
Common Shiner	*Luxilus cornutus*				Watched
Greenback Cutthroat Trout	*Oncorhynchus clarkii stomias*	Threatened			Tracked
Rainbow Trout	*Oncorhynchus mykiss*			MIS	
Brown Trout	*Salmo trutta*			MIS	
Brook Trout	*Salvelinus fontinalis*			MIS	
Mammals					
Pallid Bat	*Antrozous pallidus*				Tracked

Common Name	Scientific Name	ESA Listing Status	BLM Status	USFS Status	WYNDD Status
Ringtail	*Bassariscus astutus*				Watched
Plains Bison	*Bos bison bison*				Tracked
Gray Wolf	*Canis lupus*	Endangered: *Experimental, Non-Essential*		Sensitive	Tracked
Hog-nosed Skunk	*Conepatus leuconotus*			Sensitive	
Townsend's Big-eared Bat	*Corynorhinus townsendii*		Sensitive	Sensitive	Tracked
White-tailed Prairie Dog	*Cynomys leucurus*		Sensitive	Sensitive	
Black-tailed Prairie Dog	*Cynomys ludovicianus*		Sensitive	Sensitive	Tracked
Spotted Bat	*Euderma maculatum*			Sensitive	
North American Wolverine	*Gulo gulo luscus*	Threatened			
Thirteen-lined Ground Squirrel	*Ictidomys tridecemlineatus*				Tracked
Silver-haired Bat	*Lasionycteris noctivagans*				Watched
Hoary Bat	*Lasiurus cinereus*			Sensitive	Watched
Snowshoe Hare	*Lepus americanus*			MIS	
Northern River Otter	*Lontra canadensis*			Sensitive	Tracked
Canada Lynx	*Lynx canadensis*	Threatened			Tracked
American Marten	*Martes americana*			Sensitive, MIS	
Water Vole	*Microtus richardsoni*			Sensitive	
Black-footed Ferret	*Mustela nigripes*	Endangered: *Experimental, Non-Essential*			Tracked
Western Small-footed Myotis	*Myotis ciliolabrum*				Watched
Long-eared Myotis	*Myotis evotis*		Sensitive		Watched
Little Brown Myotis	*Myotis lucifugus*				Watched
Fringed Myotis	*Myotis thysanodes*		Sensitive	Sensitive	Tracked
Long-legged Myotis	*Myotis volans*				Watched
Bighorn Sheep	*Ovis canadensis*			Sensitive	Watched
Abert's Squirrel	*Sciurus aberti*				Watched
Dwarf Shrew	*Sorex nanus*				Watched
Eastern Cottontail	*Sylvilagus floridanus*				Watched
Wyoming Pocket Gopher	*Thomomys clusius*		Sensitive	Sensitive	Tracked
Uinta Ground Squirrel	*Urocitellus armatus*				Watched
Wyoming Ground Squirrel	*Urocitellus elegans*				Watched
Swift Fox	*Vulpes velox*		Sensitive	Sensitive	Tracked
Preble's Meadow Jumping Mouse	*Zapus hudsonius preblei*	Threatened	Sensitive		Tracked
Reptiles					
Eastern Spiny Softshell	*Apalone spinifera spinifera*				Watched
Great Plains Earless Lizard	*Holbrookia maculata maculata*				Tracked
Bullsnake	*Pituophis catenifer sayi*				Watched

Common Name	Scientific Name	ESA Listing Status	BLM Status	USFS Status	WYNDD Status
Northern Many-lined Skink	*Plestiodon multivirgatus multivirgatus*				Tracked
Massasauga	*Sistrurus catenatus*			Sensitive	
Plains Gartersnake	*Thamnophis radix*				Watched
Invertebrates					
Rocky Mountain Capshell	*Acroloxus coloradensis*			Sensitive	
Snow Scorpionfly	*Boreus bomari*				Tracked
Fairy Shrimp	*Branchinecta constricta*				Tracked
Versatile Fairy Shrimp	*Branchinecta lindahli*				Tracked
Rock Pool Fairy Shrimp	*Branchinecta packardi*				Tracked
Monarch Butterfly	*Danaus plexippus plexippus*				Tracked
Rita Dotted-Blue Butterfly (subspecies)	*Euphilotes rita coloradensis*				Tracked
Ottoe Skipper	*Hesperia ottoe*			Sensitive	
Spineynose Clam Shrimp	*Leptestheria compleximanus*				Tracked
Susan's Purse-making Caddisfly	*Ochrotrichia susanae*			Sensitive	
Ringed Crayfish	*Orconectes neglectus*				Tracked
Pygmy Mountain Snail	*Oreohelix pygmaea*				
Cooper's Rocky Mountain Snail	*Oreohelix strigose cooperi*			Sensitive	
Hudsonian Emerald	*Somatochlora hudsonica*			Sensitive	
Regal Fritillary Butterfly	*Speyeria idalia*			Sensitive	
Greater Plains Fairy Shrimp	*Streptocephalus texanus*				Tracked
Cylindrical Papershell	*Anodontoides ferussacianus*				Tracked
Plants					
Scibner's needlegrass	*Achnatherum scribneri*				Tracked
Larimer aletes	*Aletes humilis*			SOLC	Tracked
Laramie columbine	*Aquilegia laramiensis*		Sensitive		
Fendler's false cloak fern	*Argyrochosma fendleri*				Tracked
Maidenhair spleenwort	*Asplenium trichomanes*				Tracked
Nelson's milkvetch	*Astragalus nelsonianus*		Sensitive		
Three-fingered milkvetch	*Astragalus tridactylicus*				Watched
Roundleaf water-hyssop	*Bacopa rotundifolia*				Tracked
White River kittentails	*Besseya plantaginea*			SOLC	Tracked
Mat grama	*Bouteloua simplex*				Tracked
Crawe's sedge	*Carex crawei*				Tracked
Western sedge	*Carex occidentalis*				Tracked
Grassyslope sedge	*Carex oreocharis*				Tracked
Halls sedge	*Carex parryana var. unica*				Tracked

Common Name	Scientific Name	ESA Listing Status	BLM Status	USFS Status	WYNDD Status
Cedar rim thistle	*Cirsium aridum*		Sensitive		
Watson's goosefoot	*Chenopodium watsonii*				Tracked
Flat-top fragrant goldenrod	*Euthamia graminifolia var. major*			SOLC	Tracked
Colorado butterfly plant	*Gaura neomexicana var. coloradensis*	Threatened			Tracked
Bigelow's prairie gentian	*Gentiana affinis var. bigelovii*			SOLC	Tracked
Weber's scarlet gilia	*Ipomopsis aggregata var. weberi*		Sensitive		
Vasey's rush	*Juncus vaseyi*			SOLC	Tracked
Many-flowered gromwell	*Lithospermum multiflorum*				Tracked
Marsh felwort	*Lomatogonium rotatum*			SOLC	Tracked
Bigelow's spiny aster	*Machaeranthera bigelovii var. bigelovii*				Tracked
Rusby's blazing star	*Mentzelia rusbyi*				Tracked
Leech-leaf mentzelia	*Mentzelia sinuata*				Tracked
Jeweled blazing star	*Mentzelia speciosa*				Tracked
Mountain muhly	*Muhlenbergia montana*				Tracked
Ring muhly	*Muhlenbergia torreyi*				Tracked
Streambank groundsel	*Packera pseudaurea var. flavula*			SOLC	Tracked
James' nailwort	*Paronychia jamesii*				Tracked
Narrowleaf scurf-pea	*Pediomelum linearifolium*				Tracked
Gibbens beardtongue	*Penstemon gibbensii*		Sensitive		
White phacelia	*Phacelia alba*			SOLC	Tracked
North Park phacelia	*Phacelia formosula*	Endangered			
Rocky Mountain phacelia	*Phacelia denticulata*			SOLC	Tracked
Western prairie fringed orchid	*Platanthera praeclara*	Threatened			
Persistent sepal yellowcress	*Rorippa calycina*		Sensitive		
Rocky Mountain polypody	*Polypodium saximontanum*				Tracked
Hoary willow	*Salix candida*			Sensitive	Tracked
Blunt-leaf spike-moss	*Selaginella mutica*				Tracked
Underwood's spike-moss	*Selaginella underwoodii*				Tracked
Rosinweed	*Silphium integrifolium var. laeve*				Tracked
Pale blue-eyed grass	*Sisyrinchium pallidum*		Sensitive		
Laramie false sagebrush	*Sphaeromeria simplex*		Sensitive		Tracked
Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened			Tracked
Prairie skeletonplant	*Stephanomeria pauciflora*				Tracked
Porter's aster	*Symphyotrichum porteri*			SOLC	Tracked
Lesser bladderwort	*Utricularia minor*			Sensitive	Watched
Dwarf bilberry	*Vaccinium myrtillus var. oreophilum*				Tracked

3.5.7 State of Wyoming Habitat Priority Areas

The WGFD classifies certain areas within the state as particularly important sites for wildlife and fisheries management (WGFD 2015). These areas are designated as Crucial Habitat Priority Areas and Enhancement Habitat Priority Areas (HPA), which may overlap or be spatially distinct. Crucial HPAs, as defined by the WGFD, exhibit significant biological or ecological values, which require protection and targeted management to maintain. Examples of such values include crucial winter range for big game, migration or movement corridors, sage grouse core areas, and rare or imperiled vegetative communities and watersheds. The WGFD concentrates habitat protection and management in these areas. Enhancement HPAs represent areas with realistic potential for habitat improvement and restoration if management steps are taken to correct issues. Examples of such issues include water quality and quantity problems, habitat fragmentation, connectivity loss, and habitat degradation. Designated HPAs are further classified as terrestrial, aquatic, or combined habitats; 'combined' areas exhibit both aquatic and terrestrial habitat, but do not occur within the watershed study area (WGFD 2015).

3.5.7.1 State of Wyoming Terrestrial Habitat Priority Areas

The watershed study area contains portions of three terrestrial WGFD Crucial HPAs and two terrestrial WGFD Enhancement HPAs (Figure 3.24. The WGFD provides a summary for most HPAs, which describes its habitat values and rationale for selection; information regarding potential threats and key management targets is also available for some HPAs (WGFD 2016a). Summaries of the terrestrial HPAs in the study area are below, adapted from WGFD (2016a) and available geospatial data (WGFD 2016b):

Laramie and North Laramie Rivers (Crucial)

Values of this HPA include functioning stream habitat, which supports healthy and resilient riparian communities, and high densities of native, non-game, and sensitive fish species. Riparian sites within this HPA contain high-quality moose habitat, which is enhanced and maintained by robust beaver populations. Management to support healthy beaver populations is encouraged to promote wetlands, riparian meadows, and other habitat favored by moose. Supportive beaver management should also enhance fisheries quality.

Pole Mountain Watershed (Crucial)

The headwater streams in the Pole Mountain HPA provide important functions of capturing, storing, filtering, and releasing precipitation to streams on the Eastern Plains of Wyoming. The beaver ponds of this HPA provide habitat for northern leopard frogs, boreal chorus frogs, brook trout, and support a regionally important sport fishery and riparian corridors that benefit many wildlife species.

Statewide Big Game Crucial Range (Crucial)

This statewide HPA emphasizes lands which support one or more key components of habitat for big game species. These components are limiting factors in the capacity of big game populations to persist at abundance targets over the long term. This HPA emphasizes lands which contain crucial winter or crucial winter-yearlong range for one or more big game species. Management targets for WGFD in this HPA include maintaining the functionality and integrity of big game crucial ranges, migration routes and parturition areas. Where possible, WGFD will seek opportunities for habitat enhancement, preservation and protection through partnerships and agreements with USFS, BLM, the Wyoming State Land Board, private landowners, and other collaborators. Possible actions include protecting and maintaining crucial range values through conservation easements, public/private land exchanges and agency management plans.

Mixed Mountain Shrub (Enhancement)

This HPA supports mountain and foothills shrub communities dominated by sagebrush, mountain mahogany, sumac, yucca, currant, chokecherry, and other key forage species for big game, migratory birds, and other wildlife. Wildfire is an important component of this community; fire suppression may lead to transition to other community types. This community is believed to be declining across much of Wyoming; management to enhance mixed mountain shrub habitat is ongoing.

Waterfowl / Upland Game / Shortgrass Prairie (Enhancement)

This HPA supports important and regionally declining prairie species, key native grass forage, prairie ponds critical to waterfowl and other wildlife, and important habitat for upland game bird populations. Plant diversity is often high in relatively undisturbed sites. Prairie communities within this HPA are likely resilient to brief, intense disturbances from fire, drought, and grazing, but extended exposure to these disturbances may lead to undesirable changes, such as increasing dominance by non-native vegetation or soil degradation. Energy development is also a potential threat to this HPA.

3.5.7.2 – State of Wyoming Aquatic Habitat Priority Areas

The watershed study area contains portions of two aquatic WGFD Crucial HPAs and two aquatic WGFD Enhancement HPAs (Figure 3.25). As for terrestrial HPAs, WGFD provides a summary for most aquatic HPAs describing habitat values, selection rationale, management goals, and potential threats (WGFD 2016a). Summaries for aquatic HPAs are below, drawn from WGFD (2016a, b); WGFD provides only limited summary information for some aquatic HPAs.

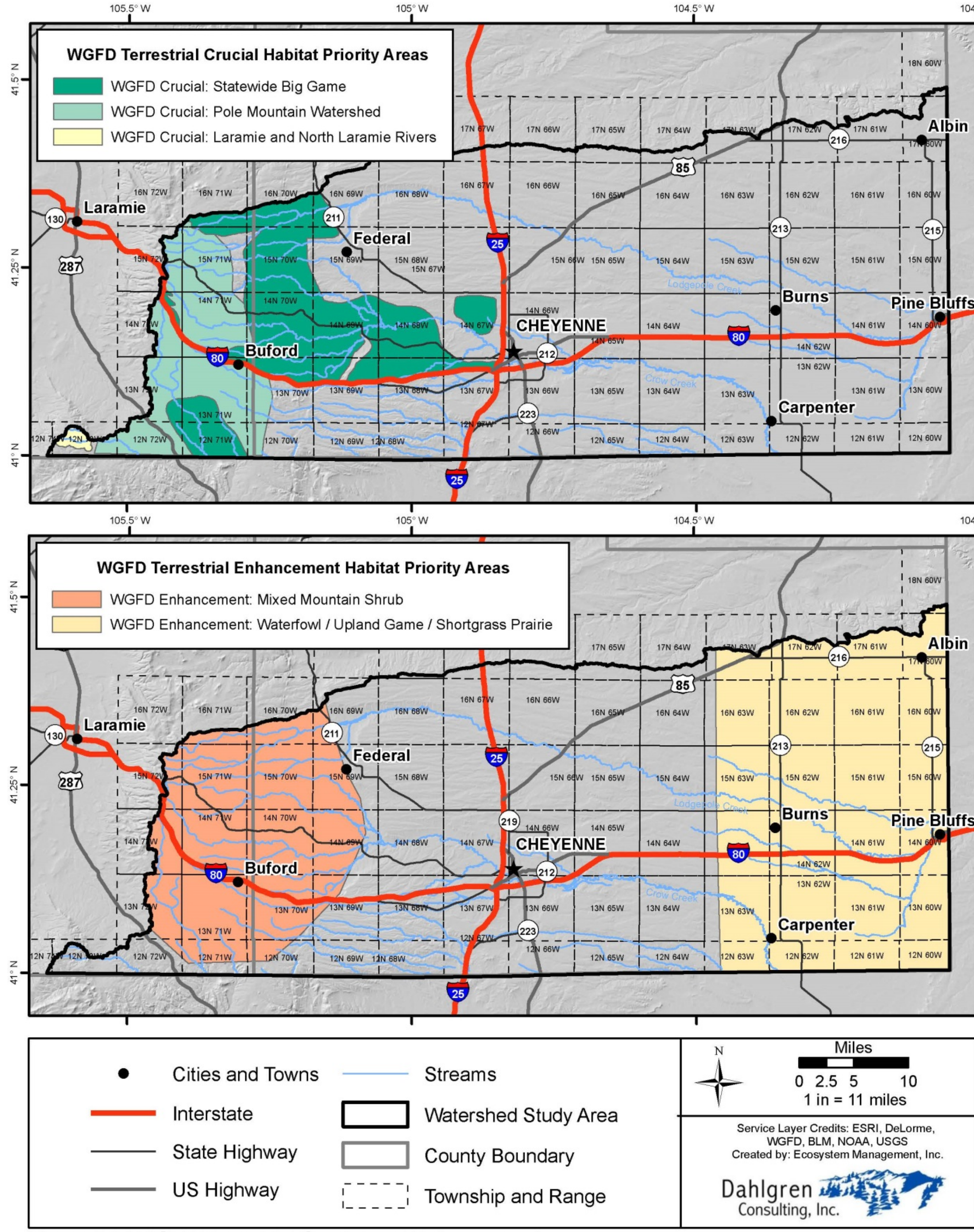

Figure 3-24 WGFD Terrestrial Crucial and Enhancement Habitat Priority Areas within the watershed study area.

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Pole Mountain Watershed (Crucial)

The aquatic habitat benefits of this HPA are primarily due to the large number of headwater streams in the Area. These streams provide important habitat for brook trout and other high-altitude fish species and perform critical water storage to maintain suitable streamflow levels downstream in mid-to-late summer. The condition of these aquatic systems further downstream is highly dependent on water storage and release dynamics at higher altitudes. Both storage and release processes are heavily influenced by beaver activity.

Lower Lodgepole and Muddy Creek (Crucial)

This HPA provides important habitat for native fish and supports extensive riparian communities. Several studies have documented uncommon diversity and density of native fishes in the Lodgepole Creek drainage. Dr. Timothy Patton found Lodgepole Creek to have one of the highest densities of native fishes, and some of the highest densities of fishes of concern, among the 83 streams he sampled in the Missouri River drainage of Wyoming (Patton 1997). WGFD will seek opportunities to investigate potential fish passage barriers in this HPA; such barriers may impede movements of native fish species but may benefit native species by depressing the spread of exotic competitor species.

Crow Creek (Enhancement)

This HPA has the potential to support native fish communities and a healthy sport fishery but is threatened by a variety of factors along its interface with the city of Cheyenne. Major factors include water quality impairments, channelization, storm drains, street runoff, livestock grazing, oil refining activity, wastewater treatment facilities, on-channel reservoirs, and irrigation diversions. The Wyoming Department of Environmental Quality has included portions of Crow Creek on its 303(d) for water quality impairments including fecal coliform and ammonia. Crow Creek is channelized as it flows through Cheyenne, until it reaches a private ranch near on the eastern side of the city. Within Cheyenne, brown trout have been stocked into Crow Creek; while survival of these stocked fish has been limited, the stream supports several native, non-game fish species. The Curt Gowdy Chapter of Trout Unlimited is interested in pursuing a habitat improvement project along Crow Creek within this HPA. Focal species for habitat restoration include brown trout, Iowa darter, bigmouth shiner, common shiner, and central stoneroller.

Lodgepole Creek (Enhancement)

This small section of Lodgepole Creek north of the town of Burns has been targeted for enhancement because the landowner has expressed interested in working with WGFD to improve habitat for native fish in the stream section.

Lodgepole Creek has some of the highest densities of native prairie stream fishes in the Laramie Region. Native species targeted for habitat enhancement include the Plains topminnow, orangethroat darter, central stoneroller, Iowa darter, and brassy minnow.

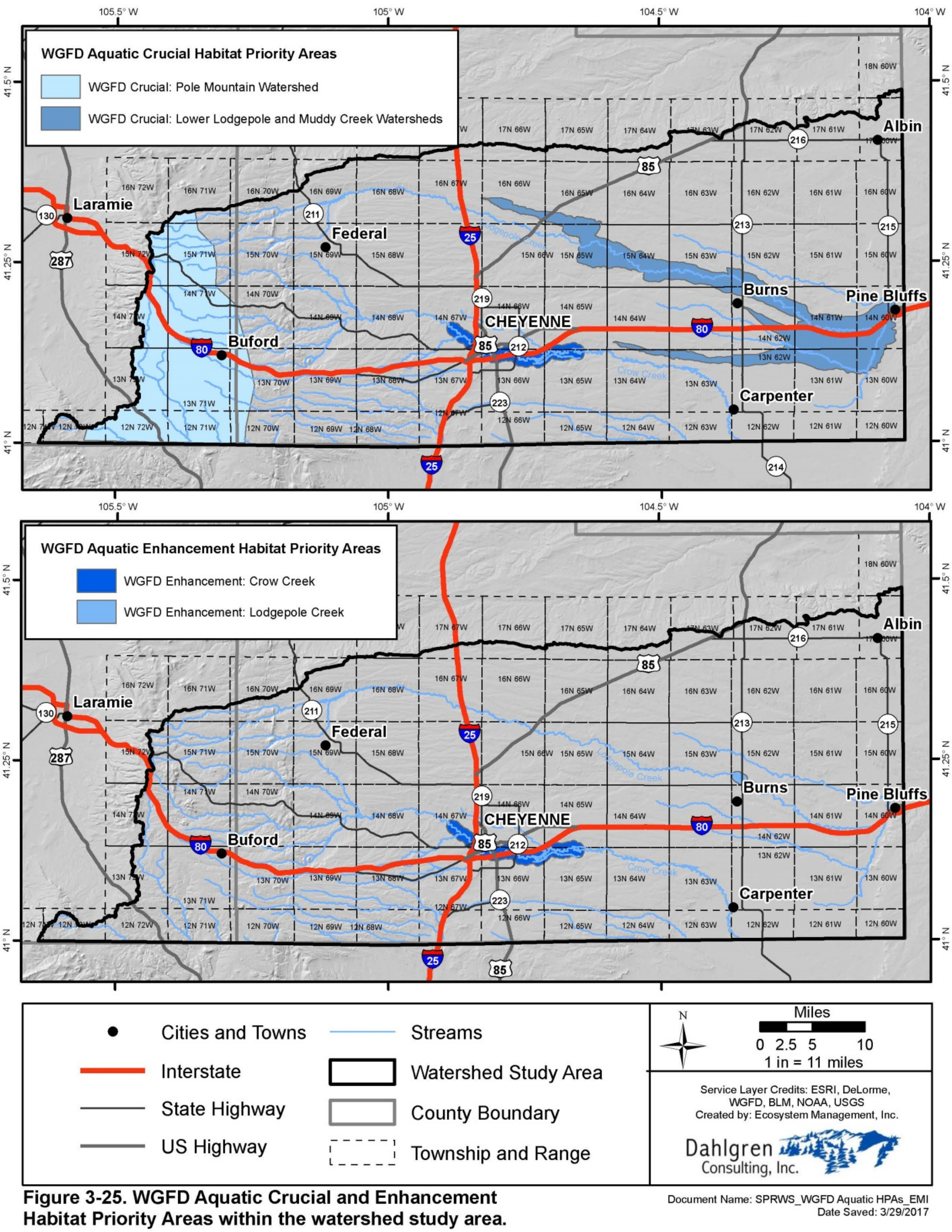


Figure 3-25. WGFD Aquatic Crucial and Enhancement Habitat Priority Areas within the watershed study area.

3.5.7.3 – State of Wyoming Big Game Species

The watershed study area contains habitat for six species classified as big game by WGFD: bighorn sheep and moose (*Ovis canadensis and Alces alces*; Figure 3.26), elk (*Cervus Canadensis*; Figure 3.27), pronghorn (Antilocapra americana; Figure 3.28), mule deer (*Odocoileus hemionus*; Figure 3.29), and white-tailed deer (*Odocoileus virginianus*; Figure 3.30). Robust, sustainable populations of these species are a key management goal of WGFD; big game populations are monitored via annual surveys, scientific studies, and habitat analysis (WGFD 2010). Each big game species has a least one hunt area within the study area, subdivided into herd units. For some species, the study area also contains WGFD mapped crucial ranges, parturition areas, and migration corridors.

3.5.7.4 – State of Wyoming Fish Species of Concern

The watershed study area contains habitat for seven fish species classified by WGFD as species of concern: central stoneroller (*Campostoma anomalum*), Iowa darter (*Etheostoma exile*), orangethroat darter (*Etheostoma spectabile*), plains topminnow (*Fundulus sciadicus*), plains killifish (*Fundulus zebrinus*), brassy minnow (*Hybognathus hankinsoni*), and common shiner (*Luxilus cornutus*). Efforts to conserve these species and improve or maintain their habitat is a priority of WGFD, however, little is known about some fish species precise distribution, overall abundance, or population trends (WGFD 2010). Fish populations are assessed via annual surveys, scientific research, angler feedback, water quality testing, and habitat analyses. Information gaps exist and more commonly for non-sport fish species. Habitat maps presented in Figure 3.31 and Figure 3.32 portray the sub-basins where each species is known to occur, but occurrence should not be assumed along all stream reaches within these sub-basins (WGFD 2010).

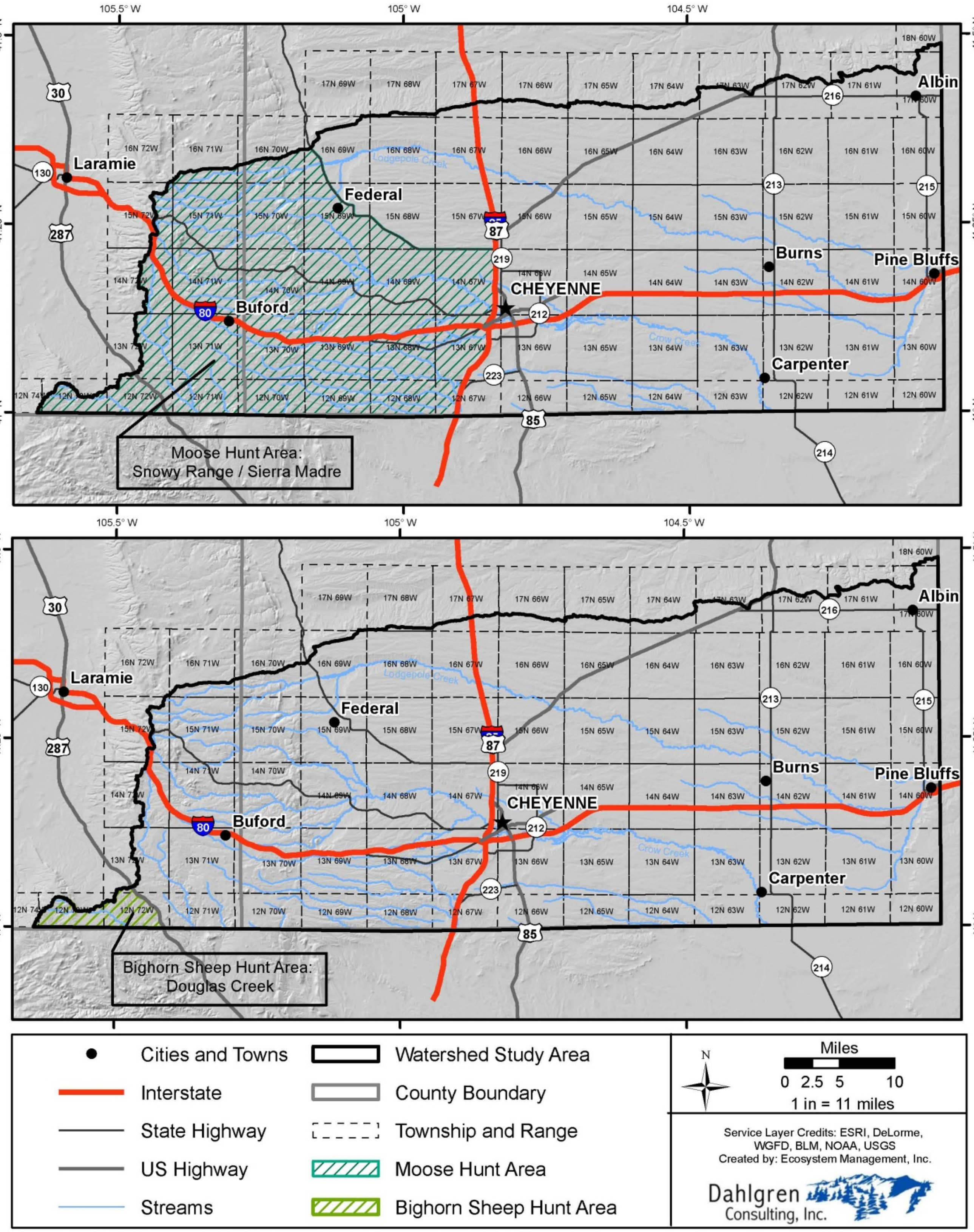


Figure 3-26. Bighorn sheep (Ovis canadensis) and moose (Alces alces) hunt areas within the study area. No parturition areas, crucial range, or migration corridors occur in the study area for these species.

Document Name: SPRWS_Moose and Bighorn_EMI
Date Saved: 3/28/2017

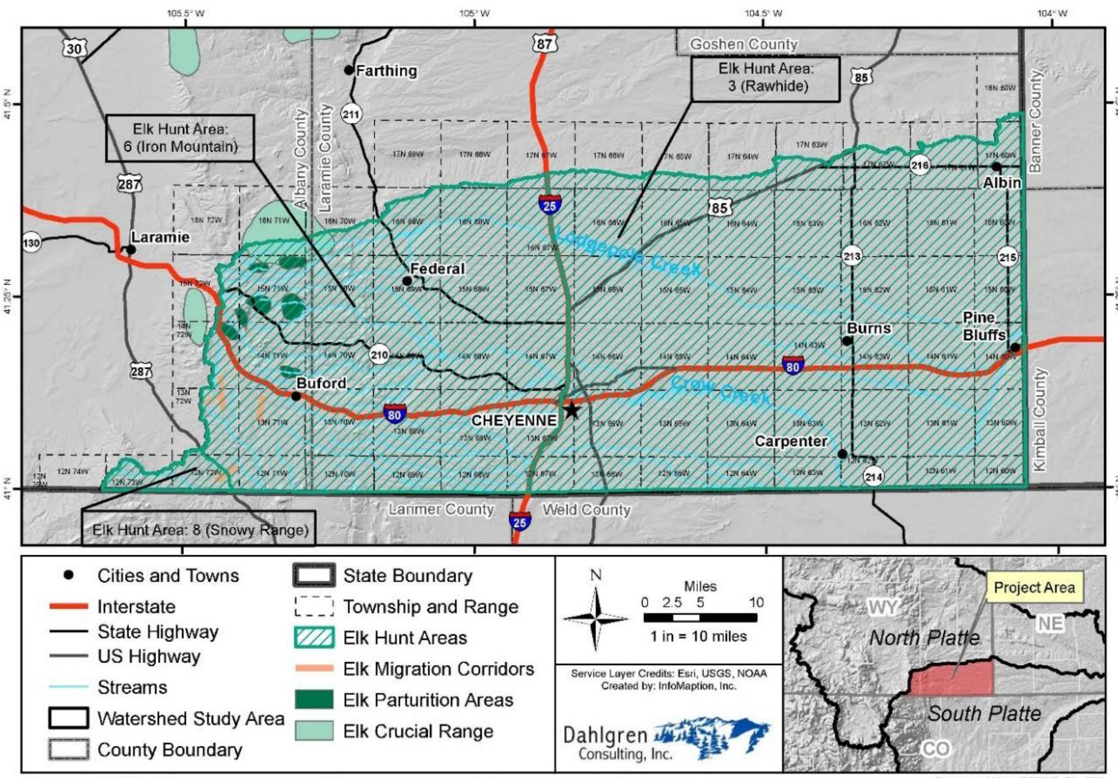


Figure 3-27 Elk (Cervus canadensis) hunt areas, crucial range, parturition areas, and migration corridors within and surrounding the study area.

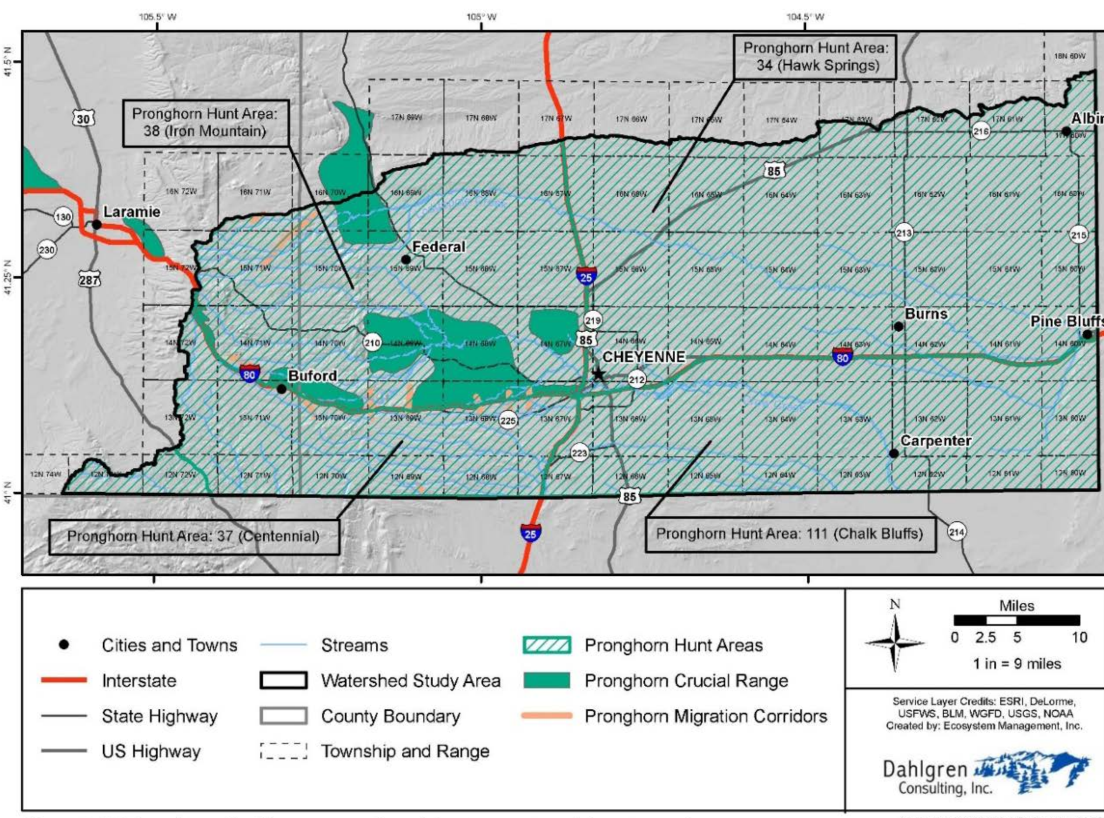


Figure 3-28 Pronghorn (Antilocapra americana) hunt areas, crucial range, and migration corridors within and surrounding the study area. No parturition areas occur in the study area for this species.

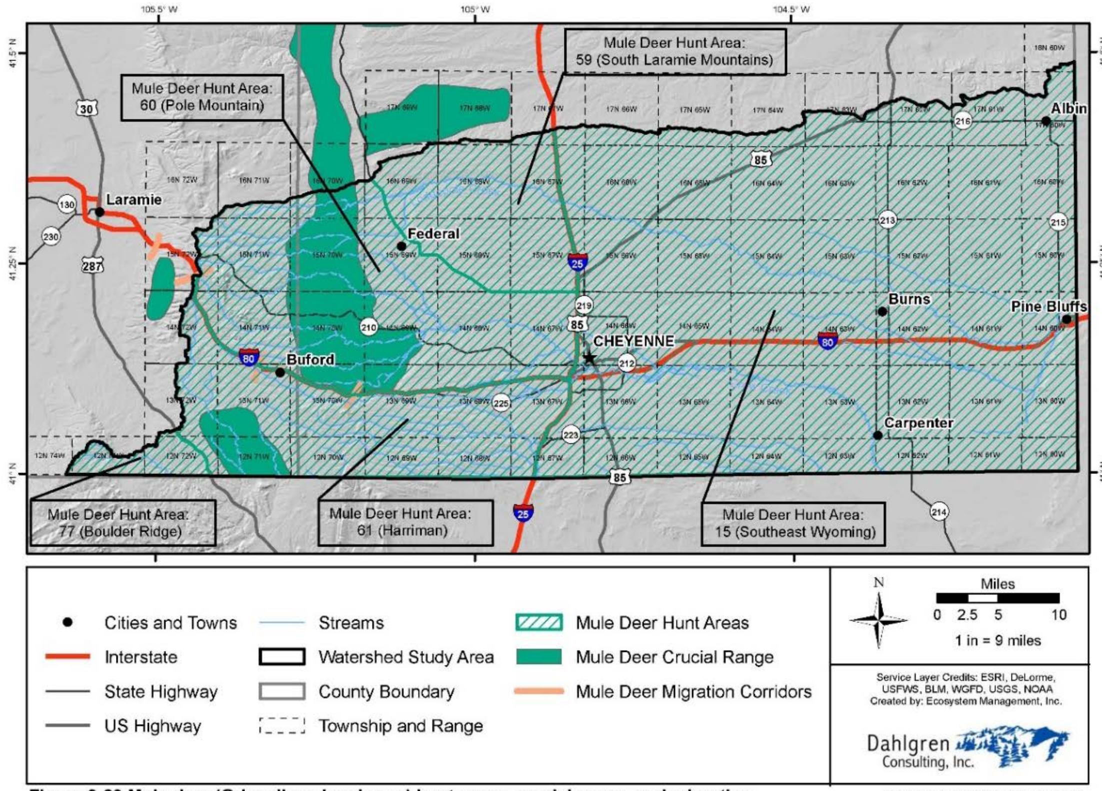


Figure 3-29 Mule deer (Odocoileus hemionus) hunt areas, crucial range, and migration corridors within and surrounding the study area. No parturition areas occur in the study area for this species.

Document Name: SPRWS_Mule Deer_EMI
Date Saved: 3/28/2017

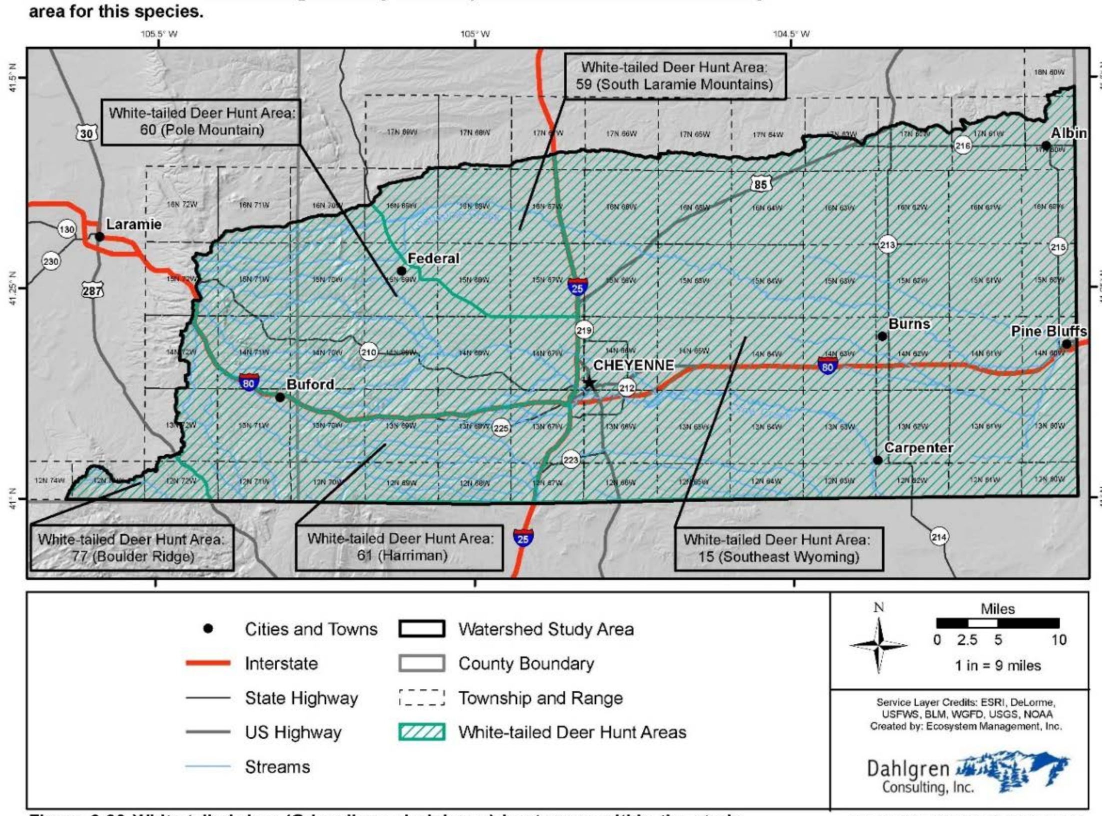


Figure 3-30 White-tailed deer (Odocoileus virginianus) hunt areas within the study area. No crucial range, migration corridors, or parturition areas occur in the study area for this species.

Document Name: SPRWS_White Tailed Deer_EMI
Date Saved: 3/29/2017

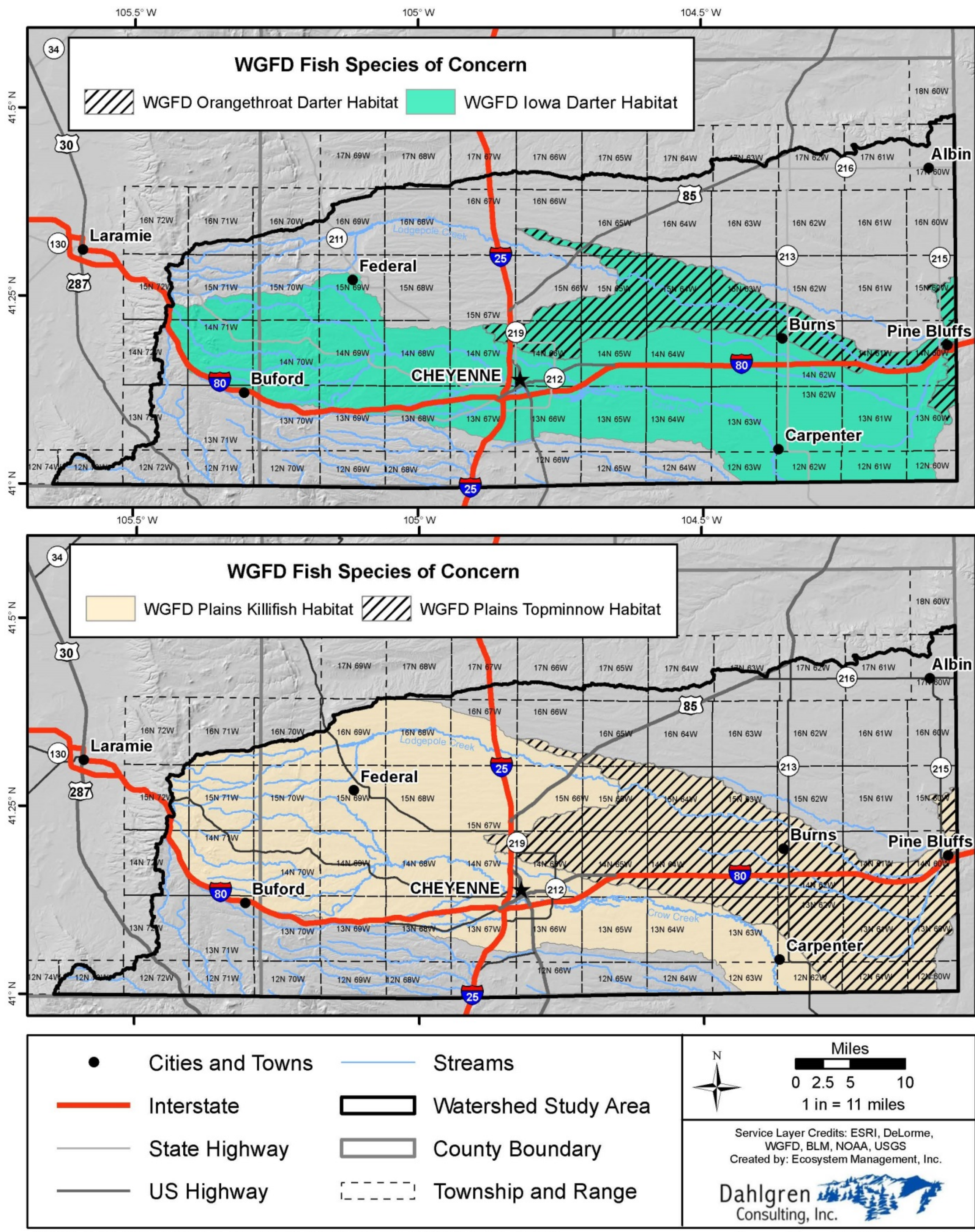


Figure 3-31 Orangethroat darter (Etheostoma spectabile), Iowa darter (Etheostoma exile), plains topminnow (Fundulus sciadicus), and plains killifish (Fundulus zebrinus) habitat in the watershed study area.

Document Name: SPRWS_WGFD Fish_I_EMI
Date Saved: 3/29/2017

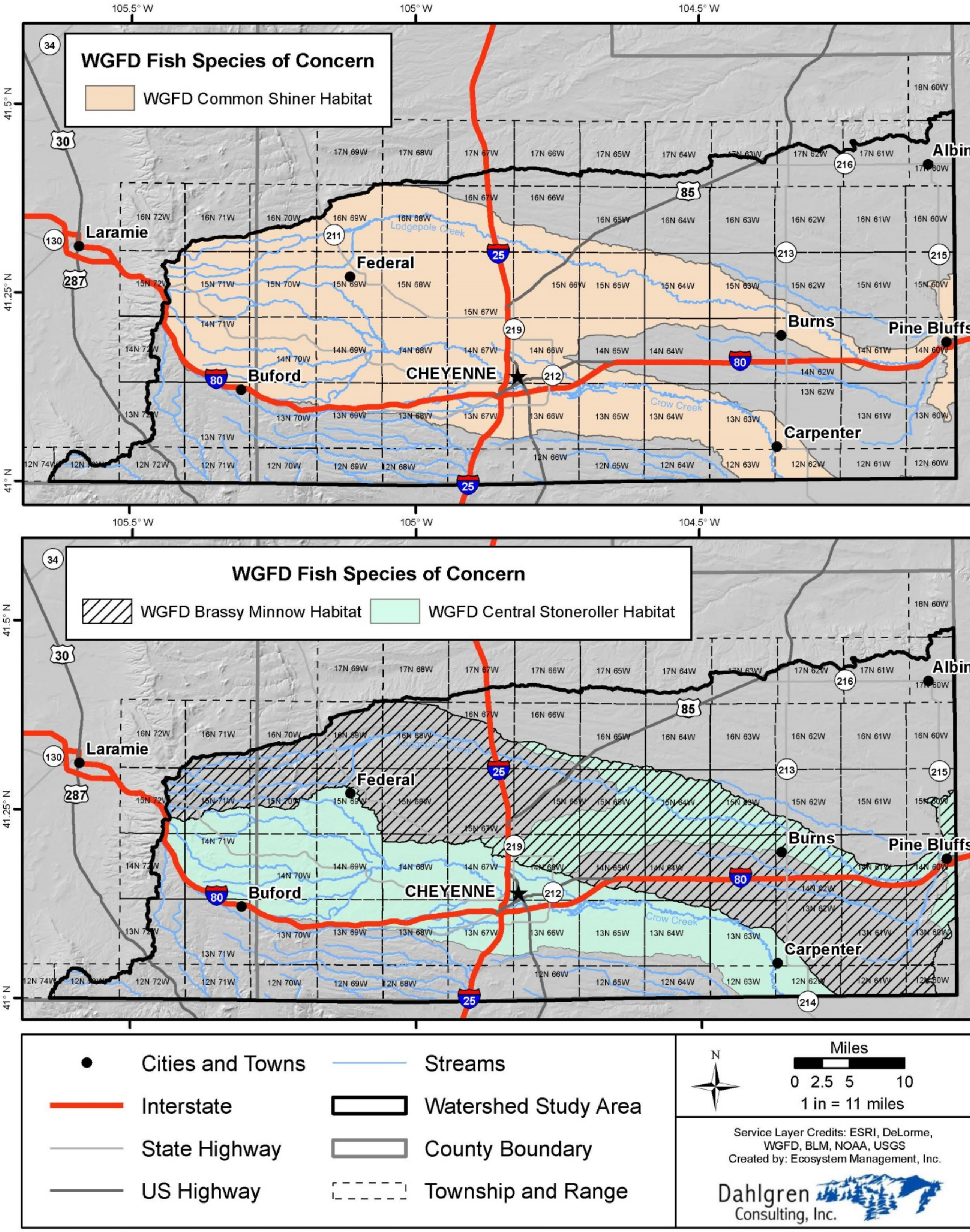


Figure 3-32. Common shiner (Luxilus cornutus), central stoneroller (Campostoma anomalum), and brassy minnow (Hybognathus hankinsoni) habitat in the watershed study area.

Document Name: SPRWS_WGFD Fish_II_EMI
Date Saved: 3/29/2017

3.5.8 Fish Passage Barriers

Numerous fish passage barriers are present in the South Platte Watershed study area. Fish passage barriers preclude or impede upstream passage to fish or other aquatic organisms and may be manmade, naturally occurring or non-physical. Manmade fish passage barriers may include reservoirs and dams, irrigation diversions, grade control structures or roadway crossings (e.g. culverts). Natural barriers include steep or turbulent stream sections or waterfalls. Non-physical barriers may include water quality or predation. Upstream fish movements are generally associated with spawning, life cycle changes, foraging, or to seek refuge from predators or environmental changes (water quality such as temperature). Due to the variety of upstream movements, fish passage is generally required over various stream flows. The focus of this study is on manmade barriers which limit passage due to water velocity, water depth, and barrier heights.

As fish passage barriers may occur at various stream flows, barriers can be classified by the following criteria:

- Complete Barrier – no passage during any stream flow
- Temporary Barrier – limited to no passage during certain stream flows for all species and age classes
- Partial Barrier – limited to no passage for some species and age classes

Beaver Dam Ditch Diversion, Example of Partial Fish Passage Barrier on Crow Creek

The Wyoming Game and Fish Department (WGFD) has identified a total of 16 barriers within the project study area (Figure 3.33). Most of the identified barriers are located on the Crow Creek and Lodgepole Creek watersheds. Within the South Platte Watershed in Wyoming, the lower sections of the streams support native prairie species which have become a conservation priority for the WGFD. Lodgepole Creek has one of the highest densities of native fishes, and also some of the highest densities of fishes of concern among the 83 streams sampled in the Missouri River drainage of Wyoming (Patton 1997). Lodgepole Creek has a higher diversity of fish species of greatest conservation need when compared to Crow Creek and is therefore a priority for the WGFD. Removing and providing fish passage at the barriers will provide more sustainable habitat for native fish species and allow for upstream movements during a variety of flow conditions.

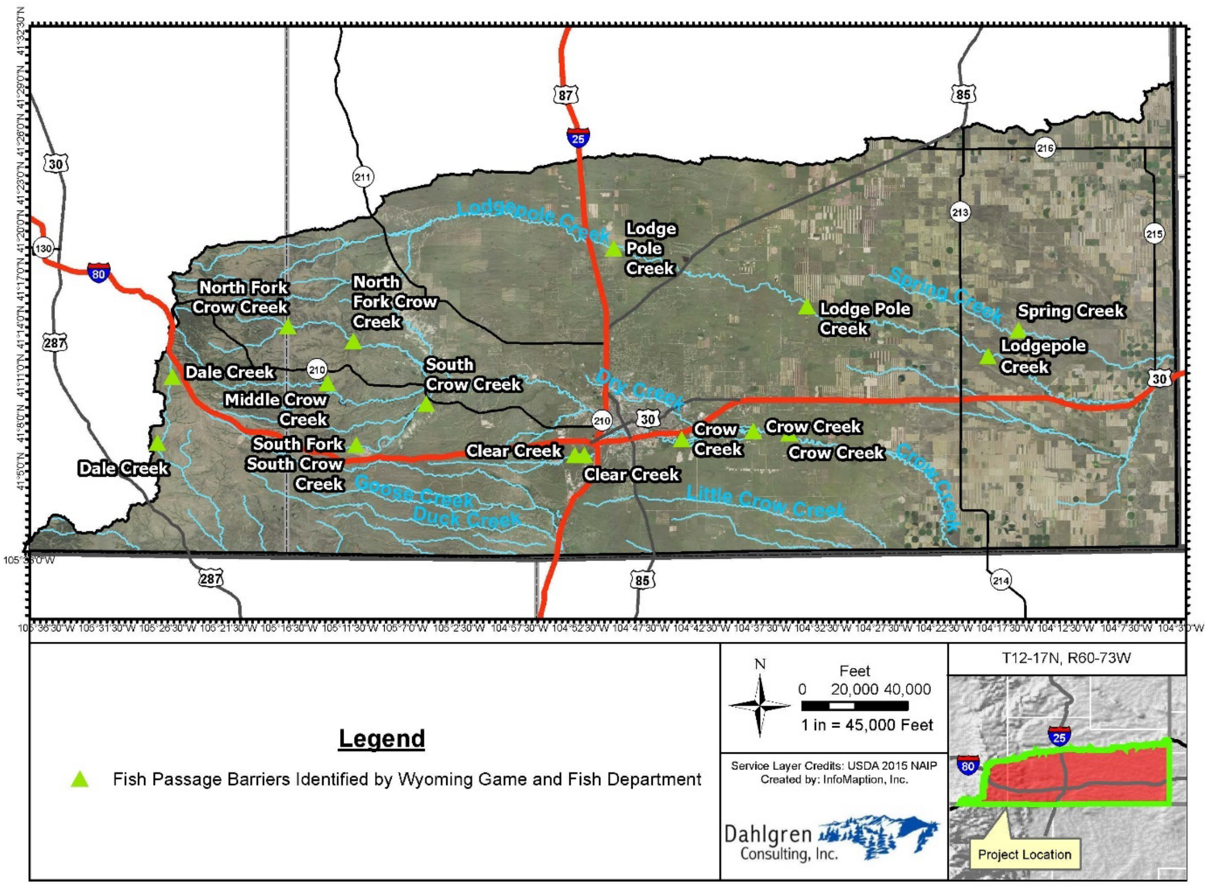


Figure 3.33 South Platte Watershed Fish Passage Barriers

Document Name: FishPassage_Template
Date Saved: 9/8/2017

The WGFD has identified two fish passage barriers within the watershed that are top priority to provide passage and system connectivity (Figure 3.34). Both of these barriers are located on Lodgepole Creek and preclude fish passage to a variety of species including plains topminnow, orangethroat darter, central stoneroller, Iowa darter and brassy minnow. The upstream barrier is the One Mile Diversion which diverts irrigation flows to One Mile Reservoir and the downstream barrier is a series of 48-inch culverts for an oil and gas roadway crossing. The two barriers are approximately 20-miles apart and separate two perennial stretches of Lodgepole Creek. These perennial stretches support native prairie species of fish and for this report are referred to as the Old Yellowstone Highway population and the Hillsdale population. By providing passage at the two identified barriers, the two currently isolated fish populations would have greater connectivity which would provide resilience in the system and ultimately, reduce chances for future endangered species listings.

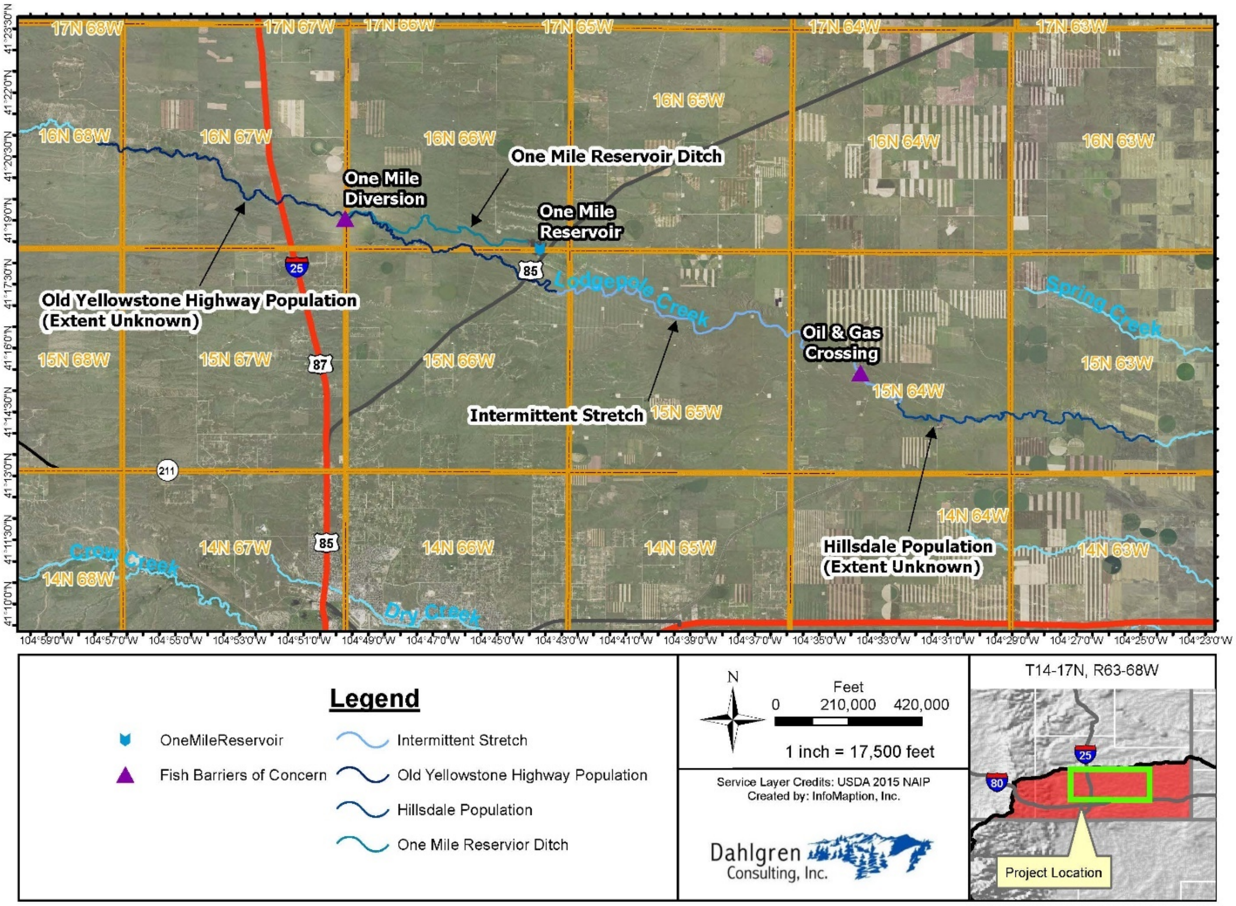


Figure 3-34 Lodgepole Creek Fish Barriers of Concern

Document Name: Fish_Passage_GF_Template
Date Saved: 9/8/2017

3.5.8.1 One Mile Reservoir Diversion – Lodgepole Creek Fish Barrier

The One Mile Reservoir Diversion provides water for irrigation and reservoir storage for One Mile Reservoir. Lodgepole Creek is perennial upstream of the structure and becomes intermittent approximately nine miles below the structure during low flows. The diversion is located in the middle of the Old Yellowstone Highway population reach. The diversion structure is on a mixture of state and private property. The existing structure is an approximately 250-foot long concrete weir with a gated concrete intake structure. The hydraulic drop across the weir during low flows appears to be approximately 3-feet or less. The Old Yellowstone Highway bridge crosses Lodgepole Creek approximately 200-feet below the diversion structure. The existing concrete diversion is in disrepair and likely beyond rehabilitation. However, the diversion still functions and appears to divert water.

One Mile Ditch Diversion Dam on Lodgepole Creek

The diversion is likely a partial barrier that allows some passage during some stream flows. As the diversion is in disrepair, closer inspection may reveal fish passage occurs for some species and age classes over a range of stream flows. Providing passage at this diversion would provide additional habitat and connectivity for the Old Yellowstone population.

3.5.8.2 Oil and Gas Crossing – Lodgepole Creek Fish Barrier

The Oil and Gas Crossing is located on private land and approximately three miles upstream of the Hillsdale population.   The road crossing was initially an unimproved, at-grade ranch road crossing and was improved to support oil and gas development in the area. Aerial imagery shows the crossing was constructed between 1994 and 2006 and major maintenance was completed between 2009 and 2012 including additional culvert installation and riprap armament. The crossing is likely a partial barrier allowing for some passage based on culvert slope and vertical elevation in relation to the stream bed. However, this barrier was inspected during a no flow condition and determining tailwater effects on culvert velocity will be key to determining passage. Providing passage at this barrier would provide connectively to the Old Yellowstone and Hillsdale populations during spring and high flows. As the two populations are generally isolated, providing passage at this barrier would likely have a big impact to the resiliency of the fishery.

Oil and Gas Roadway Crossing on Lodgepole Creek

Section 3.6 Climate

Climate in the South Platte River Watershed ranges from semi-arid within the plains areas to humid-alpine in the Laramie Range. The mountains capture much of the atmospheric moisture through orographic uplift and this causes increased annual precipitation in the mountainous regions while substantially decreasing precipitation in the plains and basin areas of the watershed.

Sources of precipitation in Wyoming are the result of different regional climate patterns. Weather systems transporting moisture from the Pacific Ocean are the primary sources of precipitation in the western part of the State. Systems bringing moisture from the Gulf of Mexico are the main sources of precipitation in eastern Wyoming.

Annual peak flows in the Laramie Mountains are caused by snowmelt runoff, rainfall runoff, and by a combination of both. These mountains often receive late winter or early spring moisture from the south and east. Annual peak floods in the plains areas are usually caused by thunderstorms.

3.6.1 Temperature and Precipitation

Figure 3.35 shows the average annual precipitation, measured in inches, across the Watershed for the period of 1981 to 2010. This data is from the PRISM Climate Group. NOAA weather stations are also shown. Table 3.13 lists the average monthly minimum and maximum temperatures and average monthly precipitation amounts for selected weather stations in the watershed.

Annual precipitation in the central portion of Laramie County is approximately 14 – 15 inches; while the annual precipitation in the Laramie Mountains exceeds 22 inches. The lowest annual precipitation is in the area around Carpenter.

Temperatures in the watershed range from average lows in January of 14°F to an average high of 84°F in July. Precipitation is highest in the spring months, with May and June exceeding 2 inches of total average precipitation.

Figure 3.36 shows the annual precipitation at the Cheyenne Airport Weather station for the period from 1950 to 2015. It is interesting to note that the average annual precipitation at the Cheyenne airport station in Table 3.13 is 15.17", while the average annual precipitation shown on Figure 3.36 is 14.75". The difference in the average annual precipitation values is due to averaging over different periods. The values in Table 3.13 are for the period 1915 to 2016 (a 102-year period), while the values in Figure 3.36 are for the period 1950 – 2015 (a 66-year period).

The average maximum and minimum temperature for the selected weather stations is illustrated in Figure 3.37 and 3.38, respectively. The average monthly precipitation for selected stations is graphed in Figure 3.39. Table 3.13 summaries this data.

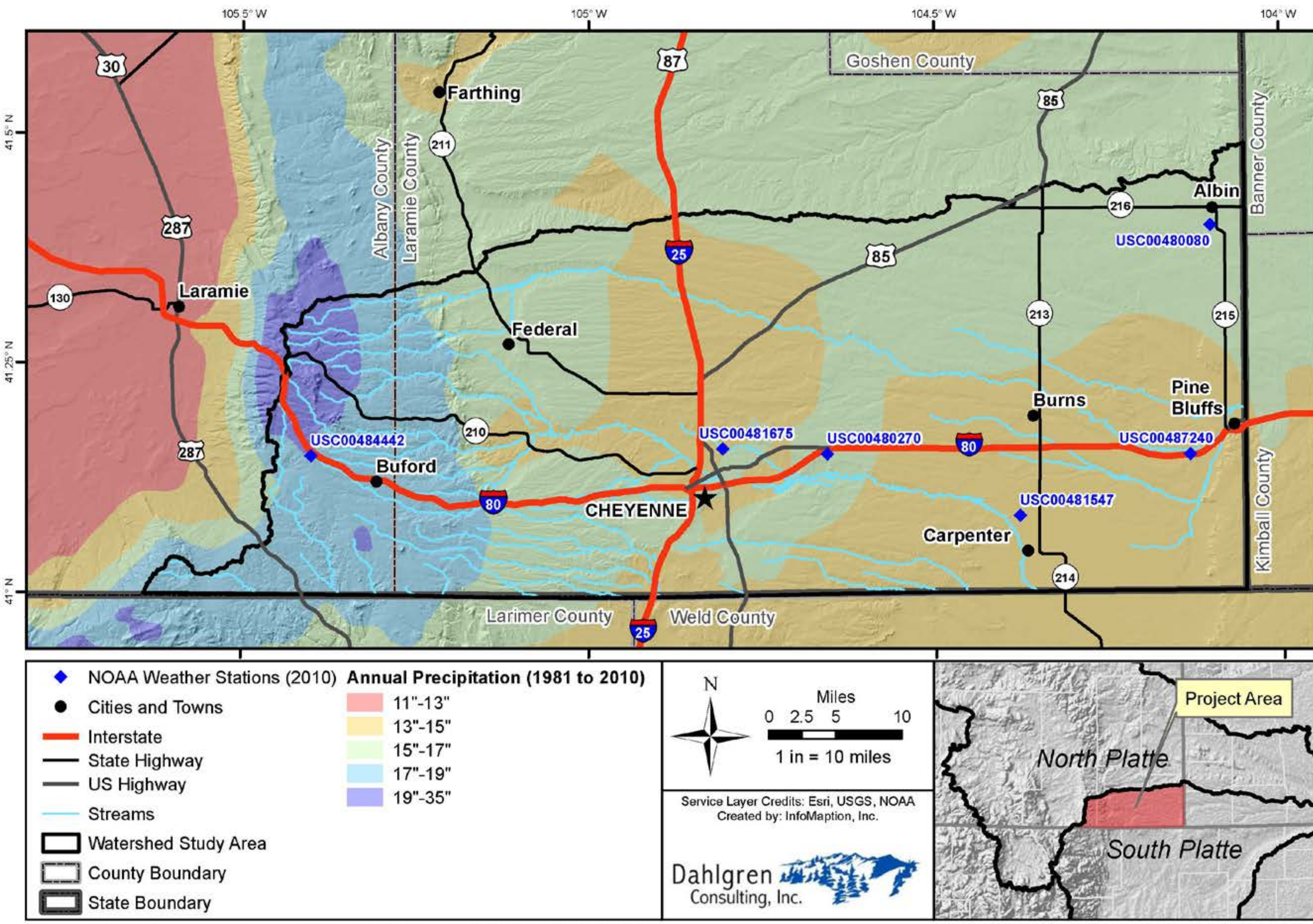


Figure 3.35 Average Annual Precipitation (PRISM, 1981-2010)

Document Name: Figure 3.17 Average Annual Precipitation
Date Saved: 10/6/2017

Table 3.13. - Average Maximum, Minimum, and Total Precipitation for Selected Stations in South Platte River Watershed.

Source: Western Regional Climate Center, 2016. http://www.wrcc.dri.edu/summary/Climsmwy.html

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
ALBIN, WYOMING (480080) 08/01/1948 to 06/30/2009													
Average Maximum Temperature (F)	38.7	42	48.3	58.1	68.1	78.8	86.4	84.6	75.7	63.3	47.8	39.8	61
Average Minimum Temperature (F)	15.4	18.1	22.5	30.2	40.1	49	55.4	53.9	44.9	34.4	23.5	17	33.7
Average Total Precipitation (in.)	0.66	0.62	1.49	1.92	2.93	2.59	2.1	1.66	1.41	1.12	0.83	0.72	18.05
ARCHER, WYOMING (480270) 07/02/1911 to 09/30/2005													
Average Maximum Temperature (F)	39.5	42.2	47.3	56	66.1	76.7	85.1	83.4	74.9	62.8	47.9	40.8	60.2
Average Minimum Temperature (F)	13.5	16	20.5	28.1	37.4	46.3	52.4	50.9	42.1	31.8	21.3	15.2	31.3
Average Total Precipitation (in.)	0.37	0.38	0.93	1.61	2.56	2.54	1.98	1.67	1.43	0.86	0.53	0.36	15.21
CARPENTER 3N, WYOMING (481547) 11/01/1948 to 09/30/2006													
Average Maximum Temperature (F)	40.6	44	49.5	59.4	69.1	79.5	87.1	85.3	76.2	64.5	49.3	42	62.2
Average Minimum Temperature (F)	13.4	16.5	21.2	29.5	39	47.8	54	52.3	43.3	32.8	21.7	15.1	32.2
Average Total Precipitation (in.)	0.3	0.23	0.82	1.22	2.45	2.46	2.26	1.63	1.38	0.73	0.42	0.31	14.2
CHEYENNE MUNI AP, WYOMING (481675) 01/01/1915 to 06/09/2016													
Average Maximum Temperature (F)	37.8	40.1	45	53.9	63.8	74.8	82.7	80.6	71.6	59.7	46.5	39.4	58
Average Minimum Temperature (F)	15.7	17.5	22.1	29.9	39.1	48.1	54.7	53.1	43.9	33.7	23.7	17.6	33.3
Average Total Precipitation (in.)	0.42	0.52	1.05	1.75	2.38	2.06	2.07	1.64	1.26	0.94	0.61	0.47	15.17
HECLA 1E, WYOMING (484442) 05/01/1979 to 04/30/2016													
Average Maximum Temperature (F)	39.2	40.2	47.9	54.1	63.6	74.4	82.7	80.4	71.5	59	47.3	38.6	58.2
Average Minimum Temperature (F)	17.2	16.8	22.3	28.6	36.8	44.9	53.1	50.9	42.1	31.4	22.7	16.4	31.9
Average Total Precipitation (in.)	0.32	0.37	0.89	1.59	2.21	2.1	2.05	1.83	1.44	1.07	0.58	0.43	14.89
PINE BLUFFS, WYOMING (487235) 01/01/1919 to 02/29/1988													
Average Maximum Temperature (F)	39.6	43.2	48.1	58.8	68.8	79.9	88.5	86.6	77.2	64.4	49.4	41.3	62.2
Average Minimum Temperature (F)	12.7	16	20.9	29.7	39.6	48.3	54.6	52.9	43	32.2	21.3	14.8	32.2
Average Total Precipitation (in.)	0.33	0.31	0.84	1.64	2.46	2.65	2.13	1.9	1.26	0.85	0.48	0.36	15.21
PINE BLUFFS 5 W, WYOMING (487240) 08/01/1948 to 10/31/2009													
Average Maximum Temperature (F)	40.5	42.6	50.2	57.9	68.2	78.6	86.8	84.4	75.3	61.9	48.9	40.7	61.3
Average Minimum Temperature (F)	13.1	14.8	21.4	28.6	39.1	48.2	53.9	52	42.2	30.2	20.7	13	31.4
Average Total Precipitation (in.)	0.17	0.2	0.62	1.12	2.1	2.26	2.2	1.83	1.35	0.82	0.3	0.2	13.17

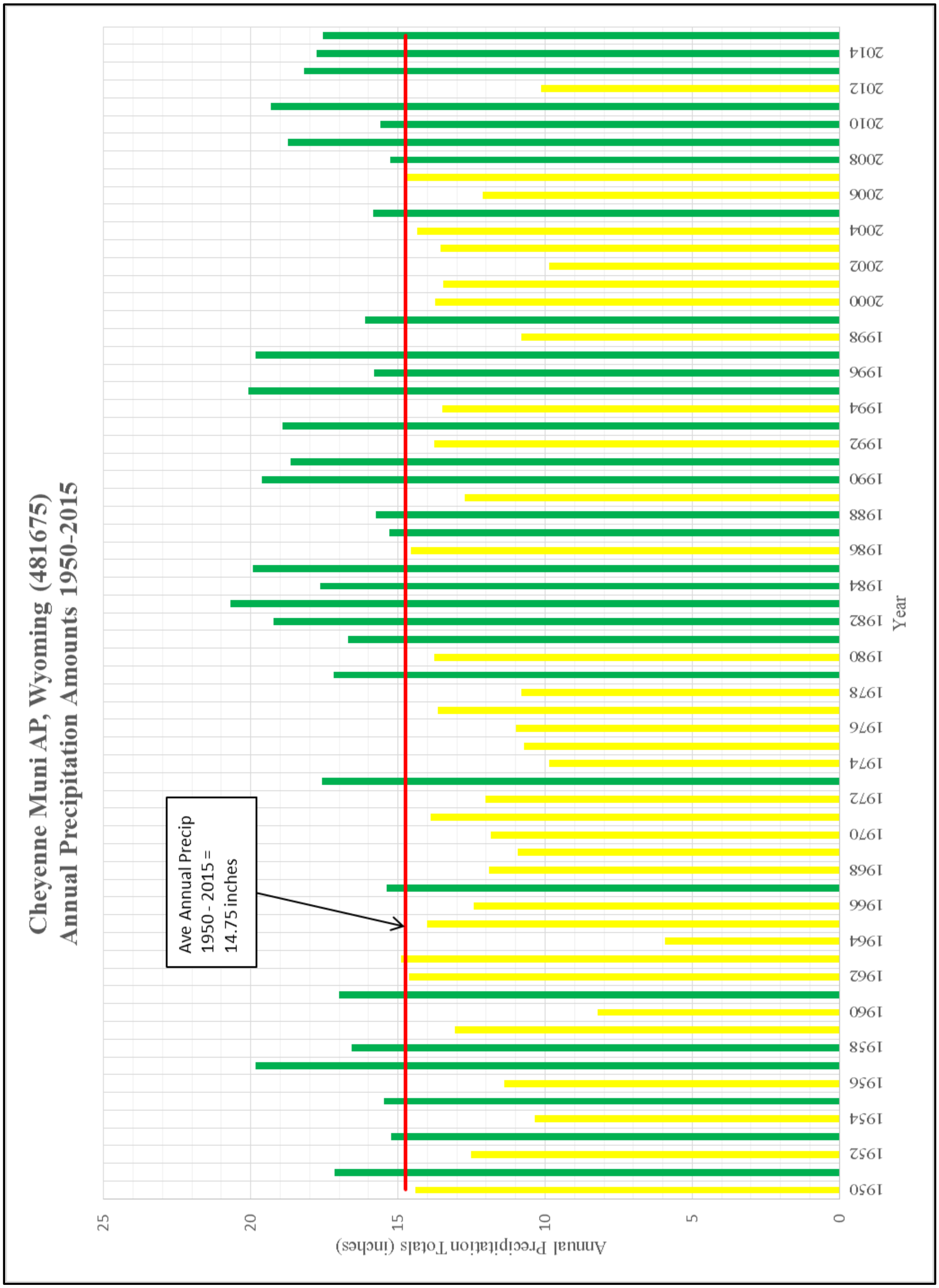


Figure 3.36. Annual Precipitation at the Cheyenne Airport Station 1950 – 2015.

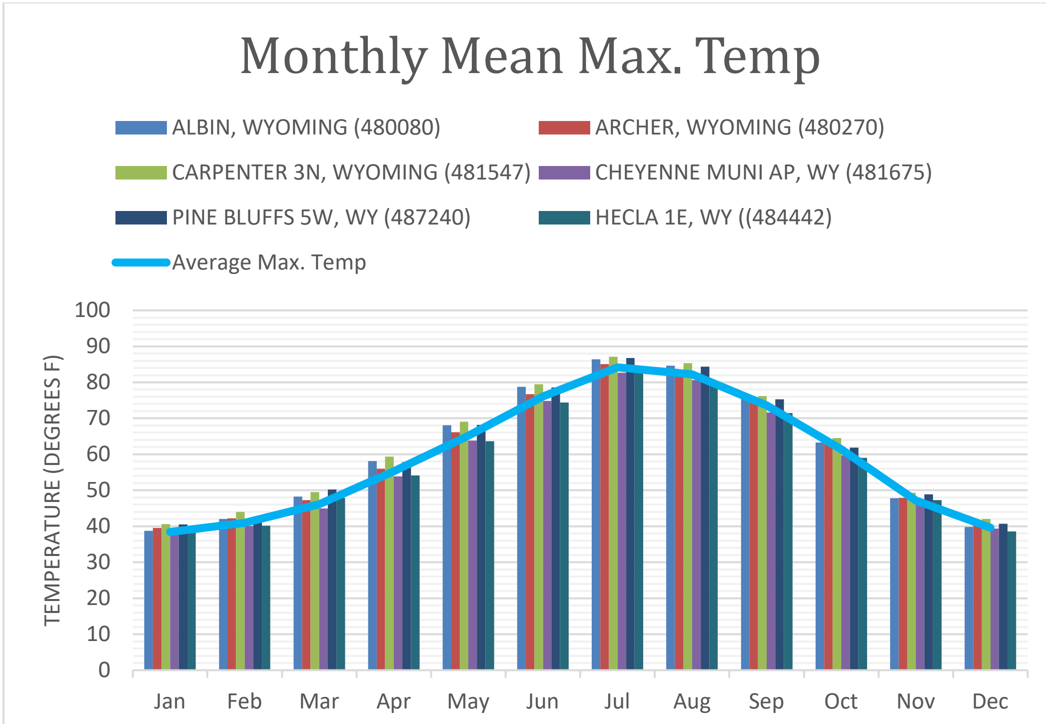


Figure 3.37 Mean Maximum Temperatures of Selected Stations in the South Platte River Watershed.

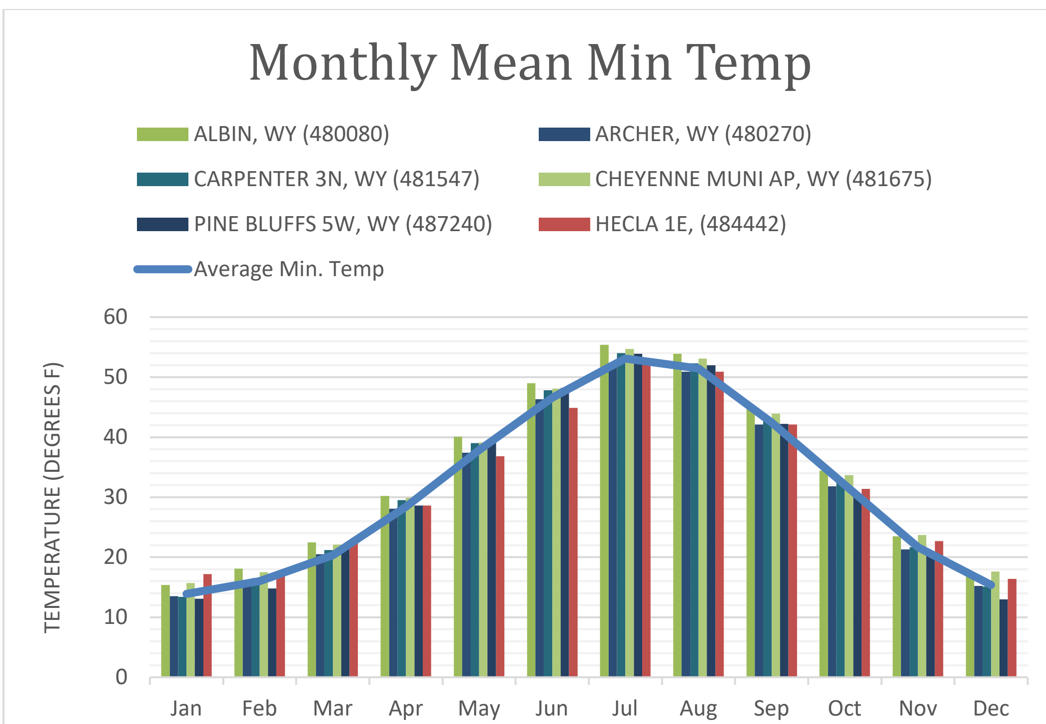


Figure 3.38 Mean Minimum Temperatures of Selected Stations in the South Platte River Watershed.

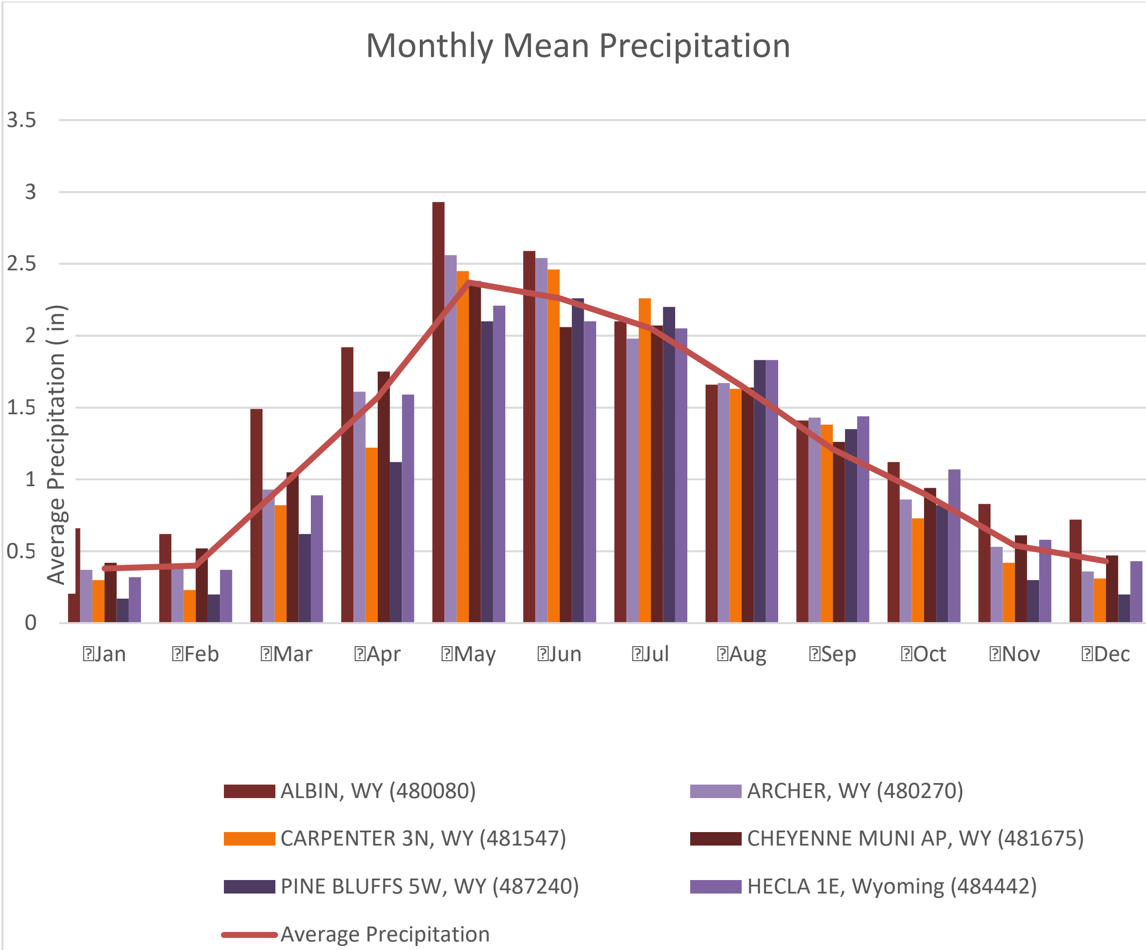


Figure 3.39. Mean Monthly Precipitation Measurements for Selected Stations in the South Platte River Watershed.

3.6.2 Droughts and Wet Cycles

Figure 3.40 shows the Palmer Drought Severity Index (PDSI) for the Wyoming, Climate Division 8, which covers most of southeast Wyoming. The PDSI indicates the prolonged and abnormal moisture deficiency or excess of an area. The PDSI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. It can be used to help delineate disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and potential intensity of forest fires.

Review of this information indicates that droughts have occurred in the area and will occur again. Likewise, wet cycles have occurred and will occur again. A prolonged wet cycle occurred from approximately 1900 until 1930.

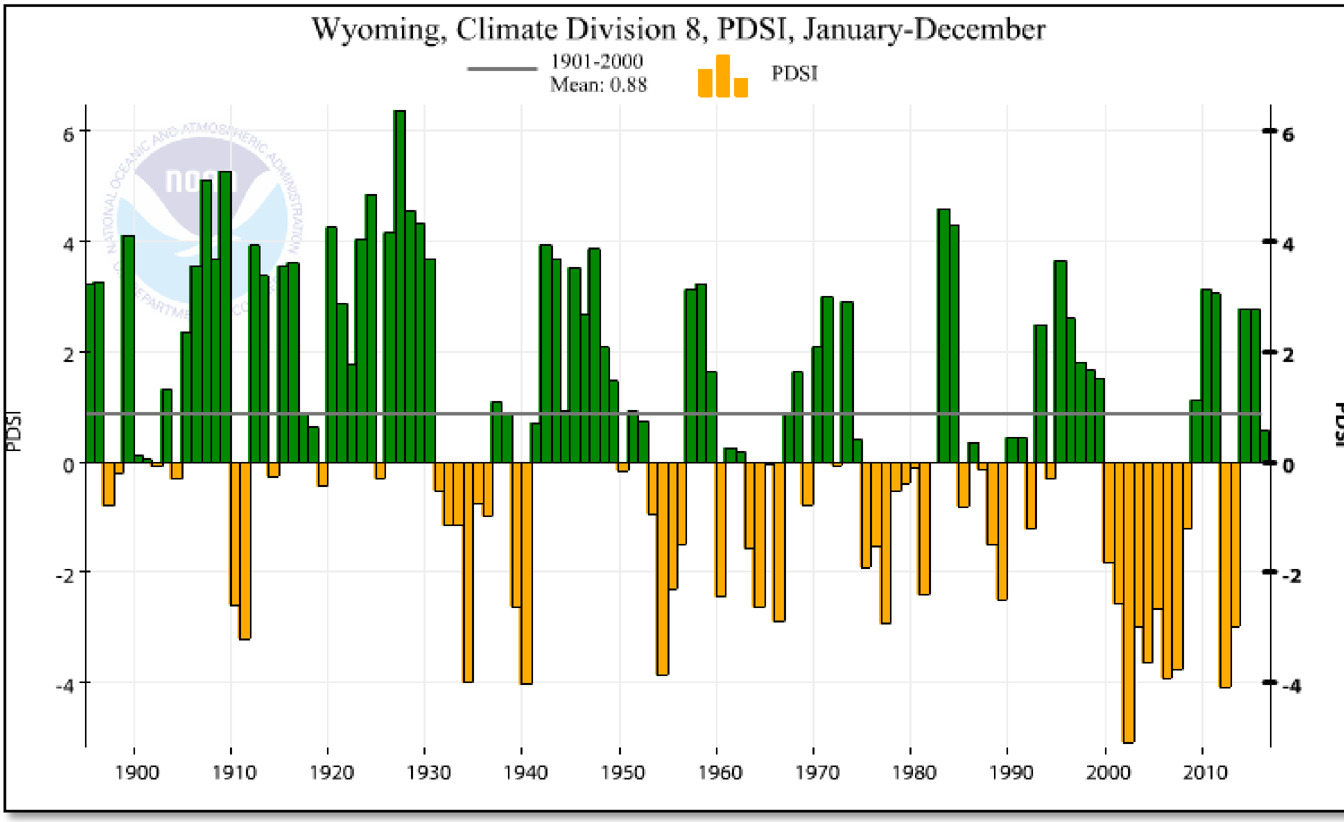


Figure 3.40. This figure shows the Palmer Drought Severity Index for Climate Division 8, which includes the SPRWS.

Previous droughts include the dust bowl periods of the 1930's and into the early 1940's, 1950's drought, the 1960's drought, and more recently the 2000's drought, which occurred from 2000 to 2008. Based on the information presented in Figure 3.40, the 2000's was perhaps the worst drought in recorded history for the South Platte River Watershed and surrounding areas. During the 2000's drought, runoff in the watershed measured by the Cheyenne Board of Utilities (BOPU) was 13% to 25% below the long-term average. Also, water levels in many BOPU wells dropped during the 2000's drought. These conditions were present in other areas of the watershed and are reflected in the low stream flow and declining groundwater levels that were observed.

3.6.3 Evapotranspiration

Evapotranspiration (ET) takes into account water transferred to the atmosphere by evaporation from soils and other surfaces as well as from plants through transpiration. Wyoming's low relative humidity, high percentage of sunshine, and high persistent winds contribute to a climate that is considered semiarid. In the SPRWS, annual evaporation ranges from approximately 45 to 50 inches (Wyoming Climate Atlas, http://www.wrds.uwyo.edu/sco/climateatlas/evaporation.html).

In Cheyenne, total mean annual evaporation is approximately 46 inches. Mean annual net evaporation (ET minus precipitation) is approximately 32 inches. Clearly, evaporation exceeds precipitation in Cheyenne. Even in the highest elevations of the watershed, which are the areas with the highest precipitation, evaporation exceeds precipitation.

3.6.4 Growing Seasons

The average growing season (freeze-free period) for the SPRWS ranges from approximately 135 - 155 days. The variation is related to the topography and elevation of the area. The growing season is relatively short in the higher elevations, and is extended along the eastern plains of the study area. Figures 3.41 through 3.43 (from the Western Regional Climate Center) show the probability of days between the last spring and first fall occurrences of various temperatures. These graphs present the data for the Cheyenne Airport, Hecla 1E, and Pine Bluffs 5W weather stations.

There is a 50% chance of having 133 consecutive days without a freeze (defined as a low temperature of 32.5° F) at the Cheyenne Muni AP Station No. 481675; at the HECLA 1E Station No. 484442 there is a 50% probability of having 111 consecutive frost free days; and at the Pine Bluffs 5 W Station No. 487240 there is a 50% probability of having 123 consecutive frost free days

For hardier plants that can withstand slightly colder temperatures (28.5° F), the growing season is slightly longer, of course. The 50% probability of consecutive days with minimum temperature above 28.5° F at the Cheyenne airport is 154 days; at the HECLA station it is 136 days; and at the Pine Bluffs station it is 144 days.

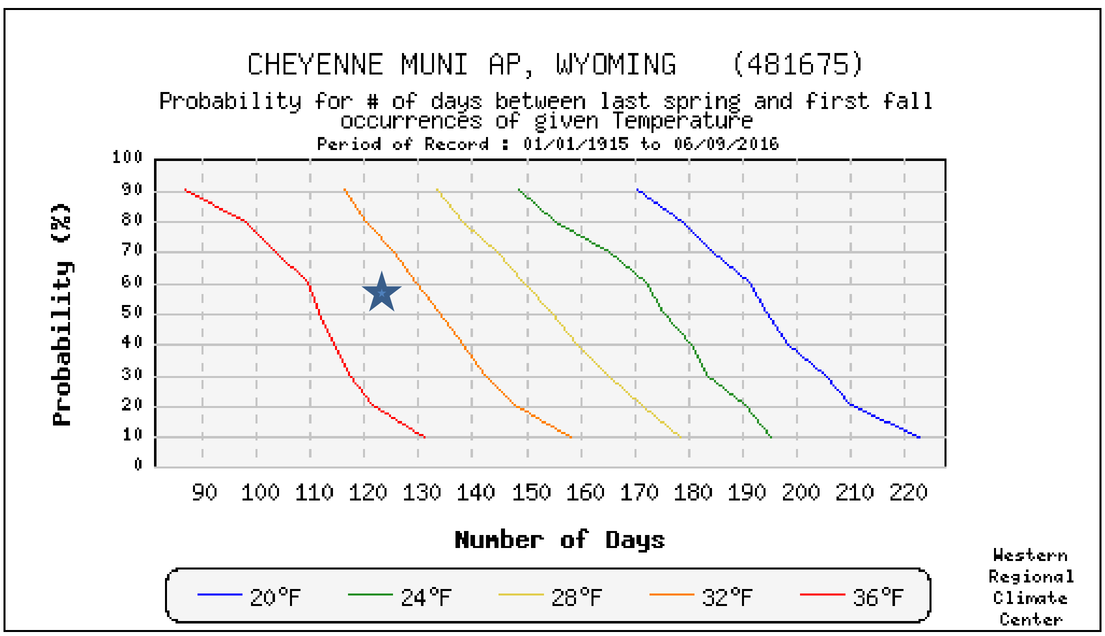


Figure 3.41 CHEYENNE MUNI AP (481675) Freeze Day's Probability

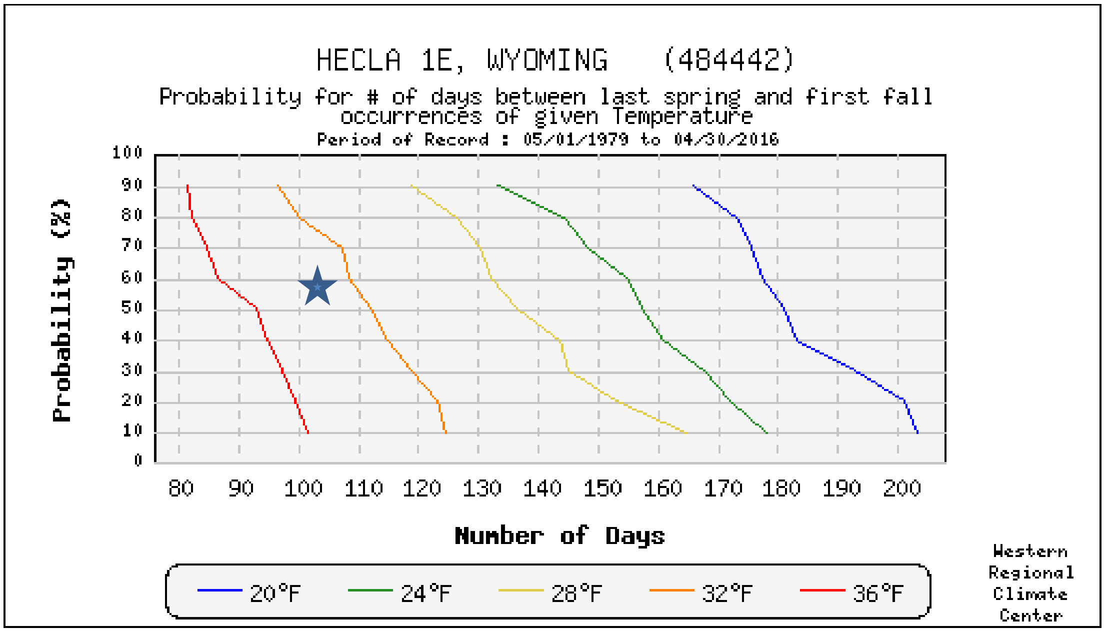


Figure 3.42 HECLA 1E, (484442) Freeze Free Days Probability

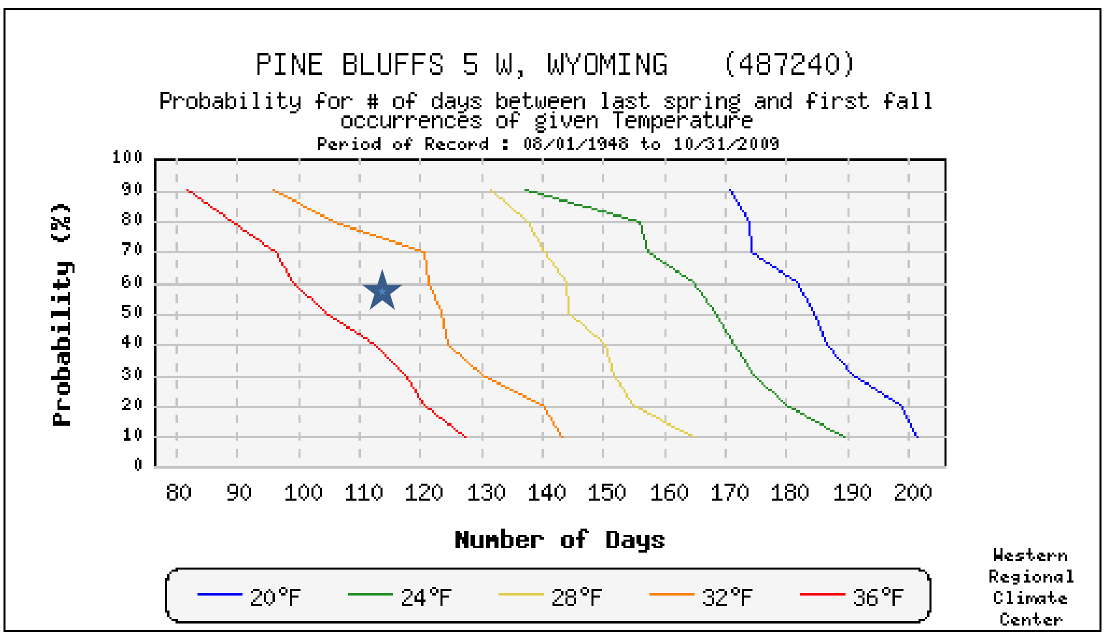


Figure 3.43 PINE BLUFFS 5 W (487240) Freeze Free Days Probability.

Section 3.7 Surface Water Hydrology

3.7.1 Introduction

This section of the report discusses surface hydrology within the Watershed, particularly the surface water hydrology of the two principal streams – Crow Creek and Lodgepole Creek. Stream flow provides water for surface water diversions and also seepage from the creeks provides groundwater recharge. Sound estimates of surface water flows are key to make sound estimates of water availability.

Unfortunately, there is limited stream flow gage data in the South Platte Watershed. The only long-term gage is Crow Creek at 19th Street, USGS gage No. 6755960. And this gage is planned to be discontinued and no longer operated after June 2018. However, the Wyoming State Engineer's Office and Laramie County Conservation District have plans to continue to operate the gage.

Figures 3.44 and 3.45 show the HUC 8 and HUC 10 drainage basins within the South Platte River Watershed. Additional information, tables, and graphs concerning surface water hydrology are presented in Appendix B of this report.

As shown on Figure 3.44, the watershed includes six HUC 8 drainage basins: 10190007 (Cache La Poudre), 10190008 (Lone Tree-Owl), 10190009 (Crow), 10190015 (Upper Lodgepole), 10190016 (Lower Lodgepole), and 10190017 (Sidney Draw). Table 3.14 summarizes the HUC 8 drainages.

Table 3.14 – Summary of HUC 8 Drainages in the SPRWS

Name	Area (acres – sq. mi)
Cache La Poudre	79,650 – 124.4
Lone Tree – Owl	86,656 – 135.4
Crow	349,870 – 546.7
Upper Lodgepole	683,050 – 1067.3
Lower Lodgepole	99,298 – 155.2
Sidney Draw	7400 – 11.56

The primary streams in the South Platte River Watershed are Lodgepole Creek and Crow Creek, whose drainage areas together comprise nearly 80% of the South Platte Watershed. The primary sources of surface flow in Lodgepole Creek and Crow Creek are snowmelt runoff coming from the Laramie Range near the headwaters of the creeks, from rainfall runoff following precipitation events, and from contributions from groundwater.

The surface flow in Lodgepole Creek and in Crow Creek does not consistently decrease as one moves downstream, like most desert area streams; nor does the flow consistently increase as one moves downstream, like streams in humid regions.

The flow in these creeks will increase, then decrease, and often increase again as one moves from upstream to downstream areas along the creek. The creeks will flow at the surface, then the flow will decrease and often nearly or completely dry up, and then re-appear. These changes in the flow are primarily caused by seepage from the creeks into the alluvium and groundwater system; and then flow from groundwater moves back into the creek, and then at another location downstream the surface flows in the creeks will seep back into sub-surface.

In 1917, Oscar Meinzer described the flow in Lodgepole Creek (USGS WSP-425). Meinzer's description of the flow in Lodgepole Creek is paraphrased below

> The flow in Lodgepole Creek was measured in September 1915, near where Highway 211 (the Horse Creek Highway) now crosses the creek, to be 7 ½ cubic feet per second (cfs). From this point to the diversion dam for the One Mile Reservoir located in Section 36, T16N, R67W (at Yellowstone Road north of Highway 85), and the flow appeared to decrease slightly. For a short distance below the diversion dam the channel was dry, but within two miles the stream had received flow from groundwater and the flow was approximately 1 cfs. In Section 8, T15N, R65W, i.e. approximately three miles below Highway 85, the stream disappeared and the channel was dry for a distance of nearly 10 miles. The stream reappeared near Section 26, T15N, R64W (which is approximately 2 miles northwest of Hillsdale) and had a flow of approximately 2 cfs to an area north of Egbert near where County Road 154 now crosses the creek. From Egbert, to its junction with Muddy Creek, the creek remained dry. Inflow from Muddy and Spring Creeks, plus contributions from groundwater gave Lodgepole Creek a flow of approximately 6 cfs at a point six-miles east of the State line.

Lodgepole Creek still has characteristics similar to those reported by Meinzer, except for the areas near Pine Bluffs and downstream, where the surface flow has decreased. Refer to the discussion concerning the flow in Lodgepole Creek at Bushnell, NE gage (USGS 6762500) presented below.

Crow Creek also has segments or reaches where it flows, disappears and re-appears again. In most years there is flow in Crow Creek from the headwaters downstream to approximately Happy Jack Road, then the flow decreases and often dries up through the Polo Ranch, it reappears above Round Top Road west of Cheyenne, and flows through Cheyenne. Storm water runoff from the City of Cheyenne, flows from Dry Creek and effluent from the Cheyenne Waste Water Treatment Plants sustains the flow through the Wyoming Hereford Ranch Reservoirs and generally to the Beaver Dam Ditch Diversion located in Section 7, T12N, R63W. Often there is flow at County Road 146, but the creek disappears as it flows through Carpenter and downstream into Colorado.

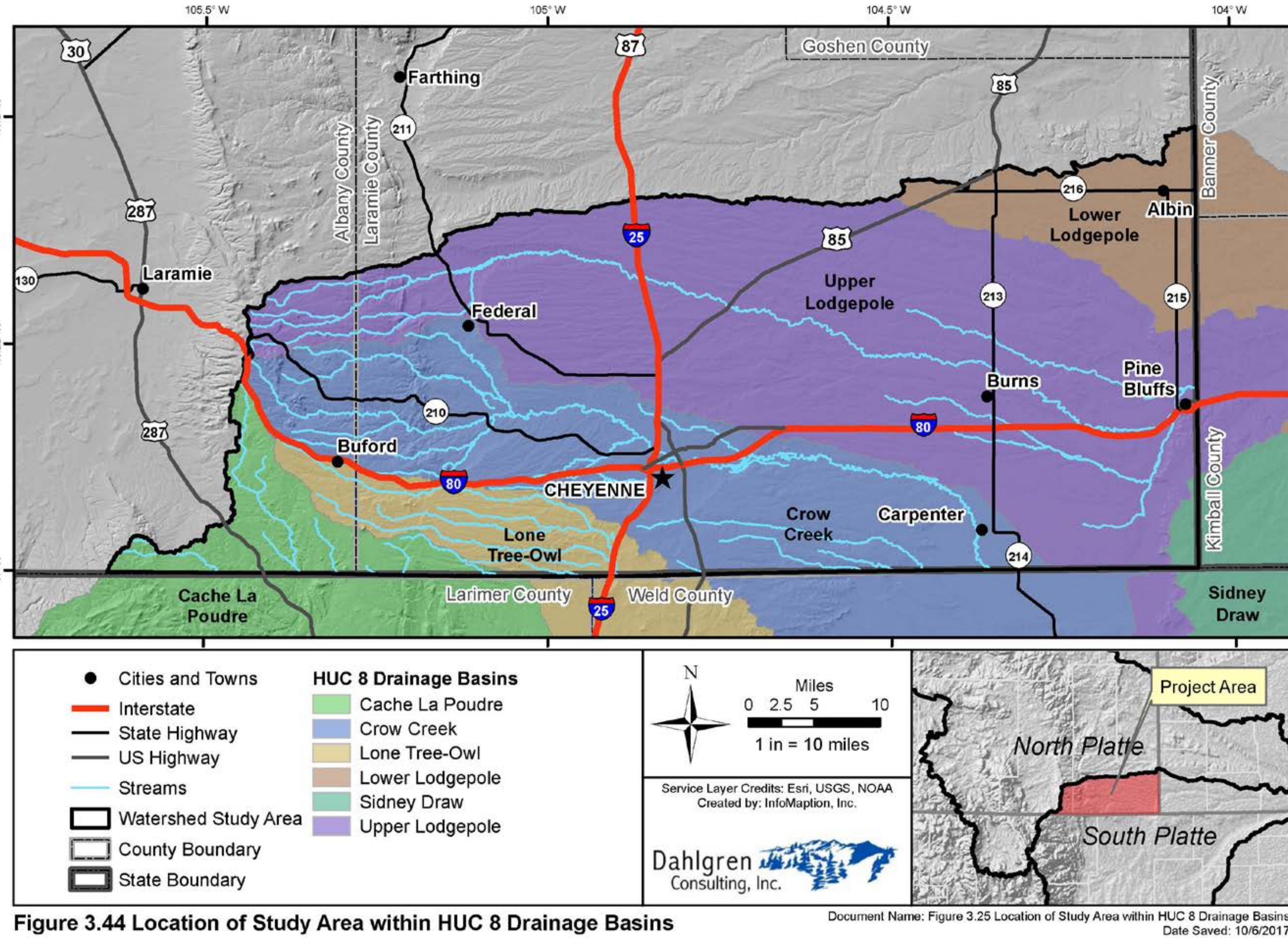


Figure 3.44 Location of Study Area within HUC 8 Drainage Basins

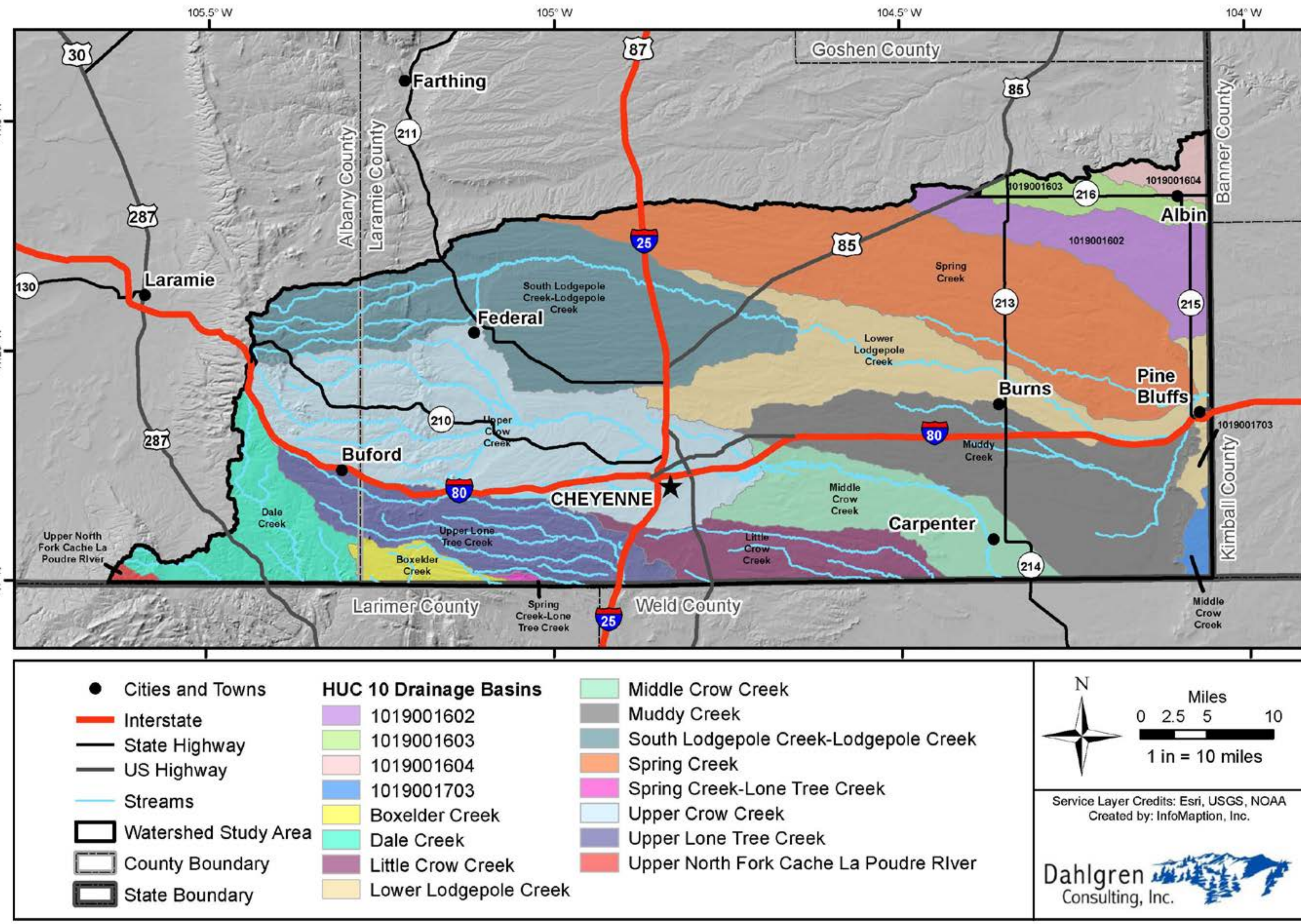


Figure 3.45 HUC 10 Drainage Basins within the South Platte River Watershed Area

Document Name: Figure 3.26 HUC 10 Drainage Basins
Date Saved: 10/6/2017

3.7.2 USGS Gaging Stations

The USGS and/or Wyoming State Engineer's Office has operated a total of 15 stream gages in the watershed. The locations of these gages are shown on Figure 3.46

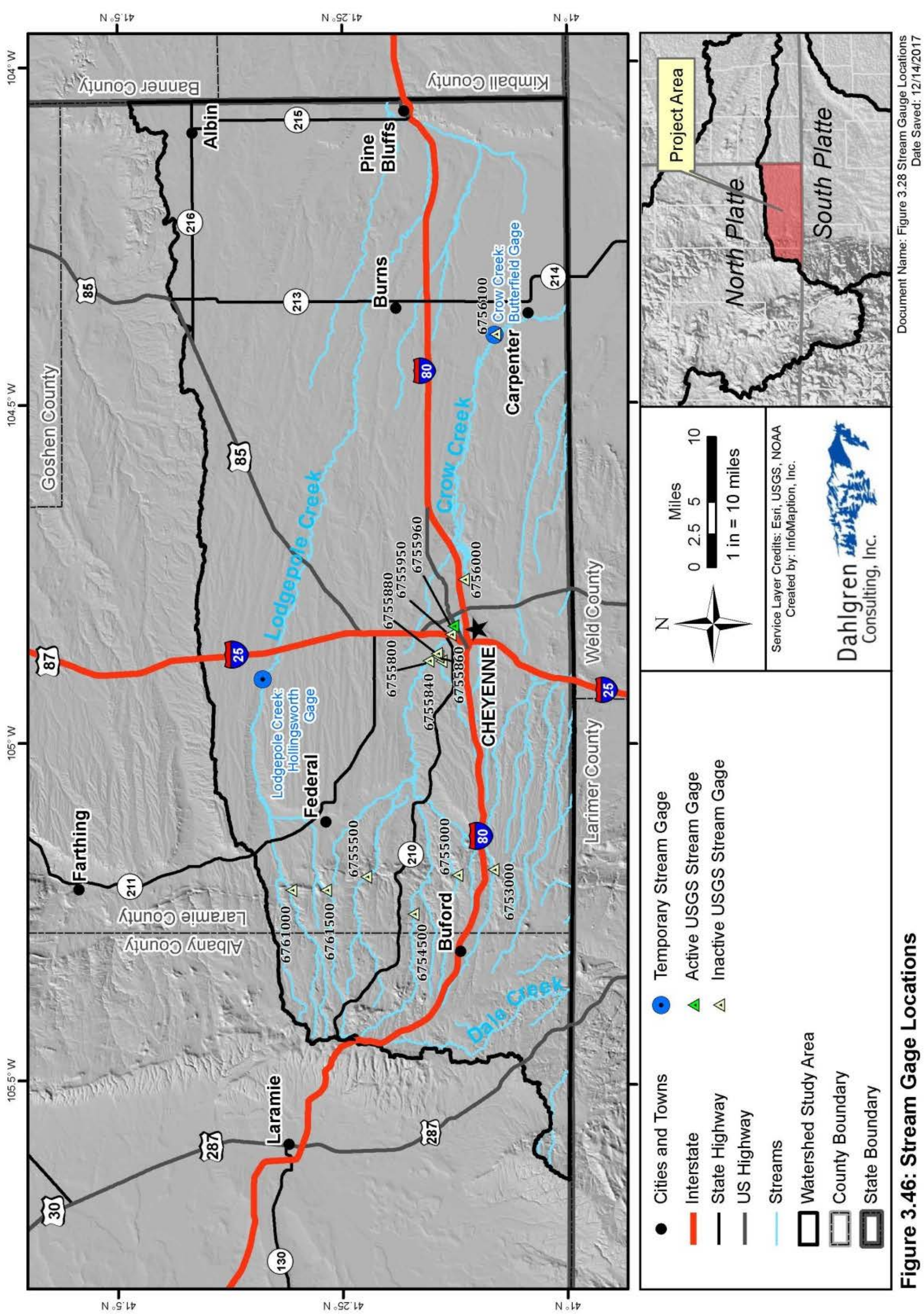


Figure 3.46: Stream Gage Locations

Figure 3.47 shows the periods when these stream gages were active. As shown on only two of these stations continue to operate (Crow Creek at 19th Street and Lodgepole Creek at Bushnell, NE and the 19th Street gage is scheduled to be discontinued by the USGS in June 2018) and 9 of the 15 gaging stations operated for less than seven years.

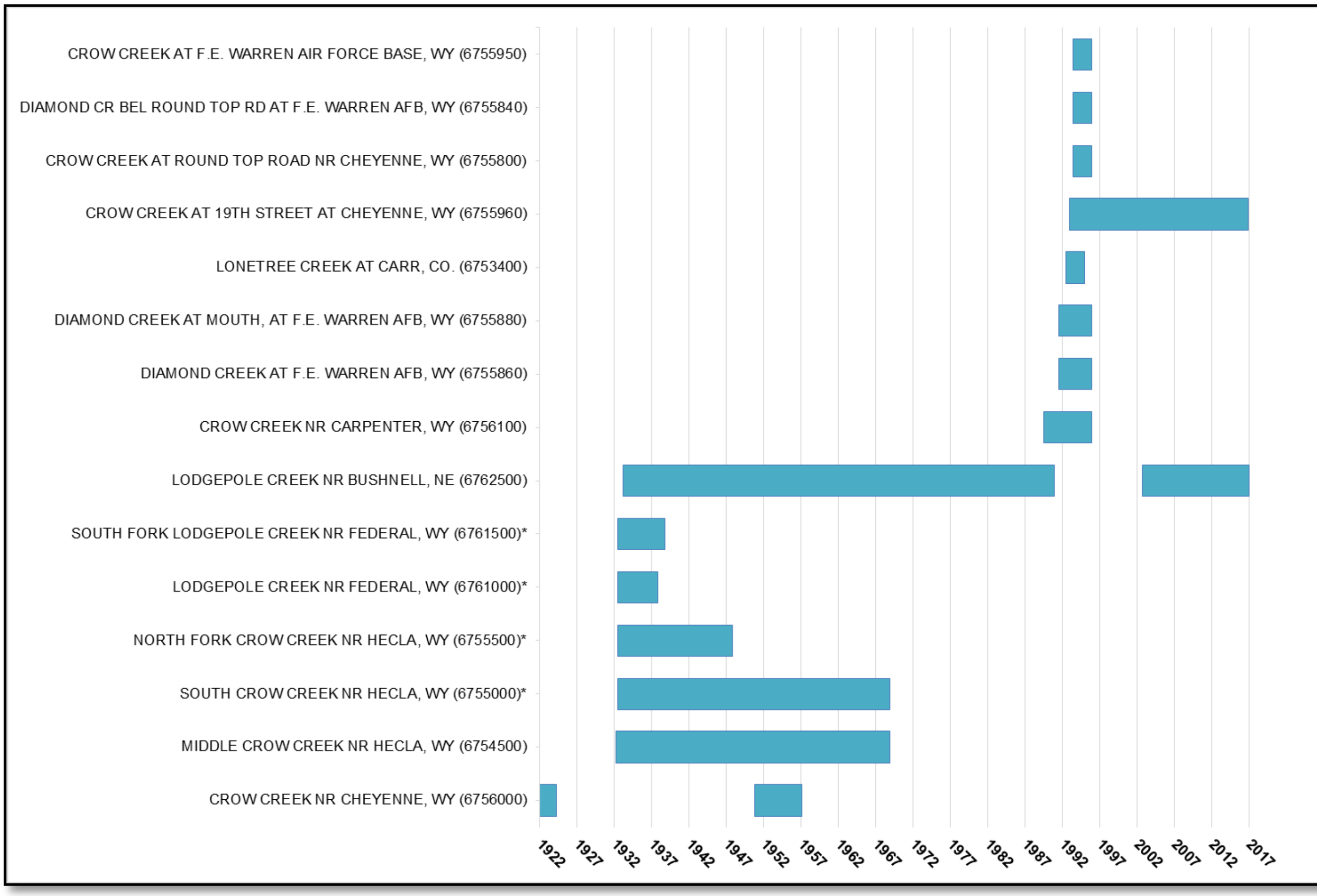


Figure 3.47. Shows the period of record of when the USGS stream gages were active.

The attributes of the 15 USGS gaging stations are displayed in Table 3.15. Historical USGS mean monthly flowrates and mean annual flowrate were analyzed for each of the available gaging stations and are displayed in Table 3.16. These values are compared to those presented in the Wyoming Geological Survey's (WGS) 2009 mapping publication titled *Surface Water Resources Map of Wyoming: Streamflows and Storage.*

USGS WRI 03-4107, *Peak Flow Characteristics of Wyoming Streams*, https://pubs.usgs.gov/wri/wri034107/ describes the hydrology of the Black Hills and Laramie Mountains, which are included in the "Eastern Mountains" hydrologic region, as follows:

> Characterization of peak flows in the Black Hills and Laramie Mountains historically has been problematic. The paucity of gaging stations, the variability of stream flows, and geologic influences on hydrology all contribute to the difficulty of

regionalizing peak flow characteristics in the mountainous area of eastern Wyoming.

Annual peak floods in the eastern mountainous areas of the State are caused by snowmelt runoff, rainfall runoff, and a combination of snowmelt and rainfall.

Annual peak flows resulting from rainfall runoff … are typically larger than those generated by snowmelt runoff.

Table 3.15 Stream Gage Attributes

USGS Station Number	USGS Station Name	Period of Record	Drainage Area [Square Miles]	Latitude	Longitude	Gage Elevation (ft, NGVD29)
6753400	LONETREE CREEK AT CARR, CO.	03/18/1993 - 09/29/1995	169	40° 53' 54" N	104° 52' 03" W	4,680
6754500	MIDDLE CROW CREEK NR HECLA, WY	04/01/1933 - 10/01/1969	26	41° 10' 30" N	105° 15' 05" W	7,270
6755000	SOUTH CROW CREEK NR HECLA, WY	06/01/1933 - 09/29/1969*	14	41° 07' 35" N	105° 11' 38" W	7,130
6755500	NORTH FORK CROW CREEK NR HECLA, WY	06/01/1933 - 09/29/1948*	28	41° 13' 40" N	105° 11' 50" W	6,920
6755800	CROW CREEK AT ROUND TOP ROAD NR CHEYENNE, WY	03/21/1994 - 09/29/1996	239	41° 09' 30" N	104° 52' 44" W	6,136
6755840	DIAMOND CR BEL ROUND TOP RD AT F.E. WARREN AFB, WY	03/21/1994 - 09/30/1996	11	41° 08' 38" N	104° 52' 46" W	6,160
6755860	DIAMOND CREEK AT F.E. WARREN AFB, WY	05/16/1992 - 09/30/1996	11	41° 08' 51" N	104° 52' 22" W	6,130
6755880	DIAMOND CREEK AT MOUTH AT F.E. WARREN AFB, WY	05/18/1992 - 09/30/1996	11	41° 08' 56" N	104° 52' 06" W	6,120
6755950	CROW CREEK AT F.E. WARREN AIR FORCE BASE, WY	03/21/1994 - 09/29/1996	253	41° 08' 02" N	104° 50' 25" W	6,070
6755960	CROW CREEK AT 19TH STREET AT CHEYENNE, WY	10/01/1993 - Current	257	41° 07' 52" N	104° 49' 41" W	6,050
6756000	CROW CREEK NR CHEYENNE, WY	10/01/1922 - 10/31/1924 07/02/1951 - 09/29/1957	297	41° 07' 09" N	104° 45' 33" W	5,930
6756100	CROW CREEK NR CARPENTER, WY	05/01/1990 - 09/30/1996	415	41° 04' 58" N	104° 23' 56" W	5,480
6761000	LODGEPOLE CREEK NR FEDERAL, WY	06/01/1933 - 09/29/1938*	25	41° 18' 40" N	105° 13' 00" W	6,970
6761500	SOUTH FORK LODGEPOLE CREEK NR FEDERAL, WY	06/01/1933 - 09/29/1939*	16	41° 16' 20" N	105° 13' 00" W	7,080
6762500	LODGEPOLE CREEK NR BUSHNELL, NE	03/01/1934 - 10/1/1991 10/01/2002 - Current	1214	41° 13' 40" N	103° 53' 35" W	4,843

*Data collection in the period of record primarily occurred from May through September of each year.

Figures B-3.1 and B-3.2, which are included in Appendix B-3 are graphical representations of the Table 3.15 data. These hydrographs illustrate that flows begin to increase in April and the highest flows occur in June. The flows quickly drop through the months of July and August.

One noteworthy observation that can be made while examining the gage data presented in Table 3.16 below is the decrease in flowrate at the USGS gage 6762500 (Lodgepole Creek near Bushnell, NE). The last three lines on Table 3.16 shows the mean annual flow at this gage for the periods 1934 – 1970, 1970 – 1991, and 2002 - present. Figure 3.50 (page 3-100) presents the annual runoff for this gage. The flowrate at the Bushnell gage on Lodgepole Creek has decreased from approximately 8670 AF per year during the period of 1935 – 1970 to less than approximately 215 AF per year currently. Groundwater pumping in the Lodgepole Creek basin upstream of the gage is the likely cause of the decrease in surface water flow observed at this gage.

Table 3.16 – Stream Flow Data for the Stream Gages in the South Platte Watershed Listed in Table 3.15

USGS Station Number	USGS Station Name	Historical Monthly Average Flowrate [cfs]												Annual Average Flowrate [cfs]	WGS Published Flowrate [cfs]	
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			average ac-ft
6753400	LONETREE CREEK AT CARR, CO.	0.4	0.4	0.6	0.7	0.7	1.0	0.6	0.3	0.3	0.6	0.5	0.4	0.5	N/A	380.1
6754500	MIDDLE CROW CREEK NR HECLA, WY	1.4	1.5	2.2	11.0	20.0	12.0	4.4	1.6	1.3	1.8	2.0	1.7	5.1	5.1	3674.3
6755000	SOUTH CROW CREEK NR HECLA, WY	0.4	0.4	1.0	4.6	5.2	3.1	1.0	0.4	0.4	0.7	0.5	0.4	1.5	1.5	1089.62
6755500	NORTH FORK CROW CREEK NR HECLA, WY	0.5	0.8	1.1	1.2	11.0	7.3	5.0	3.0	3.3	2.7	1.6	1.6	3.3	N/A	2363.256667
6755800	CROW CREEK AT ROUND TOP ROAD NR CHEYENNE, WY	3.6	3.5	3.4	5.3	3.0	21.0	6.6	0.9	0.2	3.4	6.3	3.5	5.1	N/A	3661.63
6755840	DIAMOND CR BEL ROUND TOP RD AT F.E. WARREN AFB, WY	0.0	0.0	0.0	0.1	0.5	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.1	N/A	83.26
6755860	DIAMOND CREEK AT F.E. WARREN AFB, WY	0.1	0.1	0.2	0.3	0.5	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.2	N/A	138.1633333
6755880	DIAMOND CREEK AT MOUTH AT F.E. WARREN AFB, WY	0.1	0.1	0.2	0.4	0.5	0.5	0.2	0.1	0.1	0.2	0.2	0.1	0.2	N/A	154.4533333
6755950	CROW CREEK AT F.E. WARREN AIR FORCE BASE, WY	4.7	4.4	4.1	6.5	6.1	24.0	8.1	1.5	1.5	3.7	6.4	5.3	6.4	N/A	4603.433333
6755960	CROW CREEK AT 19TH STREET AT CHEYENNE, WY	5.5	6.4	8.2	12.0	43.0	23.0	7.6	4.4	4.2	6.1	6.9	5.6	11.1	8.4	8018.3
6756000	CROW CREEK NR CHEYENNE, WY	8.2	9.9	12.0	20.0	14.0	20.0	14.0	8.5	8.4	9.9	11.0	8.8	12.1	11.9	8730.233333
6756100	CROW CREEK NR CARPENTER, WY	7.2	8.9	16.0	6.8	7.9	48.0	11.0	7.2	10.0	14.0	17.0	10.0	13.7	13.6	9894.666667
6761000	LODGEPOLE CREEK NR FEDERAL, WY	0.7	0.8	1.4	1.9	7.6	6.4	2.2	0.9	0.5	1.0	1.2	0.7	2.1	N/A	1524.02
6761500	SOUTH FORK LODGEPOLE CREEK NR FEDERAL, WY	1.0	1.1	1.5	1.4	5.5	4.1	1.4	0.8	0.8	1.1	1.2	1.1	1.7	N/A	1262.173333
	LODGEPOLE CREEK NR BUSHNELL, NE (1934-1970)	10.4	12.1	13.9	13.7	13.2	15.0	11.2	9.2	12.9	10.2	10.9	10.5	11.9 9.1		8643.705278
6762500	LODGEPOLE CREEK NR BUSHNELL, NE (1970-1991)	5.3	7.1	7.4	7.9	9.0	8.6	7.7	4.7	3.5	4.6	5.2	4.9	6.3	9.1	4579.3
	LODGEPOLE CREEK NR BUSHNELL, NE (2002-Current)	0.09	0.11	2.8	0.13	0.11	0.12	0.05	0	0	0	0.03	0.06	0.3		211.1666667

3.7.3. Temporary Gaging Stations

Temporary gaging stations were installed for this study on Crow Creek in July of 2016 and on Lodgepole Creek in March of 2017. The locations of the temporary gages are shown on Figure 3.46. A transducer was installed at each of these sites, coupled with the recorded stage and flowrate data allowed for the flowrates to be determined as a function of stage via a rating curve. Spot measurements to calibrate the gage flow and provide additional data were made periodically at each temporary gage. Flows were measured and calculated using the velocity-area method described by D. Phil Turnipseed and Vernon B. Sauer [2010] in USGS' *Discharge Measurements at Gaging Stations*. A 60% depth for velocity measurements was used with one foot sections for the width.

Descriptions of each station are given in below.

<u>Crow Creek temporary stream gage on the Butterfield property</u>

This temporary stream gage is located in Section 23, T13N, R63W (41.0832°N, 104.3998°W). It is approximately 0.7 miles east of County Road (CR) 146 on CR 206, then turn south into the Butterfield property on the private driveway. This site is approximately 400 feet upstream of discontinued USGS gage no. 6756100, Crow Creek near Carpenter. The drainage area above the gage is approximately 415 sq. miles and the elevation at the gage is 5480 (NAV29). This site was chosen because it is close enough to the discontinued USGS gage so that the between the old USGS gage and this temporary data can be correlated and the period of record extended. Also, this gage measures flow in

Crow Creek downstream of Cheyenne, but upstream of the Carpenter area, where stream flows seep into the ground.

In addition to this temporary gage which was installed with a continuous recorder to monitor flow, many spot measurements of the flow rate in Crow Creek at County Road 201 were made. These spot measurements were made to estimate the changes (typically loss in stream flow) between the temporary gage site and Crow Creek at County Road 201. Country Road 201 is approximately 5 miles downstream of the temporary gage and below Carpenter. These measurements are presented in Table 3.17 and shown on Figure B-3.3 in Appendix B.

Photo shows the temporary Crow Creek gage on the Butterfield property

Photo shows Crow Creek at County Road 201

<u>Lodgepole Creek temporary stream gate on the Hollingsworth property</u>

This temporary stream gage is located in Section 20, T16N, R67W (41.3426°N, 104.9053°W), It is approximately 10 miles north of Cheyenne on I-25, then 1.7 miles west on CR 224, then 0.7 miles south on CR 120. The gage is ~60 yards upstream of CR 120. The drainage area above the gage is approximately 111 sq. miles and the elevation at the gage is 6275 (NAV29).

Photo shows the Lodgepole Creek Gage at the Hollingsworth Property

Table 3.17 Measured Flows at the Crow Creek Temporary Gage and the Measurements made at County Road 201.

Date	Butterfield Temporary Gage Measured Flowrate [cfs]	Measured Flow Rate at County Road 201	Difference in Flow Between Temp Gage and Rd 201
7/13/2016	10.8	N/A	
8/12/2016	0.9	0	0.9
10/20/2016	7.05	0	7.05
12/2/2016	46.8	30.4	16.4
3/3/2017	24.4	25.9	-0.5 (there was more flow at Rd 201)
4/5/2017	10.3	6.8	3.5
5/10/2017	6.1	0	6.1
5/24/2017	31.1	45.0	-14.0 (there was more flow at Rd 201)
5/26/2017	48.1	38.5	9.6
6/30/2017	0.65	0	0.65
8/22/2017	1.0 (est)	0	1
11/03/2017	1.5	0	1.5

Table 3.18 showing Measured Flows at the Lodgepole Creek temporary gage

Date	**Measured Flowrate [cfs]**
4/5/2017	8.4
5/24/2017	56.0
5/26/2017	38.3
6/30/2017	1.7
11/03/2017	1.7

3.7.3.1 Additional Streamflow Spot Measurements

The Study Team also made spot streamflow measurements on Lodgepole Creek and on Crow Creek. The method for measuring flows is identical to those described in Section 3.7.3. These measurements are presented in Table 3.19.

Table 3.19 – Spot Stream Flow Measurements During the Watershed Study

Gage Name	Location	Drainage Area [Square Miles]	Elevation [ft, NGVD29]	Measurement Date	Measured Flowrate [cfs]
Crow Creek: Happy Jack Crossing	(41.159791°, -105.084555°) Approximately12 miles West of Cheyenne, WY on CR 210. Measurements were taken at the upstream side of the crossing. Approximately 6.3 miles downstream from USGS monitoring station 6755000.	33	6,450	3/3/2017	18.0
Crow Creek: CR 201	(41.020030°, -104.375597°) Approximately1.5 miles South of Carpenter, WY on CR 148, then 0.25 miles on CR 201. Measurements were taken at the upstream side of the crossing . Approximately 6 miles downstream from USGS monitoring station 6756100.	416	5,370	8/12/2016	0.0
				10/20/2016	0.0
				12/2/2016	30.4
				3/3/2017	25.9
				4/5/2017	6.8
				5/10/2017	0.0
				5/24/2017	45.0
				5/26/2017	38.5
				6/30/2017	0.0
				8/22/2017	0.0
Lodgepole Creek: CR 143	(41.240816°, -104.468022°) Approximately1.8 miles North of Hillsdale, WY on CR 143. Measurements were taken 0.3 miles on the upstream side of the crossing. Approximately 24 creek miles downstream from Lodgepole Creek: Hollingsworth Gage.	358	5,590	5/26/2017	29.0

3.7.4 Crow Creek Annual Runoff and Mean Annual Flow

Table 3.20 presents the annual runoff in acre-feet, measured at the Crow Creek at 19th Street gage. The annual runoff at the 19th Street gage is also presented in Figure B-3.4 in Appendix B-3. Figures B-3.4 and B-3.5 show the average daily discharge in Crow Creek. The values in Table 3.20 are grouped into wet, dry, and normal blocks of data, with the wet and dry years each being the high and low 25% of the data, and normal years including the other 50% of the data. The table also presents an estimate of the mean annual flow for the dry, normal and wet years.

During the South Platte Watershed study, the actual runoff observed at the Crow Creek at 19th Street gage (Table 3.20 and Figure B-3.4) and data from the Cheyenne Board of Public Utilities was reviewed and compared to the stream flow and runoff predicted from the Lowham equations.

Table 3.20 – Annual Flow USGS Gage Crow Creek at 19th Street

Year	Annual Runoff [Acre-Feet]	Classification	Average Annual Runoff [Acre-Feet]	Average Annual Flowrate [cfs]
2004	1,091	Dry	1,293	1.8
2006	1,165			
2007	1,384			
2005	1,397			
2003	1,429			
2012	1,552	Normal	5,211	7.2
2002	1,682			
1994	1,805			
2008	2,127			
2001	3,007			
2009	3,053			
2000	3,408			
1996	4,713			
2011	5,893			
1995	8,962			
2013	9,795			
1998	10,542			
1997	11,197			
2010	14,782	Wet	21,508	29.7
2014	16,209			
2015	22,923			
2016	25,449			
1999	28,176			
Average for all Years			7902	10.9

Table 3.21 compares the mean annual flow into the BOPU Granite Springs Reservoir (the natural runoff), the BOPU Upper North Crow Reservoir Inflow, and the Crow Creek flow, measured at the 19th street USGS gage (USGS Gage 6755960), against mean annual flow estimates based on Lowham's equations for the respective drainage areas.

Table 3.21 – Compare Actual Runoff to Predicated Runoff

Site	*USGS Gage 6755960*	*Granite Springs Reservoir Natural Inflow*	*Upper North Crow Reservoir Inflow*
Drainage Area [Square Miles]	257	26.2	18.6
Recorded Mean Annual Flow [cfs]	11.1	5.3	2.4
Lowham Mean Flow* [cfs]	20.4	14.3	10.4

Table 3.21 shows that the Lowham equations predicted higher mean annual flows than what was observed.

3.7.5 Peak Flow Comparison - Crow Creek

The widely known and used regression equations of Miller (USGS 03-4107) are used by engineers and others to help size road drainage infrastructure and similar flood impacted facilities. Although there are hydrologic modelling approaches, the Miller equations are often the only convenient approach for obtaining estimates for the planning and design of projects such as road culverts.

At locations where sufficient gaging data exists, a Log Pearson Type III (LPIII) analyses is the most often used approach to developing a flood frequency relationship at a gage.

Table 3.22 compares the peak flows estimated using the Miller equations and the peak flows estimated via log-Pearson Type III analysis using data from the 19th Street gage. Again the flow rate from the statistical analysis predicts lower flows for the various floods than the USGS regional regression equations.

Table 3.22. Peak Flowrate Estimations for Storm Events

Return Period [years]	Peak Flowrate (Miller)* [cfs]	Peak Flowrate (Pearson Type III)* [cfs]
2	184	178
5	572	363
10	1,239	532
25	2,841	807
50	4,775	1,061
100	7,659	1,362
200	12,155	1,715

*Analysis conducted using data from USGS gaging station 0655960 (19th street).

Based on the information presented in Table 3.22, the statistical analyses are less than the flow rates predicted using the regional regression equations (the Miller equations).

3.7.6 Crow Creek Flood Volume Frequency

In 1990 States West Water Resources Corporation (States West) completed the *Crow Creek Groundwater Recharge Project Level II – Evaluation*.

> http://library.wrds.uwyo.edu/wwdcrept/Crow_Creek/Crow_Creek-Flood_Control_and_GW_Recharge_Project_Lvl_II_Phase_IA_Eval-Final_Report-1990.html.

One of the objectives of this WWDC funded study was to prepare estimates of Crow Creek flood runoff volume for the purpose of evaluating aquifer recharge projects.

At the time of the 1990 States West study, the only meaningful gage data from Crow Creek was from USGS gage 06756000, i.e. the Crow Creek near Carpenter, WY. This gage, with a drainage area of 297 square miles, was located on Crow Creek Southeast of Cheyenne, WY and recorded data for less than nine years. The gage data was too short to be used in a frequency analysis.

Because of the sparse stream flow data, States West performed a regional analysis, whereby the hydrologic characteristics of other nearby gaged drainages were statistically evaluated to form regression relationships applicable to Crow Creek. States West then used the regression relationships to estimate flood water volumes in the Crow Creek drainage, for various frequencies and durations (e.g. 50 year-15 day).

After the flood volume estimates were prepared, States West considered existing water rights to estimate volume of water that was available above/beyond existing legal obligations. States West reported a mean annual usable run-off volume of 580 acre-feet, but they also noted that this available runoff would be derived from large, infrequent storm events. To illustrate their point, SWWRC reported that a 2-year event provides no water for storage and that a 10-year event only provides approximately 420 acre-feet.

Since the 1990 States West study, the USGS gage 06755960 (Crow Creek at 19th Street) has been operated and the data from this gage provides this Watershed study an opportunity to update or revise the estimates of flood runoff volume. The data from the 19th Street gage was used to develop a flood volume frequency analysis, because the data collected by this gage has a period of record long enough for this type of analysis.

Using the 19th Street gage data, flood volumes were estimated for consecutive 1-day, 3-day, 7-day and 15-day periods during this study. Frequency analysis was then conducted using a log-Pearson Type III probability distribution. The flood volume estimates are presented in Table 3.23 and these estimates are compared to the flood volume estimate presented in the 1990 SWWRC report. The estimates of flood volume made during this study were developed using the data from the 19th Street gage and the SWWRC values presented in Table 3.23 are also for the 19th Street gage site. The values in this table are presented as acre-feet of runoff for each event.

Table 3.23 – Flood Volume Estimates Log-Pearson Type III Analyses of the Crow Creek At 19th Street Gage –Volume in Acre-feet for each Flood Event

	Event Duration	Frequency					
		2 year	*5 year*	*10 year*	*25 year*	*50 year*	*100 year*
SWWRC	*1-Day*	78	135	189	255	278	319
19th Street Gage Data *		98	271	474	882	1,333	1,897
SWWRC	*3-Day*	159	297	386	549	653	770
19th Street Gage Data *		227	677	1,237	2,413	3,765	5,567
SWWRC	*7-Day*	296	521	692	925	1,138	1,379
19th Street Gage Data *		410	1,328	2,531	5,155	8,261	13,231
SWWRC	*15-Day*	483	859	1,170	1,723	2,153	2,592
19th Street Gage Data *		732	2,458	4,767	9,875	15,980	26,817

* Log Person Type III Analyses of Gage data for Volume

A generalization can be made based on a comparison of the SWWRC estimates and the work done during this study. Most certainly, the estimates for flood volume are higher than they were thought to be prior to the establishment of the 19th street gage. Therefore, the amount of water available for use and storage are higher than predicted in the earlier States West report.

The runoff in Crow Creek at the 19th Street gage does not reflect runoff from Cheyenne, other tributaries of Crow Creek downstream of the gage, nor does it reflect discharges from the Cheyenne waste water treatment plants. These issues are discussed in the following sections of this report.

3.7.7 BOPU Wastewater Treatment Plant Discharge

The City of Cheyenne – Board of Public Utilities operates the Crow Creek and Dry Creek Wastewater Treatment Plants (WWTPs). These facilities are located downstream of the 19th street gage and upstream of USGS gaging station 6756100, Crow Creek near Carpenter (which is also the approximate location of the temporary stream gage installed on Crow Creek during this study). The WWTPs discharge into Crow Creek and add to the natural flow in the creek. Table 3.24 shows the average inflow into both of the WWTPs less the water that is pumped back into Cheyenne via the re-cycled water or purple pipe system. These values are the average monthly flows from 2012 – 2016. It is assumed that the inflow into the WWTPS less the water pumped back or used in the recycled system equals the discharge into Crow Creek.

The values in Table 3.24 show the discharge from both wastewater treatment plants into Crow Creek. As shown, approximately 9420 acre-feet per year, which corresponds to an average flow of 13 cfs, is discharged from the wastewater treatment plants.

Table 3.24 Average Discharge from the Cheyenne WWTPs in acre-feet

Month	Average Discharge per month in acre-feet
January	759
February	716
March	776
April	773
May	928
June	833
July	826
August	748
September	743
October	795
November	769
December	753
Total	9,419 acre-feet Mean annual flow = 13.0 cfs

Data from Cheyenne BOPU – Average flow 2011 – 2016

Clearly, the WWTP effluent is providing a significant contribution to Crow Creek. The average annual runoff at the 19th Street gage is approximately 7900 acre-feet, while the discharge from the WWTPs is approximately 9420 acre-feet. As WWTP effluent is put to other uses in Cheyenne, the flow in Crow Creek downstream of Cheyenne will decline correspondingly.

3.7.8 Compare Crow Creek flow at 19th Street to the flow near Carpenter

The average daily flow and annual runoff at the 19th Street gage and at the Carpenter gages were reviewed to compare the nature and amount of streamflow in Crow Creek at the two locations. The periods when the 19th Street gage and the Carpenter gages where operating provided an opportunity to evaluate the flow at both locations.

Reiterating some of the information presented in previous sections of this report:

> The USGS operated a stream gage on Crow Creek near Carpenter (No. 6756100) from May 1, 1990 to September 30, 1996. The 19th Street gage on Crow Creek has been operated from October 1, 1993 to the present. Therefore, the USGS gages overlapped from October 1, 1993 to September 30, 1996. During the SPRWS, a temporary stream gage was installed near the location of the Carpenter gage. Data was collected at the temporary gage from August 12 through December 2, 2016 and from March 3 through November 1, 2017.

Figure B-3.6 shows the average daily runoff in Crow Creek for the period May 1, 1990 to Nov. 1, 2017. This figure includes data from the 19th Street gage, data from the USGS gage near Carpenter, and from the temporary gage installed during this study. Table 3.25 compares the runoff measured at the 19th Street and the Carpenter gages when flow was being measured at both locations.

Table 3.25 – Runoff in Crow Creek at 19th Street and Runoff near Carpenter (acre-feet)

Period	Runoff Volume (AF) at 19th Street	Runoff Volume (AF) near Carpenter	Compare Carpenter to 19th Street - Percent
Jan 1 – Dec 31, 1994	1805	4420+	244.9
Jan 1 – Dec 31, 1995	8962	14,936+	166.7
Jan 1 – Sept 30, 1996	4260	6478+	152.1
Aug 12 – Dec 2, 2016	893	1482*	166.0
Mar 3 – Nov 1, 2017	3879	2399*	0.62
Average	3960	5943	150% +/-

+USGS Gage Crow Creek near Carpenter, No. 6756100
*SPRWS Temporary Gage near Carpenter

During four out of the five periods where the Carpenter and 19th Street gages overlapped, there was more stream flow in Crow Creek at Carpenter than there was at the 19th Street gage. This makes sense considering the larger drainage area at the Carpenter gage site, compared to the 19th Street gage site (415 vs. 297 sq. mi., respectively; a 140 % larger drainage basin at Carpenter). Also, the discharges into Crow Creek from the Cheyenne wastewater treatment plants, runoff from Dry Creek, from other developed areas in Cheyenne, from Clear Creek, and from the intervening drainage area flowed into Crow Creek between the 19th Street gage and the Carpenter gage. The flow conditions observed in 2017, i.e. more flow at 19th Street than at Carpenter, was caused likely by more extensive use of surface water irrigation in 2017, particularly use of the Beaver Dam Ditch, which is the last major active irrigation ditch diverting upstream of the Carpenter gage site.

It is interesting to note that from September 1 through the end of November 2016, approximately 2070 acre-feet of water was discharged from the Cheyenne WWTPs into Crow Creek; while during this period there was only approximately 589 acre-feet more flow past the temporary stream gage near Carpenter than at the 19th Street gage.

Obviously, surface water irrigation rights and reservoir storage diverted a significant amount of water. But seepage from Crow Creek, streambank storage, and evapo-transpiration may also account for a significant percentage of the differences in the flow observed in Crow Creek at the two locations.

Figure B-3.7 shows a flow exceedance graph on Crow Creek compared to active water rights.

3.7.9 Lodgepole Creek Flow Estimates

The only stream gage on Lodgepole Creek with a long period of record is the USGS gage Lodgepole Creek at Bushnell, NE, No. 67625000. Refer to the discussion in Section 3.7.2, Table 3.16 and Figures 3.50. The flow in Lodgepole Creek measured at this gage has decreased.

There are no extensive gaging records for Lodgepole Creek in the upper part of the South Platte Basin in Wyoming from which a mean annual flow can be computed, so we have resorted to estimating mean annual flow using regional hydrologic methods. We prepared estimates using two methods, both of which are described in the following sections.

The first method was to prepare a regression equation and graph that compares the annual flow from stream gages near Lodgepole Creek to the mean basin elevation above the particular stream gage. A similar estimate of the flow in Lodgepole Creek Storage and Recharge Study, (Dahlgren 2001).
http://library.wrds.uwyo.edu/wwdcrept/Lodgepole_Aquifer/Lodgepole-Aquifer_Storage_and_Retrieval_Level_I-Final_Report-2001.html

The resulting graph and equation is presented in Figure 3-48. Using the equation presented in Figure 3-48 and determining the mean basin elevation for the Lodgepole Creek watershed, the runoff in acre-feet of runoff per year was estimated at the Hollingsworth Temporary gage location, At the Hollingsworth gage, the annual runoff in Lodgepole Creek is estimated to be 31.7 acre-feet per square mile. Multiplying this value by the entire basin area of 111 square miles, results in a mean annual flow of 3,519 acre feet.

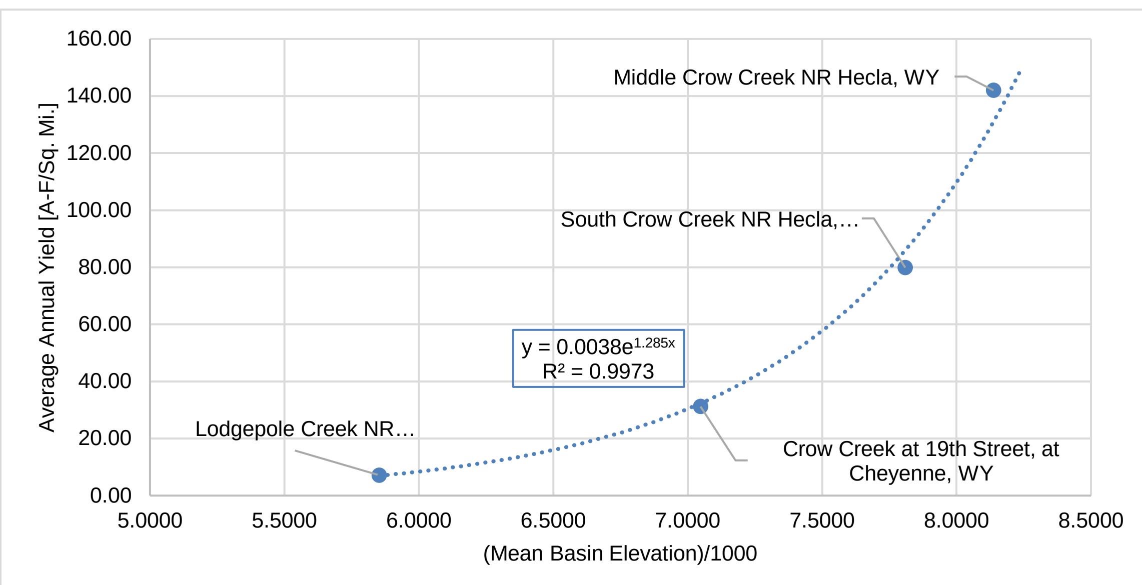


Figure 3-48: Regional Runoff Relationship for Lodgepole Basin

Our second approach was to use a method given by the U.S. Department of the Interior in the first edition of the *Flood Hydrology Manual,* specifically the equation.

$$\frac{Q_1}{Q_2} = \frac{{A_1}^{exp}}{{A_2}^{exp}}$$

This method assumes that if the runoff at one location is known or can be estimated, the runoff at another location can be estimated based on the sizes of the drainage areas. We attempted to estimate the flow in Lodgepole Creek using the flow data from Crow Creek.

The major assumption with this method is that the drainage basins are similar and that the Crow Creek at 19th Street gage data provides sound information concerning the flow in Crow Creek. For Lodgepole Creek at the Hollingsworth gage, the resulting mean annual yield would be 31.2 acre-feet per square mile or 3410 acre feet per year, essentially the same as estimated by the regression approach.

Although there is only one partial year of data (March 10 – November 1, 2017), Figure 3-49 compares the actual annual runoff measured in Crow Creek at 19th Street; Crow Creek at the temporary Butterfield gage, and the Lodgepole Creek at the Hollingsworth gage.

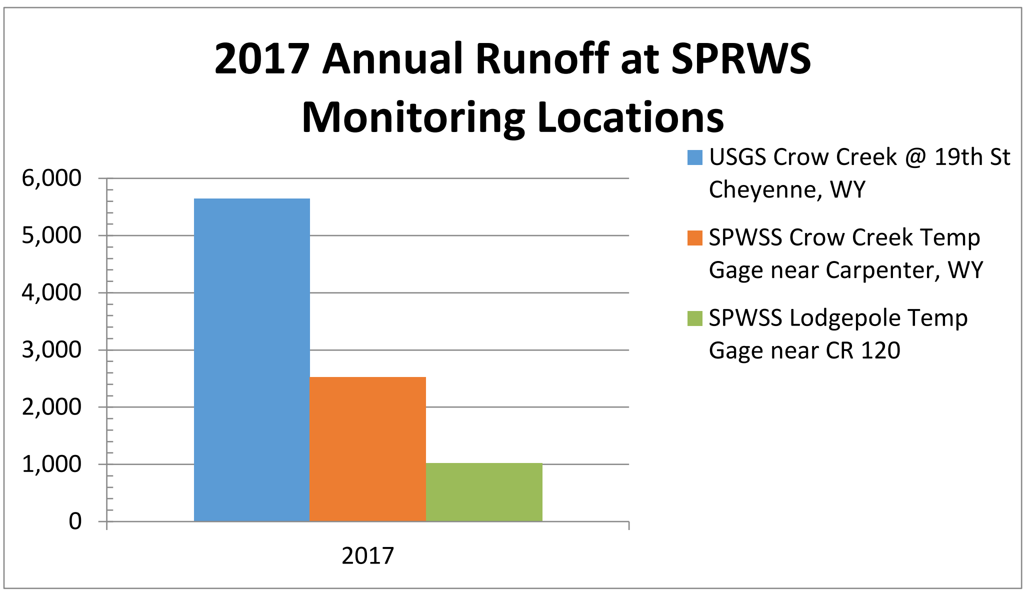


Figure 3.49, 2017 Annual Runoff

The runoff in Crow Creek at 19th Street for the period January 1 to November 1, 2017 was 5,650 acre-feet. Data was not collected at the temporary gages until March 10, 2017; therefore to compare runoff estimates, the flow that occurred at the 19th Street gage prior to March 10th was subtracted from the 5,650 acre-foot total. The runoff in Crow Creek at 19th Street for the January 1 – March 10th period was 1,730 acre-feet. Subtracting 1,730 from 5,650 equals 3,920 acre-feet.

For the period March 10 – November 1, 2017 the flow at the Butterfield gage was 2,530 acre-feet and in Lodgepole Creek at the Hollingsworth gage it was 1,025 acre-feet.

The runoff (acre-feet of flow past the gage) observed in Crow Creek at 19th Street for the period March 10 – November 1 was 3.8 times the volume observed at the Hollingsworth Lodgepole Creek gage. The 19th Street drainage area is 257 sq. miles, while the Lodgepole Creek Hollingsworth gage drainage is 111 sq. miles (2.32 times larger).

3.7.9.1 Lodgepole Creek near Bushnell, NE

Figure 3-50 shows the annual runoff in acre-feet flowing past the USGS gage 6762500 Lodgepole Creek near Bushnell, NE. During the period of record of the Bushnell gage, i.e. from 1935 to the present, the amount of water flowing past the gage has decreased. The most likely explanation for this change is groundwater pumping has reduced stream flow.

Starting in approximately 1970, there is a noticeable decrease in the flow at the Bushnell gage. This time period corresponds to an increase in the number of wells in the Lodgepole Creek valley. Currently, essentially no water flows in Lodgepole Creek at the Bushnell gage.

Our study team postulates that an estimate of the average annual aquifer recharge is the difference between the flow change at Bushnell (1934-1970 mean minus 2002-current mean, from Figure 4) and the mean annual yield generated in the western part of the sub watershed (Lodgepole Creek: Hollingsworth Gage).

$$\begin{aligned} &Average\ Annual\ Aquifer\ Recharge \\ &\qquad = Bushnell\ (1934-1970) - Bushnell\ (2002-current) \\ &\qquad - \ LPC{:}\,Hollingsworth \end{aligned}$$

$$8{,}669 - 215 \ - \ 3{,}519 \ = \ 4{,}935\ acre-feet$$

The State monitoring well network in the Pine Bluffs area should be examined to see if the water table continues to decline. If decline is not present, then the recharge estimate could be considered what is needed to sustain pumping.

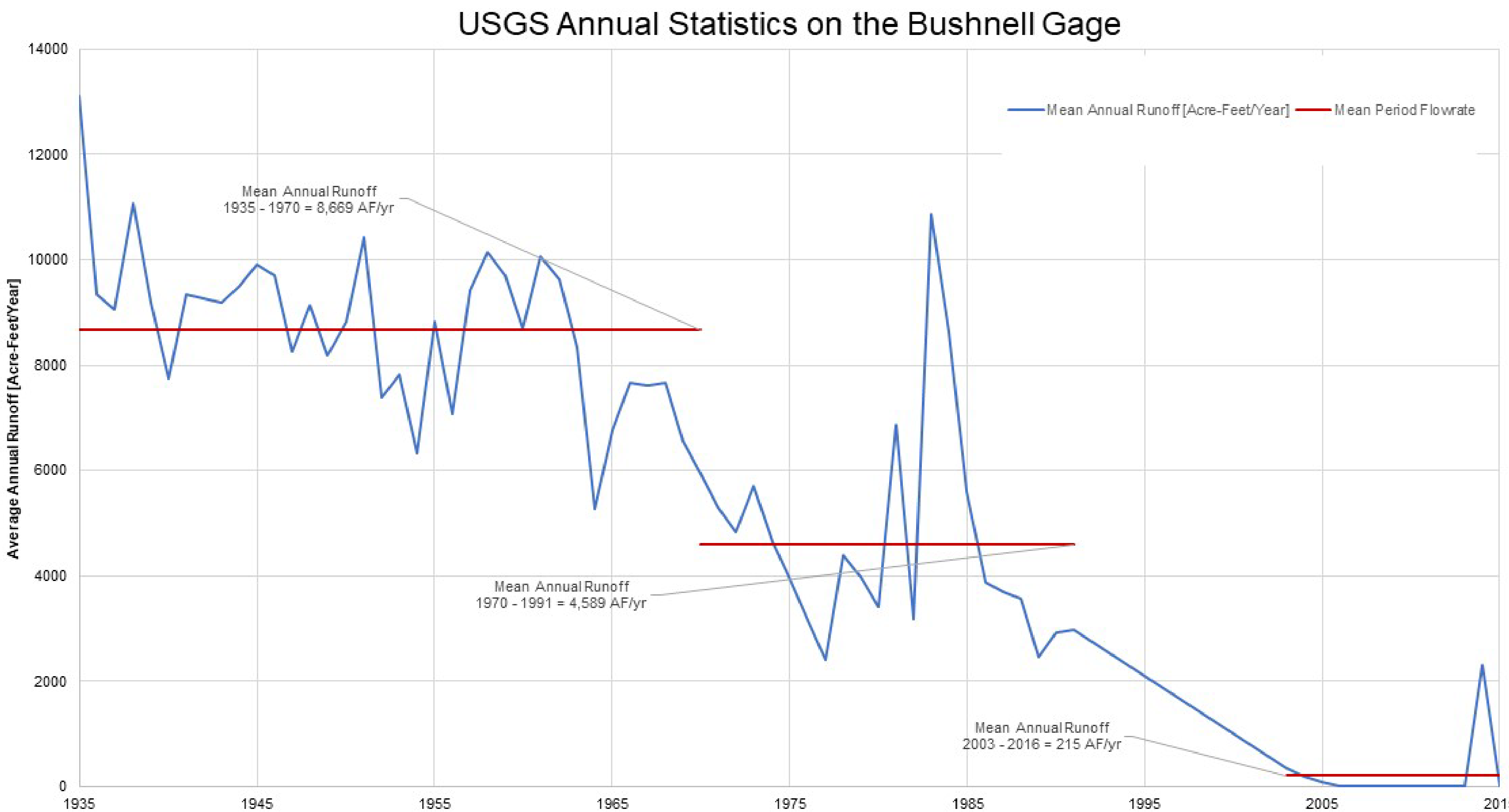


Figure 3-50 USGS Annual Statistics on the Bushnell Gage (1935-2015)

3.7.10 Discussion of Flooding in the South Platte River Watershed

Major flooding has occurred within the corporate limits of Cheyenne on average every twenty years resulting in significant economic impact and loss of life. Flooding is one of most significant natural hazards in Wyoming and Laramie County is identified as having historically experienced significantly greater flood damage than any other county in Wyoming. Based on the State's 2010 Hazard Mitigation plan, over a 60-year period from 1950 to 2010, Laramie County experienced $144,393,715 total dollars in flood related damages including crop damages. Damaging flood events occur on average three times a year in Wyoming.

The potential for flood damages is reiterated in the Laramie County Hazard Mitigation Plan. This plan lists twenty-two (22) damaging floods that have occurred in Cheyenne between 1960 and 2010. This yields a 44% chance that a damaging flood will occur in any given year, which corresponds to a likely occurrence rating. Additionally, the County Hazard Mitigation Plan estimates the potential magnitude for a flood event in Laramie County to be catastrophic. Even an event of limited magnitude could result in multiple severe injuries, multiple deaths, a complete shutdown of critical facilities for 30 days or more, and damages to more than 50% of the planning area. This is consistent with the flood event history in the county.

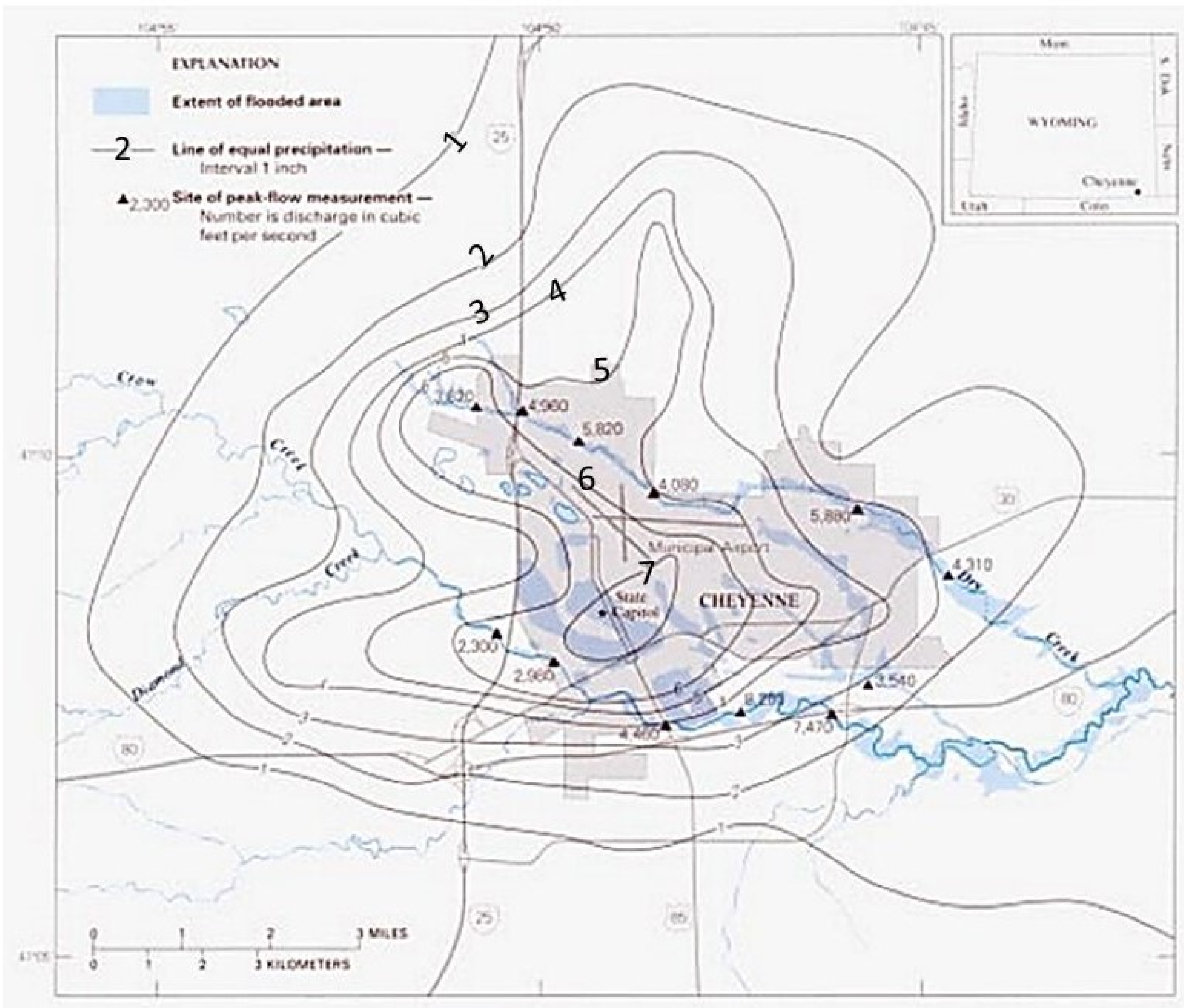
Wyoming is the 5th driest state in the union and drought is a constant threat to the region. For much of the decade from 2000 to 2010, Wyoming was gripped by moderate to severe drought. Historically, many of the flood events and flash flood events occurring in the Cheyenne community have occurred during droughts or drier periods, exacerbating an already precarious situation for the Cheyenne community and downstream Laramie County. Providing flood control projects for the creeks and tributaries affecting Cheyenne and downstream Laramie County will provide much needed flood protection while also providing more efficient conveyance of stream flow downstream of Cheyenne where it could provide benefits for agricultural uses, wildlife, and recreational uses.

The following information is taken from the Pre-Disaster Mitigation Plan for the City of Cheyenne. The Cheyenne area has experienced many floods. The Crow Creek drainage basin has experienced moderate floods resulting from snowmelt from its headwaters west of Cheyenne. Floods with the highest peak discharges occurring in the Cheyenne area are the result of intensive convective rainstorms over the high plains. These storm events commonly occur between June and late August in the Cheyenne area. These floods and flood-producing storms are summarized below in Table 3.26.

Table 3.26. Cheyenne Flood Data

1883	Significant flood along Crow Creek.
July 15, 1896	Precipitation of 4.7 inches in 3 hours and 4.86 inches in 24 hours, produced significant flood along Crow Creek.
May 20, 1904	Precipitation of 0.63 inches was recorded during the night of May 19th. During the afternoon of May 20th, 1.10 inches of rain and hail fell in 1 hour. Precipitation probably was more intense along the upstream reach of Crow Creek. Maximum discharge was estimated to be 8,500 cubic feet per second.
1918	Large flood occurred along downstream reaches of Dry Creek, approximately the same magnitude as the August 1, 1985 flood event.
June 14, 1926	Severe hailstorm lasting from 10:20 p.m. to 11:05 p.m. concentrated in a 1- by 6-mile area and produced 2.51 inches of precipitation.
April 23, 1929	Storm produced 3.20 inches of precipitation in a 24 hour period.
1929	Large flood event along Dry Creek.
June, 1929	Flood in Crow Creek (8,200 cubic feet per second on June 2nd) was caused by precipitation near the headwaters west of town, where the ground was already saturated and tributaries were full from melting snow.
June 1935	Large flood event along downstream reaches of Dry Creek, approximately the same magnitude as the August 1, 1985 event. Precipitation during the storm was greatest in the Roundtop area at the headwaters of Dry Creek. Flooding also occurred along Crow Creek.
August 1946	Severe storm producing 1 inch of precipitation in 10 minutes caused flooding along Dry Creek.
June 1955	Intense rains occurred the afternoon of June 14th and continued into the next day producing 2.68 inches of precipitation. This produced a large flood along the downstream reaches of Dry Creek at approximately the same magnitude as the August 1, 1985 flood.
1972	Flood occurred along the downstream reaches of Dry Creek. Water surface elevations were slightly lower than those for the 1955 flood event.
August 1985	On August 1st, intense thunderstorm produced 7 inches of precipitation in the downtown area between 6:20 p.m. and 9:45 p.m. The storm was accompanied by hail, up to 3 feet in areas. A new 24-hour Wyoming rainfall record was set. Flooding occurred along Dry Creek, Crow Creek, their tributaries, and throughout the City.

On August 1, 1985 a severe thunderstorm stalled over Cheyenne and dropped six inches of rain in less than four hours. Figure 3.51 shows the rainfall amounts from this storm. Citywide damages were estimated at $65 million in 1985 dollars. 70 people were injured in the flood, and 12 others lost their lives. Most of the deaths resulted from people becoming trapped in their cars by rushing floodwaters. Much of the damages occurred in the City's Dry Creek and Capitol drainage basins with significant damages occurring in the City's historic downtown business district. If a flood the size of the 1985 disaster happened again, it is estimated that the downtown area would suffer $70 million in direct property damages and over $100 million with indirect damages factored in.



Precipitation and peak flows of Dry Creek, Crow Creek, and an unnamed tributary of Crow Creek resulting from the storm of August 1, 1985, Cheyenne, Wyoming. (Source: Precipitation data compiled by National Weather Service on U.S. Geological Survey base map, Cheyenne, 1981, scale 1:100,000; peak-flow data from U.S. Geological Survey files.)

Figure 3.51 August 1, 1985 Rainfall Amounts from USGS

The Cheyenne flood of August 1, 1985, was one of the most devastating flash floods to occur in Wyoming. The flood history of the Cheyenne area is documented by Druse, et. al. (1986), the U.S. Geological Survey (USGS) and the Wyoming Department of Transportation (WYDOT), with assistance from the City.

The historical data show that, although the 1985 storm event produced records for precipitation and peak discharges, large flood events are not uncommon for the area. Conditions such as wet soil from preceding storms, or hardpan developed in drought conditions, intense precipitation, and storm paths moving downstream along drainages are possible. Such conditions combined with continued urban development will produce floods of similar magnitude or greater than the event that occurred on August 1, 1985.

Flood control projects remain a high priority for Crow Creek, Dry Creek, Clear Creek, Diamond Creek and their respective tributaries for developed areas of Laramie County. In fact, a serious life safety hazard and high property damage hazard due to flooding is a continued concern for Cheyenne and other areas within the South Platte River Watershed. Flood control projects located within the Crow Creek, Dry Creek, and Clear Creek basins have the potential to provide a significant public benefit in terms of added flood control, environmental best management practices, expanded and new wetlands, stream bank protection, and erosion control. Moreover, these benefits will serve to improve efficient conveyance of stream flow downstream of Cheyenne where it can be put to use for irrigation and aquifer recharge purposes providing much needed benefits for agricultural uses, wildlife, and recreational uses.

The addition of constructed wetlands would be a prudent measure in addressing the City's NPDES-Phase II compliance requirements as well the 303-D listings for Crow Creek within the corporate limits with respect to e-coli and excess bed load sediment. The Wyoming DEQ in recent years identified "primary causes of non-attainment for fisheries and other aquatic life designated uses…as excess sediment contributions, high concentrations of total selenium and elevated water temperatures" (Water Quality Condition and Designated Use Determination for Crow Creek, South Platte Basin, 2007-2008, page 2). The Wyoming DEQ is developing sediment and E. coli Total Maximum Daily Loads for a segment of Crow Creek, defined as Crow Creek from Happy Jack Road downstream to Herford Reservoir #1 (Wyoming Department of Environmental Quality, 2010). The wetland projects are timely and can improve conditions related to excess bedload sediment and E. coli TMDLs within the impaired Crow Creek watershed.

The opportunity to enhance and create more wetland and aquatic habitat in a part of Mylar Park along Dry Creek that is currently underused would be of great benefit to the community. This project would also help in easing the current flooding that occurs just upstream of the park as flood waters would have additional storage capacity in the park before backing up and overtopping the banks upstream of the park.

Mylar Park could be used to create detention on the park site. Any detention on Mylar Park property would be regional in nature providing beneficial flood protection for properties upstream and downstream of the park. Use of Mylar Park would represent a beneficial public/private partnership providing flood protection for multiple properties and needed water quality improvements for this part of the upper Dry Creek basin.

Cheyenne's lower Dry Creek Basin is also prone to flooding and water quality issues affecting the 303-D listings for downstream Crow Creek. The Union Pacific Railroad crossing of lower Dry Creek represents a unique constraint affecting continuing development of the lower basin. There continues to be regional storage opportunities for the lower Dry Creek Basin that would provide significant public benefit in terms of added flood control, environmental best management practices, expanded and new wetlands, and more efficient conveyance of stream flow downstream of Cheyenne where it can be better put to use for irrigation and aquifer recharge purposes providing much needed benefits for agricultural uses, wildlife, and recreational uses. Moreover, an expanded regional storage facility in the lower basin would facilitate a fully developed lower drainage basin in one of a few areas in Cheyenne where development is possible within the corporate limits.

Immediately downstream of this site is where the LCCD's Cheyenne Business Parkway Natural Area. There is potential to tie expanded wetlands and storage to the BMPs being planned for the Business Parkway site.

Public/private sector partnerships could develop and implement flood control, water quality, and storage projects through-out the South Platte River Watershed. These projects could afford the community both flood control and much needed water quality benefits. With respect to water quality, this approach represents the most cost-effective approach that the City of Cheyenne can take to comply with the Federally-mandated Clean Water Act.

Additionally, the flood control and water quality facilities envisioned would provide multiple benefits to the community that would ultimately enhance our overall quality of life. Constructed wetlands, adjacent greenway path and parkway surrounded by a clustered development would be a welcome addition to our community.

As Cheyenne continues to grow and develop into various county pockets it is likely that stormwater runoff concerns will become even greater. Expanding existing wetlands within the lower Dry Creek Basin has the potential to reduce many stormwater contaminants from reaching Crow Creek. Lands adjacent to Crow Creek are difficult to obtain for wetland construction. Furthermore, the lower Dry Creek Basin is likely to become a fully developed urbanized area. Wetlands located in Crow Creek tributaries are important for reducing additional loads to the impaired main stem segment of Crow Creek.

Section 3.8 – Water Quality

This section of the report describes the water quality for the watershed, including any relevant data associated with 303(d) listed streams. Information available concerning the Wyoming DEQ Watershed Program, Wyoming Pollutant Discharge Elimination Systems (WyPDES) Program, and the Wyoming DEQ information concerning Formerly Used Defense Sites (FUDS) was reviewed and included where relevant as it relates to the SPRWS.

3.8.1 Surface Water

3.8.1.1 Surface Water Classifications

The Wyoming DEQ Water Quality Division has classified water bodies in Wyoming for water quality standards. The classifications of surface water bodies are determined based on quality and use. The specific stream segment classifications are contained in a document entitled "Wyoming Surface Water Classification List" which is published by the WDEQ and periodically revised and updated.

There are 33 classified surface water bodies within the South Platte River Drainage in Wyoming. Table 3.27 shows the water body and surface water classification. The first column shows the water body, followed by primary and secondary tributaries, respectively. All classified surface water bodies in the drainage area are classified 2AB, 3B, or 3C.

Table 3.27 South Platte River Drainage Surface Water Body Classification

Water Body	Primary Tributary	Secondary Tributary	Classification
Lodgepole Creek (BL Hwy 85)			2AB
Lodgepole Creek (Remainder)			2AB
	Muddy Creek		2AB
		Spring Creek	2AB
		N. Fork Muddy Creek	3B
	Chivingtion Draw		3B
		Spring Creek	2AB
		Antelope Draw	3B
	Ninemile Draw		3B
	S. Lodgepole Creek		2AB
	N. Lodgepole Creek		2AB
	Middle Lodgepole Creek		2AB
Crow Creek (Above Ave. C in Cheyenne)			2AB

Water Body	Primary Tributary	Secondary Tributary	Classification
Crow Creek (Remainder)			2C
	Dry Creek		3B
	Roundtop Lake		3B
	Trek Draw		3B
	Spring Creek		3B
	N. Crow Creek		2AB
		Spring Creek	3B
	Upper N. Crow Reservoir		2AB
	S. Crow Creek		2AB
		S. Fork S. Crow Creek	2AB
	Middle Crow Creek		2AB
	Crystal Lake Reservoir		2AB
	Granite Springs Reservoir		2AB
Porter Draw			3B
Lone Tree Creek			2AB
	Duck Creek		2AB
	Goose Creek		2AB
Dale Creek			2AB
	Fish Creek		2AB

Source: WYOMING SURFACE WATER CLASSIFICATION LIST [WDEQ 2001]

The following paragraphs describe each Classification as determined by the Wyoming DEQ Water Quality Division (http://deq.wyoming.gov/wqd/). There are four major classes of surface water in Wyoming with various subcategories within each class (see "Wyoming Surface Water Classification List" for current listing).

(a) Class 1, Outstanding Waters. 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 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.

(b) Class 2, Fisheries and Drinking Water. Class 2 waters are waters, other than those designated as Class 1, that are known to support fish or drinking water supplies or where those uses are attainable. Class 2 waters may be perennial, intermittent or ephemeral and are protected for the uses indicated in each sub category listed below. There are five subcategories of Class 2 waters:

(i) Class 2AB. 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.

(ii) Class 2A. Class 2A waters are those that are not known nor have the potential to support game fish but are used for public or domestic drinking water supplies, including their perennial tributaries and adjacent wetlands. Uses designated on Class 2A waters include drinking water, aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value.

(iii) Class 2B. Class 2B waters are those known to support or have the potential to support game fish populations or spawning and nursery areas at least seasonally and all their perennial tributaries and adjacent wetlands and where it has been shown that drinking water uses are not attainable pursuant to the provisions of Section 33. Class 2B waters include 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 2B 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”. Uses designated on Class 2B waters include game and nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value.

(iv) Class 2C. Class 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.

(v) Class 2D. Effluent dependent waters which are known to support fish populations and where the resident fish populations would be significantly degraded in terms of numbers or species diversity if the effluent flows were removed or reduced. Class 2D waters are protected to the extent that the existing fish communities and other designated uses are maintained and that the water quality does not pose a health risk or hazard to humans, livestock or wildlife. Uses designated on Class 2D waters include game or nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value.

(c) Class 3, Aquatic Life Other than Fish. Class 3 waters are waters, other than those designated as Class 1, that are intermittent, ephemeral or isolated waters and because of natural habitat conditions, do not support nor have the potential to support fish populations or spawning, or certain perennial waters which lack the natural water quality to support fish (e.g., geothermal areas). Class 3 waters provide support for invertebrates, amphibians, or other flora and fauna which inhabit waters of the state at some stage of their life cycles. Uses designated on Class 3 waters include aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value. Generally, waters suitable for this classification have wetland characteristics, and such characteristics will be a primary indicator used in identifying Class 3 waters. There are four subcategories of Class 3 waters.

(i) Class 3A. Class 3A waters are isolated waters including wetlands that are not known to support fish populations or drinking water supplies and where those uses are not attainable.

(ii) Class 3B. 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.

(iii) Class 3C. Class 3C waters are perennial streams without the natural water quality potential to support fish or drinking water supplies but do support wetland characteristics. These may include geothermal waters and waters with naturally high concentrations of dissolved salts or metals or pH extremes.

(iv) Class 3D. Effluent dependent waters which are known to support communities of aquatic life other than fish and where the existing aquatic habitat would be significantly reduced in terms of aerial extent, habitat diversity or ecological value if the effluent flows are removed or reduced.. Class 3D waters are protected to the extent that the existing aquatic community, habitat and other designated uses are maintained and the water quality does not pose a health risk or hazard to humans, livestock or wildlife.

(d) Class 4, Agriculture, Industry, Recreation and Wildlife. Class 4 waters are waters, other than those designated as Class 1, where it has been determined that aquatic life uses are not attainable pursuant to the provisions of Section 33 of these regulations. Uses designated on Class 4 waters include recreation, wildlife, industry, agriculture and scenic value.

(i) Class 4A. Class 4A waters are artificial canals and ditches that are not known to support fish populations.

(ii) Class 4B. Class 4B waters are intermittent and ephemeral stream channels that have been determined to lack the hydrologic potential to normally support and sustain aquatic life pursuant to the provisions of Section 33(b)(ii) of these regulations. In general, 4B streams are characterized by only infrequent 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 4B waters.

(iii) Class 4C. Class 4C waters are isolated waters that have been determined to lack the potential to normally support and sustain aquatic life pursuant to the provisions of Section 33(b)(i), (iii), (iv), (v), or (vi) of these regulations. Class 4C includes, but is not limited to off-channel effluentdependent ponds where it has been determined under Section 33(b)(iii) that removing a source of pollution to achieve full attainment of aquatic life uses would cause more environmental damage than leaving the source in place.

Table 3.28 summarizes the WDEQ surface water classes and use designation.

Table 3.28: Surface Water Classes and Use Designation

Designated Use	**Surface Water Classes and Use Designation**												
	1	2AB	2A	2B	2C	2D	3A	3B	3C	3D	4A	4B	4C
Drinking Water	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Game Fish	Yes	Yes	No	Yes	No	When Present	No	No	No	No	No	No	No
Non-Game Fish	Yes	Yes	No	Yes	Yes	When Present	No	No	No	No	No	No	No
Fish Consumption	Yes	Yes	No	Yes	Yes	Yes	No	No	No	No	No	No	No
Other Aquatic Life	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

Source: WDEQ 2013

3.8.1.2 Waters Requiring Total Maximum Daily Loads (TMDL)

Once designated use support determinations are made by WDEQ using the classification system described above, the USEPA requires that all surface waters of the state be placed into one of five categories (USEPA 2005, 2006) reflecting if the designated uses are supported.

Because designated uses, water quality standards and designated use support methodologies are not consistent across all states, tribes and territories, surface water categorizations are used to standardize these various approaches for USEPA's national reporting purposes. In Wyoming, designated use support determinations translate directly into the five categories below.

Category 1 - Available data and/or information indicate that all designated uses are supported and no use is threatened.

Category 2 - Available data and/or information indicate that at least one designated use is supported, while one or more other uses are either indeterminate or not assessed.

Category 3 - Available data and/or information are either insufficient or inconclusive and designated use support cannot be determined for any uses.

Category 4 - Available data and/or information indicate that at least one designated use is impaired, but a TMDL is not needed. There are three sub-categories of category 4:

> **4A.** Impaired waters with TMDLs approved by EPA.
>
> **4B.** A use impairment that is being addressed by the state through other pollution control measures. For example, a stream that has been historically impaired by excess sedimentation from urban stormwater runoff may be moved to category 4B after storm water best management practices are installed that are expected to effectively trap the excess sediment before it reaches the stream.
>
> **4C.** A use impairment not caused by a pollutant, but instead by anthropogenic non-pollutant stressor(s). A pollutant can be thought of as a stressor for which an allowable load can be calculated and is defined in Section 502(6) of the CWA as dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. Examples of anthropogenic non-pollutant stressors for which a pollutant load cannot be calculated include stream flow alterations, stream channelization and concrete lined channels (USEPA, 2005).

The Wyoming State Engineer's Office (SEO) regulates water quantity in Wyoming's surface waters; neither the USEPA nor WDEQ have any regulatory authority over water quantity related issues. Augmenting and/or decreasing natural streamflow is collectively termed "flow alterations" by WDEQ for the purpose of assessing designated use support. Flow alterations occur in all of Wyoming's river basins to some degree and their effects on water quality can range from beneficial to deleterious. WDEQ routinely evaluates the effects of flow alterations and other anthropogenic non-pollutant stressors when reviewing water quality data and other information toward designated use support determinations.

Waters are not placed on Wyoming's 303(d) List of impaired waters requiring a TMDL (USEPA category 5) when flow alterations are considered to be the primary cause of a water quality impairment. Instead, these waters are placed into USEPA category 4C, which recognizes that a use impairment is not caused by a pollutant, but instead by an anthropogenic non-pollutant stressor(s). Placing a water in category 4C for flow alterations indicates that at least one designated use is impaired, but that neither WDEQ nor EPA has any regulatory authority over the cause of the impairment.

Category 5 - Available data and/or information indicate that at least one designated use is not being supported or is threatened. Category 5 waters are added to Wyoming's 303(d) List of impaired waters requiring TMDLs. Each pollutant/segment combination is considered a separate 303(d) Listing. For example, if the aquatic life other than fish use on a stream segment is impaired due to copper, sediment and selenium, these three pollutants would be considered three separate 303(d) Listings.

Tables 3.29 and 3.30 below summarize the status of the streams in the South Platte River Watershed.

Table 3.29: Category 4A Waters

South Platte River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles**	**Cause**	**Listing Date**	**Year**
Crow Creek	WYSP 101900090107_01	From the inlet of Hereford Reservoir #2 upstream to the outlet of Hereford Reservoir #1	2C	9.4 mi.	E. coli	1996	2014
Crow Creek	WYSP 101900090107_05	From Happy Jack Road upstream to Roadtop Road	2AB	3.1 mi.	E. coli	2012	2014
Crow Creek	WYSP 101900090203_01	From Missile Road (HWY 217) upstream to the outlet of Hereford Reservoir #2	2C	10.1 mi.	E. coli	1996	2014

Table 3.30: Category 5 or 303(d) Listed Waters:

South Platte River Basin								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles**	**Uses**	**Cause**	**List Date**	**TMDL Date**
Middle Fork Crow Creek	WYSP 101900090101_01	2AB	A 1.5 mile section of creek at FS Road 700 crossing	1.5 mi.	Recreation	E. coli	2010	2016
North Branch North Fork Crow Creek	WYSP 101900090104_01	2AB	From FS Road 701 upstream 300 yards	0.2 mi.	Recreation	E. coli	2004	2016
Crow Creek	WYSP 101900090107_02	2C	From 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1	3.7 mi.	Non-Game Fishery, Aquatic Life other than Fish	Sediment	2012	2010
Crow Creek	WYSP 101900090107_03	2C	From Morrie Avenue to a point 0.7 miles downstream	0.7 mi.	Non-Game Fishery, Aquatic Life other than Fish	Sediment	2010	2010
Crow Creek	WYSP 101900090107_04	2AB	From Morrie Avenue upstream to Happy Jack Road	3.4 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Sediment	2012	2010

In the South Platte River Watershed, some segments of Crow Creek currently listed as category 5 have USEPA approved TMDLs and should be moved to category 4a; however some of the segments will remain in Category 5 because they all still have sediment impairments.

Delistings of 303 (d):

The following changes have been made to the DEQ 303(d) listing as of 2016:

Crow Creek (WYSP101900090107_01) - A TMDL was developed for the fecal coliform impairment on Crow Creek from the inlet of Hereford Reservoir #2 upstream to the outlet of Hereford Reservoir #1. The TMDL was approved by USEPA in February 2014 and this water was placed in Category 4A.

Crow Creek (WYSP101900090107_02) - A TMDL was developed for the selenium impairment on Crow Creek along a segment from 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1. The TMDL was approved by USEPA in August 2013, however the segment will remain in Category 5 because it is still on the 303(d) List for a sediment impairment.

Crow Creek (WYSP101900090107_02) - A TMDL was developed for the E. coli impairment on Crow Creek from 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1. The TMDL was approved by USEPA in February 2014, however the segment will remain in Category 5 because it is still on the 303(d) List for a sediment impairment.

Crow Creek (WYSP101900090107_03) - A TMDL was developed for the E. coli impairment on Crow Creek from Morrie Avenue to a point 0.7 miles downstream. The TMDL was approved by USEPA in February 2014, however the segment will remain in Category 5 because it is still on the 303(d) List for a sediment impairment.

Crow Creek (WYSP101900090107_04) - A TMDL was developed for the E. coli impairment on Crow Creek from Morrie Avenue upstream to Happy Jack Road. The TMDL was approved by USEPA in February 2014, however the segment will remain in Category 5 because it is still on the 303(d) List for a sediment impairment.

Crow Creek (South Platte River Basin, WYSP101900090107_05) - A TMDL was developed for the E. coli impairment on Crow Creek from Happy Jack Road upstream to Roundtop Road. The TMDL was approved by USEPA in February 2014 and this water was placed in Category 4A.

Crow Creek (South Platte River Basin, WYSP101900090203_01) - A TMDL was developed for the E. coli impairment on Crow Creek from Missile Road (HWY 217) upstream to the outlet of Hereford Reservoir #2. The TMDL was approved by USEPA in February 2014 and this water was placed in Category 4A.

Figure 3.52 displays the Waters Requiring Total Maximum Daily Loads (TMDL) within the watershed area.

3.8.2 Wyoming Pollutant Discharge Elimination System (PDES) Permitted Discharges

The Federal Clean Water Act provides that the discharge of any pollutants from a point source into surface water of the United States must be regulated under the Wyoming Pollutant Discharge Elimination System (WYPDES) Program. Through this program, operators of a point source discharge are required to receive coverage under a WYPDES discharge permit. The permits contain limitations and conditions that will assure that the state's surface water quality standards are protected. (http://deq.wyoming.gov/wqd/wypdes/)

The South Platte River watershed has 18 Wyoming Pollutant Discharge Elimination System (WYPDES) point discharge permits. The map in Figure 3.53 shows the locations and Table 3.31 is a list of WYPDES permits in the watershed. There are two sanitary wastewater treatment facilities in the watershed for the City of Cheyenne, (WY0022381, WY0022934), as well as three wastewater lagoon facilities; Town of Burns (WY0021652), Town of Pine Bluffs (WY0032212), and the Town of Albin (WY0095192).

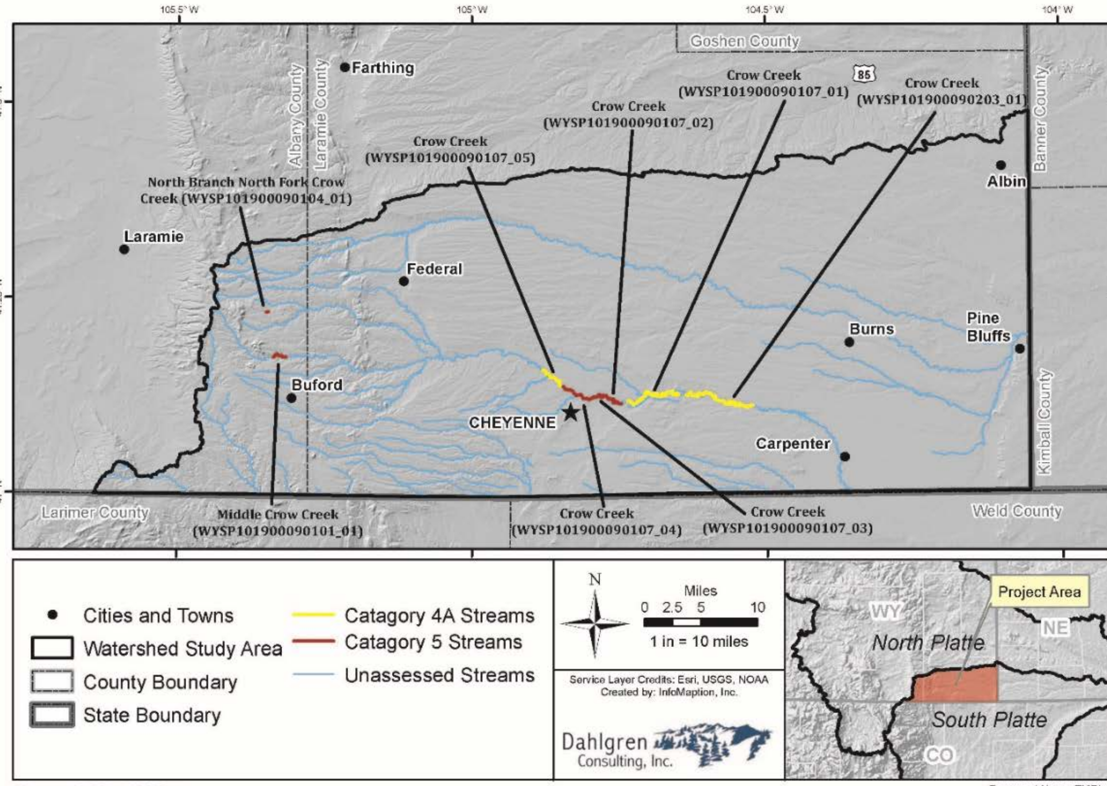


Figure 3-52. TMDLs

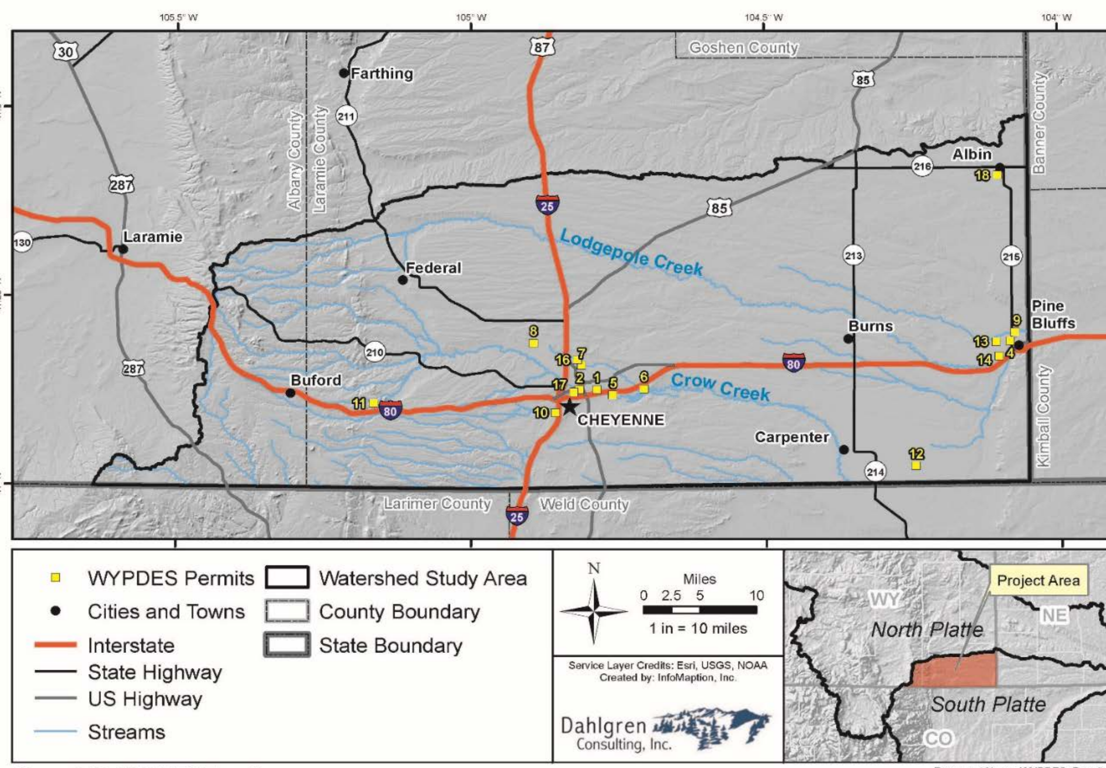


Figure 3-53. WYPDES Permits

Table 3.31: Wyoming Pollutant Discharge Elimination System Permitted Discharges

WYPDES Permit Number	**Permittee**	**Facility Name**	**Permit Type**	**Number of Outfalls**	**Monthly Average Flow (MGD)**
WY0000442	Frontier Refining LLC	Frontier Oil Refinery	Oil Treaters	3	0.8
WY0000647	Union Pacific Railroad	Cheyenne Rail Yards	Railroad Wastewater	1	0.3
WY0021652	Town of Burns, WY	Town of Burns	Wastewater Lagoon	1	NA
WY0022144	Gross Wilkinson Ranch	Feedlot Runoff Control Structure	Feedlot Runoff	1	NA
WY0022381	City of Cheyenne, Wyoming	Crow Creek Water Reclamation Facility	Wastewater Treatment Facility	1	3.25
WY0022934	City of Cheyenne, Wyoming	Dry Creek Water Reclamation Facility	Wastewater Treatment Facility	1	5.7
WY0032212	Town of Pine Bluffs, WY	Pine Bluffs Wastewater Lagoon	Wastewater Lagoon	1	0.165
WY0033944	Flying J, Inc.	Cheyenne Flying J Travel Plaza	Sheet Flow Runoff Oil/Water Seperator	1	NA
WY0034266	Granite Canyon Quarry - Martin Marietta Materials	Granite Canyon Quarry	Granite Quarry Groundwater Infiltration	1	NA
WY0039209	Burnett Land and Livestock	Burnett Land and Livestock LTD, LLP	Feedlot Runoff	1	NA
WY0043672	Wisroth Ranch Company	Wisroth Ranch Feedlot	Feedlot Runoff	1	NA
WY0053988	Gaspar Farms	Gaspar Farms	Feedlot Runoff	1	NA
WY0056731	153rd Airlift Wing, Wyoming Air National Guard	Wyoming Air National Guard (Mylar Park Pump and Treat)	Groundwater Extraction (TCE)	1	0.02

WYPDES Permit Number	Permittee	Facility Name	Permit Type	Number of Outfalls	Monthly Average Flow (MGD)
WY0094617	City of Cheyenne, Parks and Recreation Department	David R. Romero Park	Groundwater Extraction	1	0.04

3.8.3 Wyoming Formerly Used Defense Sites (FUDS)

There are a number of Peacekeeper (MX), Minuteman III, Atlas D and E missile sites located within the South Plate River Watershed. FE Warren became an Air Force base in 1947 and after the establishment of the Air Force base, F. E. Warren became an important command and support center site for missile fields. The following is a brief timeline of the missile mission at FE Warren:

- 1958: 4320th Strategic Missile Wing established
  - Responsible for 24 Atlas Missile sites under Strategic Air Command
- Sept. 2, 1960: 564th Strategic Missile Squadron
  - Declared first operational Intercontinental Ballistic Missile (ICBM) squadron
- July 1, 1963: 90th Strategic Missile Wing Activated
  - New Minuteman replaced the Atlas Missiles
- 1970: SAC ICBM Force Modernization Program
  - Replacing Minuteman I with Minuteman III missiles
- 1973: 400th Strategic Missile Squadron
  - First all Minuteman III squadron at F. E. Warren
- 1975: 90th Strategic Missile Wing
  - Selected to base the Peacekeeper missile
- 1986-2005: F. E. Warren housed the Peacekeeper missiles
  - Deactivated in 2005
- Present: F. E. Warren missile fields
  - Maintain 150 Minuteman III missiles

When the military inactivates, or decommissions a site, they become known as Formerly Used Defense Sites (FUDs). The Federal Facilities Program and federal partners work with current land owners to find acceptable clean-up methods for these sites. There are currently several dozen FUDs located in Wyoming. Top priority sites for clean-up include those which impact drinking water supplies.

There are several dozen FUDS identified through out Wyoming, with five specifically within the SPRWS area, as identified in Figure 3.54. These are all Atlas Missile Bunker Sites. (http://deq.wyoming.gov/media/uploads/wqd/ground_water/2014-05-07_wqd-gw-fedfac_bunker_sites.pdf).

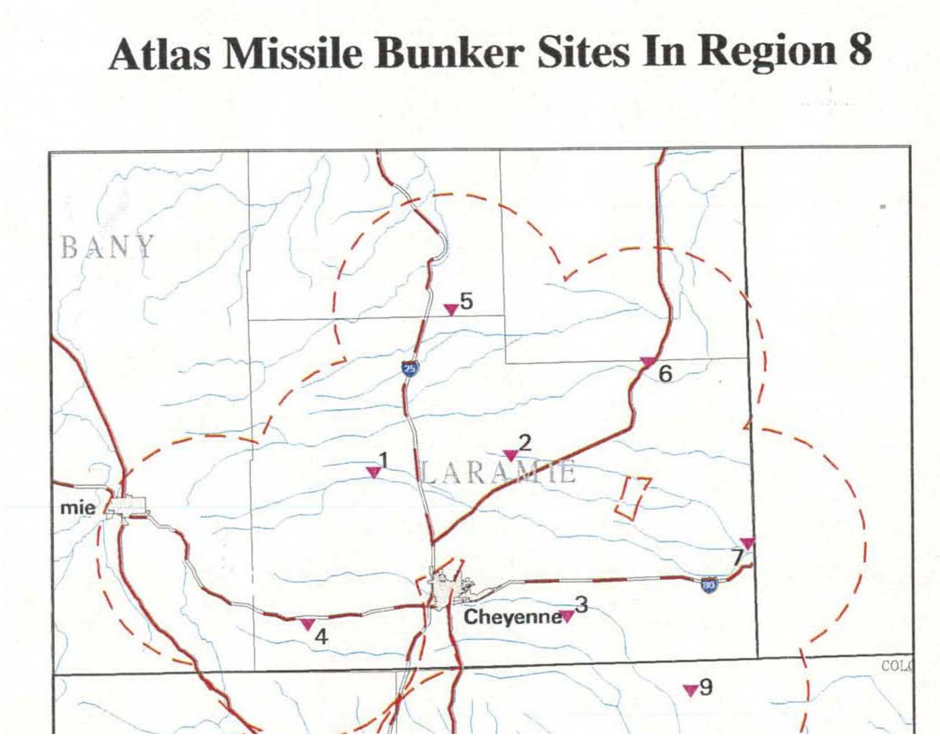


Figure 3.54 Atlas Missile Bunker Sites in Region 8 (Note that Site 8 is located in southern Weld County and is not shown on the map in Figure 3.54.)

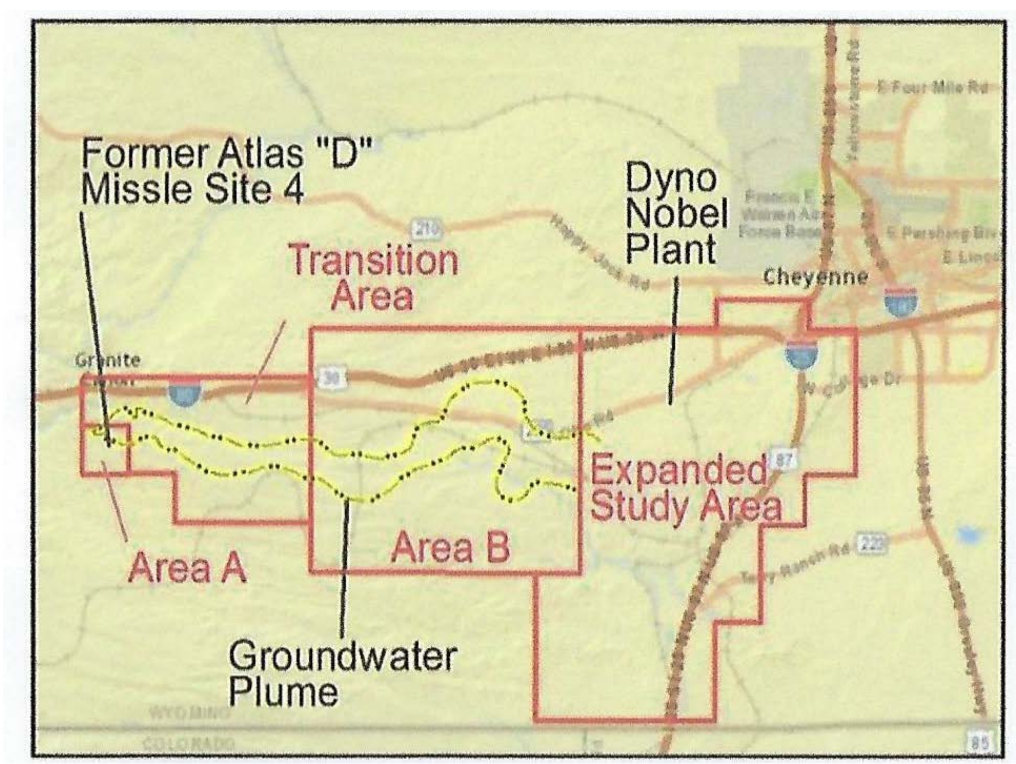


Figure 3.55: Former Atlas Missile Site 4 Map

These sites continue to be monitored by the Wyoming DEQ and USACE, and are in various stages of remediation. It was reported that containments related to Missile Site 7 were found outside expected locations, and that the plume related to Missile Site 4 extends for more than 10 miles. (Figure 3.55)

Quoting from the USACE website (http://www.atlassite4.com)

> "TCE has been detected on-site at a maximum level of 200,000 ug/L in one well. Downgradient of the source area, TCE detections in groundwater are generally less than 40 ppb. EPA's maximum contaminant level (MCL) for TCE in drinking water is 5 ppb. Site 4 and the downgradient Belvoir Ranch and adjoining properties have been segregated into three general areas based on site characteristics, topography, and contaminated media. The three general areas are defined as icon Area A, icon Area B, and the icon Transition Area.
>
> The launch and service building area of Site 4 (Section 20, Township 13 North, Range 69 West [6th Principle Meridian]) is the contaminant source area and is referred to as Area A. Numerous monitoring wells have been installed in this area by the USACE. The western portion of the Borie Well Field (a drinking-water source for the City of Cheyenne located in Sections 7 through 36 in Township 13 North, Range 68 West) is referred to as Area B. Numerous residential, industrial, municipal, and irrigation wells are located in Area B. Several deep oil wells are also located in the northeastern part of Area B. The west edge of Area B is located four miles east of Area A; the area between Area A and Area B is referred to as the Transition Zone. The Transition Zone contains a four-mile long segment of Lone Tree Creek and adjacent upland areas (three miles wide, including Sections 13-17 and 21-27). Several monitoring wells have also been installed in this area by the USACE. Two stock wells are located in the northwest corner of this area (1/2 mile northeast of Area A) and a few residential (domestic) wells are located in the northeast part the icon Transition Area"

3.8.4 DEQ Aquifer Vulnerability

The Wyoming DEQ Aquifer Prioritization Project prioritizes aquifers for groundwater monitoring based on their geology and potential contaminant sources. The Wyoming Groundwater-Quality Monitoring Network (WGQMN) is designed to include wells that are in priority areas where groundwater has been identified as an important source of drinking water to public and private water supplies, is susceptible to contamination, and is overlain by one or multiple land-use activities that could negatively affect groundwater resources (Bedessem et al, 2003). Cheyenne is identified as a priority monitoring area. Data collection and reporting activities by the USGS as part of the WGQMN will include the following:

- *Measurement of the water level in each well;*
- *Collection of groundwater samples from each well to be analyzed for a wide variety of natural and human-made constituents;*
- *Analysis of select samples for constituents such as stable isotopes to help determine recharge characteristics of the groundwater;*

• Reporting of analytical results through a publicly available USGS water-quality Web site (http://waterdata.usgs.gov/ wy/nwis/qw/); and

• Periodic summaries of groundwater data in published USGS Fact Sheets and Scientific Investigations Reports.

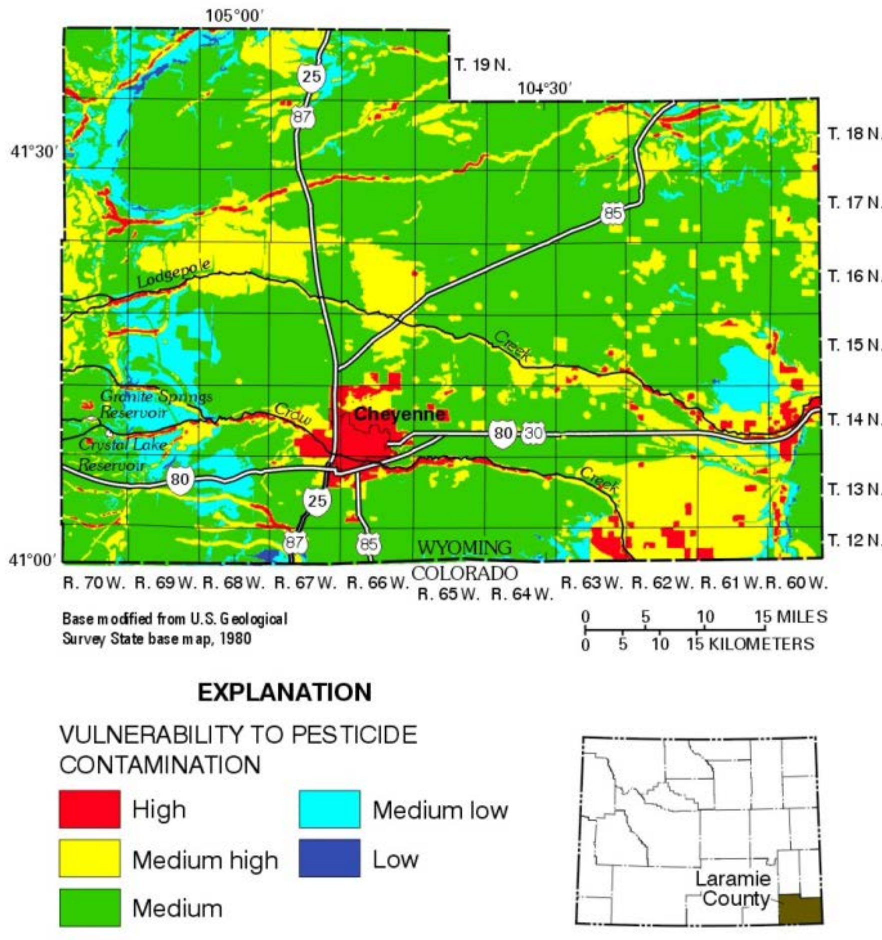


Figure 2. Vulnerability of Laramie County ground water to pesticide contamination (from Hammerlink and Arneson, 1998).

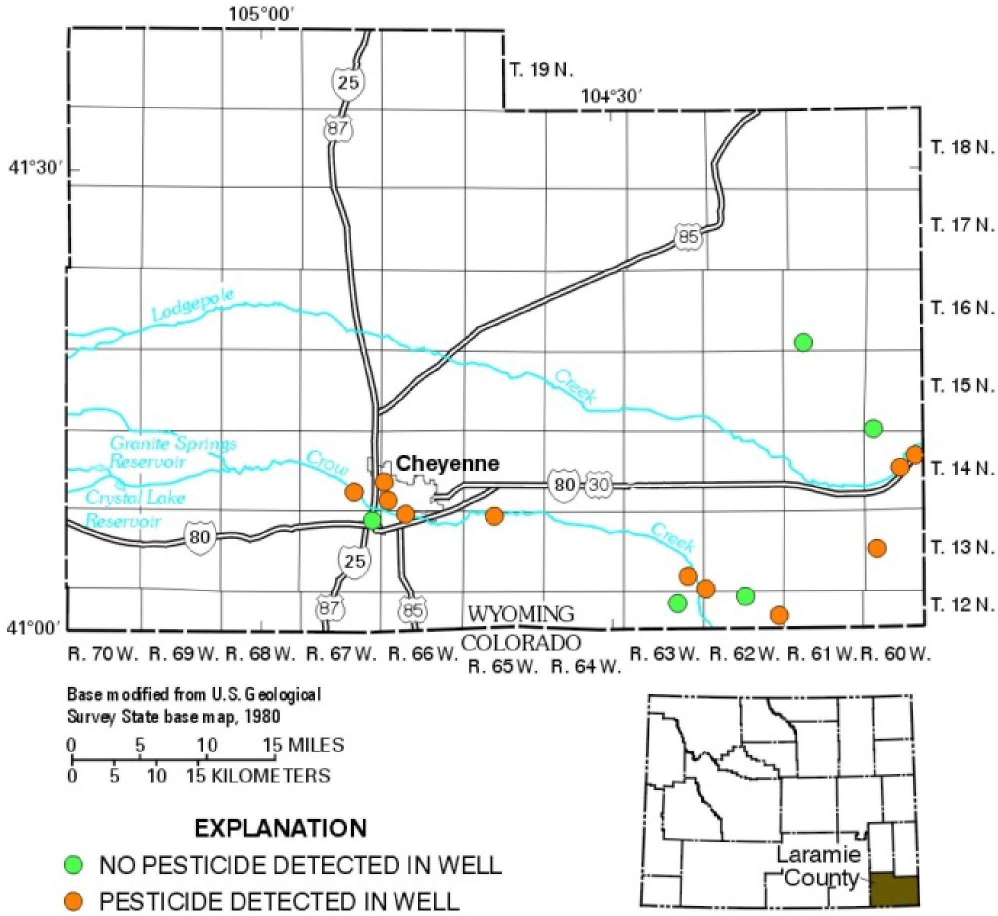
Figure 3.56. Groundwater with the highest priority for sampling from *Pesticides in Ground Water - Laramie County, Wyoming, 1998-99, USGS Fact Sheet 034-00*

3.8.4.1 Monitoring for Pesticides in Wyoming's Groundwater

Since 1995, the U.S. Geological Survey, in cooperation with the Wyoming Department of Agriculture, has been sampling groundwater in Wyoming. Sampling of surface water for pesticides began in 2006. In 1995, the groundwater sampling for pesticides began. Since then, over 700 samples have been collected. The latest report was published in April 2013 (http://pubs.usgs.gov/sir/2013/5064/). Results show:

- *All detected concentrations of pesticides were less than the associated drinking-water standard.*

- *Pesticides have been detected in every county.*
- *Most detected pesticides were herbicides or herbicide degradates.*
- *Wells in an urban setting were more likely to have pesticide detections than wells in agricultural, undeveloped, or mixed use settings.*
- *Over time, the concentrations of pesticides detected are decreasing in the groundwater*
- *Over time, the specific pesticides detected are changing, but the number of different pesticides detected are about the same.*



Location of wells sampled in Laramie County, and notation of pesticide detection in each well.

Figure 3.57 Close up of the Laramie County region and indicates wells were the presences of pesticides were detected from *Pesticides in Ground Water - Laramie County, Wyoming, 1998-99, USGS Fact Sheet 034-00*

Section 3.9 Geology and Aquifers

3.9.1 Introduction

The South Platte River Watershed is located in parts of three geologic or geographic regions. It covers parts of the Denver Basin, the Laramie Mountains, and the Laramie Basin. The geologic deposits range in age from recent Quaternary-aged deposits to Pre-Cambrian aged rocks. Figure 3-58 is a block diagram showing the bedrock geology and landforms within the Watershed.

The Late Tertiary rocks are nearly horizontal and lie un-conformably on the Mesozoic and Paleozoic formations which have been uplifted and folded next to the Laramie Mountains. At Cheyenne, the Cenozoic through Paleozoic units reach_a maximum thickness of approximately 12,000 ft. In total the structural relief is over 15,000 feet, measured from the top of Sherman Mountains in the Laramie Range to the top of the Pre-Cambrian near the deepest part of the structural basin, which are approximately 6,000 ft below sea level.

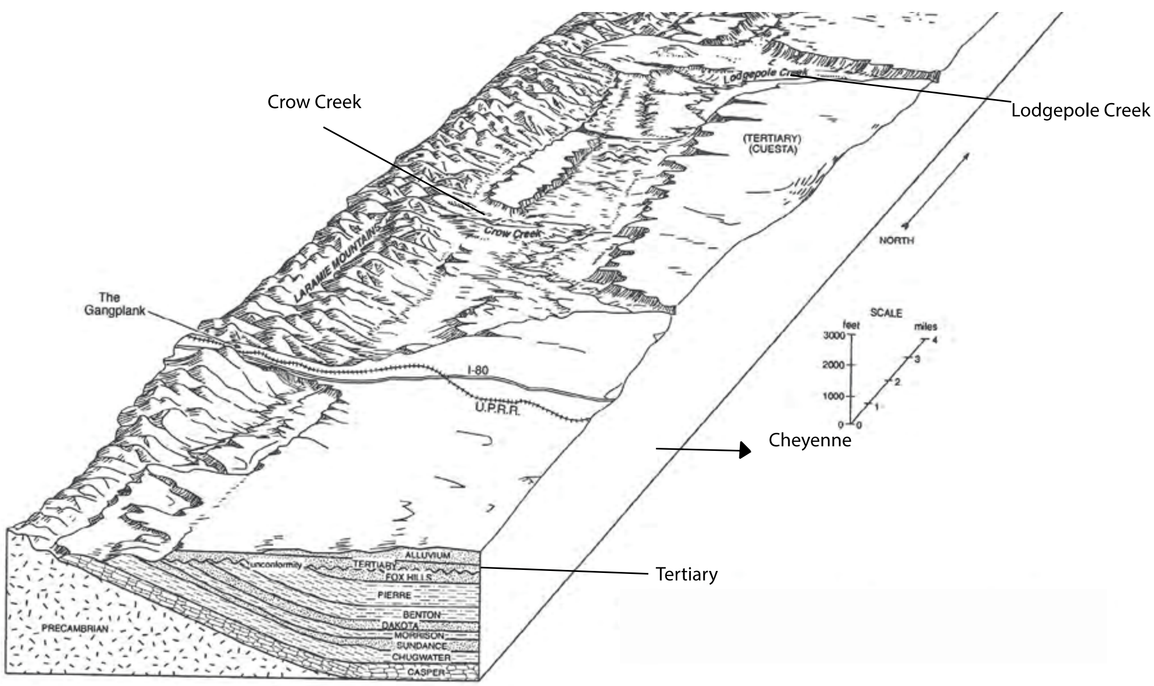


Figure 3-58 modified from the WGS report <u>Structural Geology of the Laramie Mountains, Southeastern Wyoming and Northeastern Colorado</u> by D.L. Blackstone, Jr, 1996.

Unit	Sherman Granite	Madison Ls/ Fountain Fm/ Casper Fm	Opeche Sh Minnekahta Ls	Spearfish Fm	Sundance Fm	Morrison Fm	Dakota Group	Mowry Shale	Frontier Fm	Niobrara Fm	Steele Shale	White River Fm
Age	Precambrian	Mississippian/ Pennsylvanian/ Pennsylvanian-Permian	Permian	Permian/ Triassic	Jurassic	Jurassic	Cretaceous	Cretaceous	Cretaceous	Cretaceous	Cretaceous	Oligocene
Thickness (feet)	—	983	32	981	67	232	340	470	355	477	385+	200+
Quality of Exposure	Good	Good	Excellent	Fair	Fair	Fair	Good	Poor	Poor	Fair	Poor	Good

Figure 3-59 modified from the WGS report Structural Geology of the Laramie Mountains, Southeastern Wyoming and Northeastern Colorado by D.L. Blackstone, Jr, 1996.

Many professional reports and maps have been prepared that describe the geology and groundwater resources of the South Platte River Watershed, particularly the area within Laramie County. The references sited contain much more detailed information than is presented in this Study and the reader is encouraged to review the basic reports. In addition to the professional papers, many well drilling projects and reports have added to the knowledge of the geology and aquifer system in south east Wyoming.

One of the most recent and comprehensive reports concerning the geology and groundwater resources in the South Platte Watershed, at least of the Tertiary or High Plains aquifer is the USGS report Geology and Hydrogeological Characteristics of the Ogallala Formation and White River Group, Belvoir Ranch near Cheyenne, Laramie County, Wyoming, by Bartos, Diehl, et al USGS Scientific Investigations Report 2013-5242. (https://pubs.usgs.gov/sir/2013/5242/) Although this publication specifically discusses the conditions on the Belvoir Ranch west of Cheyenne, the overview of the Regional High Plains aquifer system in Southeastern Wyoming provides a comprehensive summary of this topic.

The following is a brief description of the High Plains aquifer, quoting and paraphrasing from the Belvoir Ranch report:

> In southeast Wyoming, the High Plains aquifer system can include four Cenozoic units, including the Quaternary aged deposits, the Miocene aged Ogallala Formation, the Miocene and Oligocene aged Arikaree Formation, and the late Eocene to Oligocen aged White River Formation of group.
>
> Alternating episodes of stream laid deposits and windborne deposition and erosion created the Cenozoic sedimentary aged deposits that comprise the High Plains aquifer.
>
> The Tertiary rocks that comprise the High Plains aquifer can be divided into two major groups:

1. An older more homogenous group comprised mostly of fine grained wind borne volcanic tufts or ash, with some stream deposit. This generally comprises the White River Group and Arikaree Formation.

2. The second younger group of younger coarser grained deposits, which are stream deposits and derived from weathering and erosion. These are represented by the Ogallala Formation. Furthermore, the Ogallala is described as a complex sequence of cuts and fills mostly of stream-laid sediments with minor amounts of volcanic ash.

3.9.2 Geologic History

The time between the Late Cretaceous to the present spans approximately 80 million years. The principal water bearing formations in southeastern Wyoming were formed and deposited during this period of time. A summary of geologic events will be presented in chronological order and will attempt to explain the anomalous style of deformation and sedimentation that occurred in Wyoming during this time. The vast amount of sedimentary rock exposed in the study area provides significant evidence in the form of lithologic source, fossil discovery, and radiometric age dating which help constrain timing of the adjacent uplifts.

The term orogeny refers to a mountain building episode. Most Wyoming mountains (including the Laramie Range) began gaining surface expression during the Laramide orogeny. This orogeny began near 80–75 Million years ago (MYA) (Dickinson et al., 1988) and ended by 51 Ma (Lillegraven, 1993). The term “Laramide” relates to a very specific style, timing, and location of uplift in the Rocky Mountains. It has been proposed that the mountain building characteristic of this interval occurred in response to plate tectonic interactions on North America’s western margin causing overall east-west shortening of the continent (Engebretson et al., 1984).

This compressional stress was manifested by faults that separated large blocks of mountains (with Precambrian crystalline rock exposed in their cores) between deep, broad basins of much younger sedimentary rock. Faults associated with this orogeny around Wyoming have been demonstrated to have as much as 45,000 feet of offset between rock layers exposed on the tops of mountains and the same rock layer imaged at depth with seismic technology in the adjoining basin (Steidtmann and Middleton, 1991). However, that large amount of uplift occurred slowly over approximately 20 million years causing the mountains to be eroded quickly as they were uplifted. The total relief from mountaintop to basin floor at that time may have been just slightly more than today.

Most of the uplift and erosion associated with the Laramide orogeny took place while the basin elevations remained near sea level. The Eocene age (which followed the Laramide orogeny) climate in Wyoming consisted of a warm, tropical environment. Palms, fig trees, cypress and magnolias grew, and flamingos and crocodiles can be found preserved in rocks of equivalent age in the Green River Basin near Rock Springs (Mears et al., 1986). Basin deposits from this interval are chiefly composed of clasts derived from the adjacent mountains.

Figure 3-60 shows a map of the bedrock geology within the Watershed.

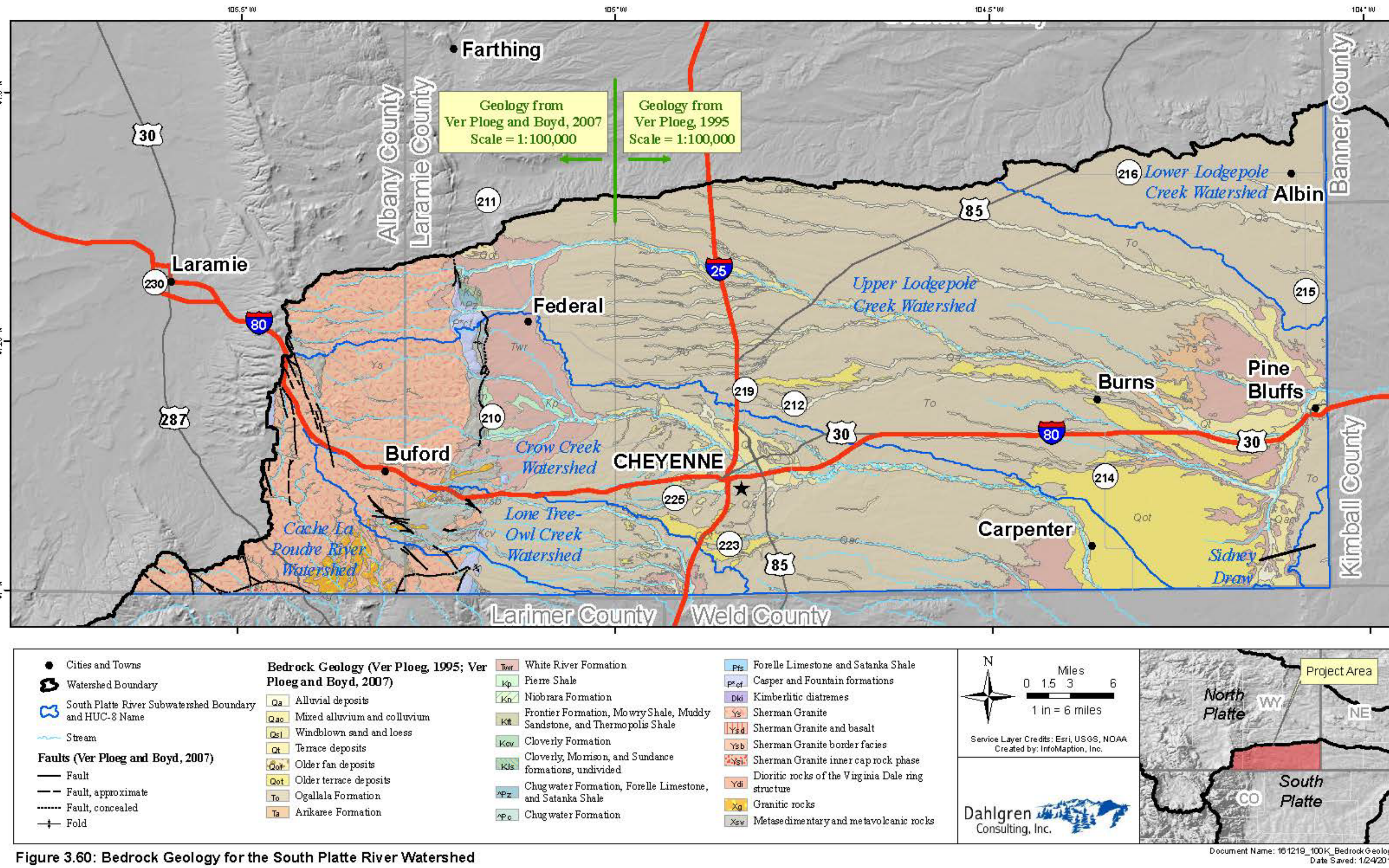
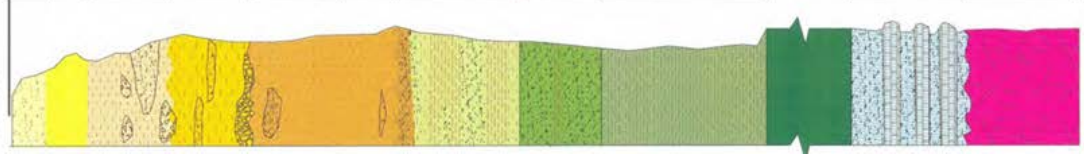


Figure 3.60: Bedrock Geology for the South Platte River Watershed



THICKNESS FT.	AGE		UNIT		LITHOLOGIC DESCRIPTION	AQUIFER DESCRIPTION	AQUIFER PROPERTIES**
0-85		QUATERNARY		ALLUVIUM	STREAM CHANNEL SILTS, SAND, AND GRAVEL WITH SOME COBBLES AND BOULDERS	WHERE DEPOSITED, MAY PRODUCE SMALL TO LARGE YIELDS, GOOD WATER QUALITY.	YIELDS: 20 - 1,700 GPM TRANSMISSIVITIES: 10,000 - 230,000 GPD / FT STORAGE COEFFICIENTS: 10E-3 - 10E-2 HYDRAULIC CONDUCTIVITIES: 690 - 3200 GPD / FT²
0-200		QUATERNARY		TERRACE			
0-500	TERTIARY	PLIOCENE	HIGH PLAINS AQUIFER	OGALLALA	HETEROGENEOUS MIX OF INTERBEDDED AND LENTICULAR SILT, CLAY, SAND, GRAVEL, AND CEMENTED CONGLOMERATE DEPOSITED BY ALLUVIAL FAN COMPLEX.	REGIONAL AQUIFER, SMALL TO LARGE YIELDS, GOOD WATER QUALITY.	YIELDS: 5 - 1,800 GPM TRANSMISSIVITIES: 45 - 343,000 GPD / FT STORAGE COEFFICIENTS: 10E-5 - 10E-2 HYDRAULIC CONDUCTIVITIES: 164 - 4000 GPD / FT²
0-400	TERTIARY	MIOCENE	HIGH PLAINS AQUIFER	ARIKAREE	LOOSE TO WELL CEMENTED VERY FINE GRAINED TO FINE-GRAINED GRAY TO WHITE SANDSTONE AND SILT, CONTAINING HARD CONCRETIONARY ZONES. MAY BE A COARSE CHANNEL CONGLOMERATE AT BASE IN SOME AREAS.	REGIONAL AQUIFER, SMALL TO LARGE YIELDS, GOOD WATER QUALITY.	YIELDS: 5 - 1,600 GPM TRANSMISSIVITIES: 110 - 77,000 GPD / FT STORAGE COEFFICIENTS: 10E-4 - 10E-3 HYDRAULIC CONDUCTIVITIES: 10 - 100 GPD / FT²
0-480	TERTIARY	OLIGOCENE	HIGH PLAINS AQUIFER / WHITE RIVER GROUP	BRULE	BUFF TO PINK MASSIVE SILTSTONE WITH OCCASIONAL BEDS OF VOLCANIC ASH AND IRREGULAR DEPOSITS OF SANDSTONE AND GRAVEL.	REGIONAL AQUIFER, SMALL TO LARGE YIELDS, GOOD WATER QUALITY.	YIELDS: 1 - 2,000 GPM TRANSMISSIVITIES: 2,600 - 780,000 GPD / FT STORAGE COEFFICIENTS: 10E-5 - 10E-1 HYDRAULIC CONDUCTIVITIES: 0.1 - 6000 GPD / FT²
0-100	TERTIARY	OLIGOCENE	WHITE RIVER GROUP	CHADRON	SILICA CEMENTED ARKOSIC SANDSTONE AND CONGLOMERATE WITH SILTSTONE/CLAYSTONE. NEAR LARAMIE RANGE.		
0-1500		UPPER CRETACEOUS		LANCE FORMATION	INTERBEDDED SANDSTONE AND SHALE WITH OCCASIONAL COAL.	SMALL TO MODERATE YIELDS, GOOD WATER QUALITY IN SOME AREAS.	YIELDS: 14 - 239 GPM TRANSMISSIVITIES: 65 - 5,400 GPD / FT STORAGE COEFFICIENTS: 10E-5 - 10E-3
+/- 250		UPPER CRETACEOUS		FOX HILLS SANDSTONE	MED-GRAINED GRAY TO YELLOW-BROWN SILTY SANDSTONE WITH OCCASIONAL DARK SHALE.	SMALL YIELDS, GOOD WATER QUALITY IN SOME AREAS.	
+/- 5700		UPPER CRETACEOUS		PIERRE SHALE	DARK GRAY SHALE WITH MINOR SANDSTONE INTERBEDS.	REGIONAL AQUITARD, POOR WATER QUALITY.	
~2,400 FEET OF UPPER CRETACEOUS (NIOBRARA) TO TRIASSIC ROCK (CHUGWATER/GOOSE EGG).						AQUIFER CHARACTERISTICS POORLY UNDERSTOOD, YIELDS AND WATER QUALITY GENERALLY BELIEVED TO BE POOR.	
800-1,300		PENNSYLVANIAN		CASPER FORMATION	INTERBEDDED RED SANDSTONE AND GRAY LIMESTONE/DOLOMITE, OCCASIONAL RED SHALE. ARKOSIC SANDSTONE AT BASE.	REGIONAL AQUIFER, POTENTIAL FOR LARGE TO MODERATE YIELDS AND GOOD WATER QUALITY IN RECHARGE AREA.	YIELDS: 600 GPM TRANSMISSIVITIES: 43,000 - 59,000 GPD / FT HYDRAULIC CONDUCTIVITIES: 45 - 62 GPD / FT²
		PRECAMBRIAN		SHERMAN GRANITE	PREDOMINANTLY GRANITE, GNEISS, AND SCHIST	LOW YIELDS, GOOD WATER QUALITY	

NOT TO SCALE

* GENERALIZED STRATIGRAPHIC COLUMN COMPILED FROM: LOWRY AND CRIST, 1967 AND BLACK AND VEATCH, 2003.
** AQUIFER PROPERTY VALUES REPRESENT RANGES OF KNOWN VALUES FOR LARAMIE COUNTY FROM NUMEROUS CONSULTANT AND USGS REPORTS.

Figure 3-61 is a stratigrahic column showing the geologic units in Laramie County, from the Laramie County Groundwater Atlas (JR Engineering, 2008).

However, the Denver Basin does not contain rocks from the Paleocene or Eocene possibly indicating that the Laramie Range had enough surface expression to redirect eastward flowing streams away from this area (Blackstone, 1975).

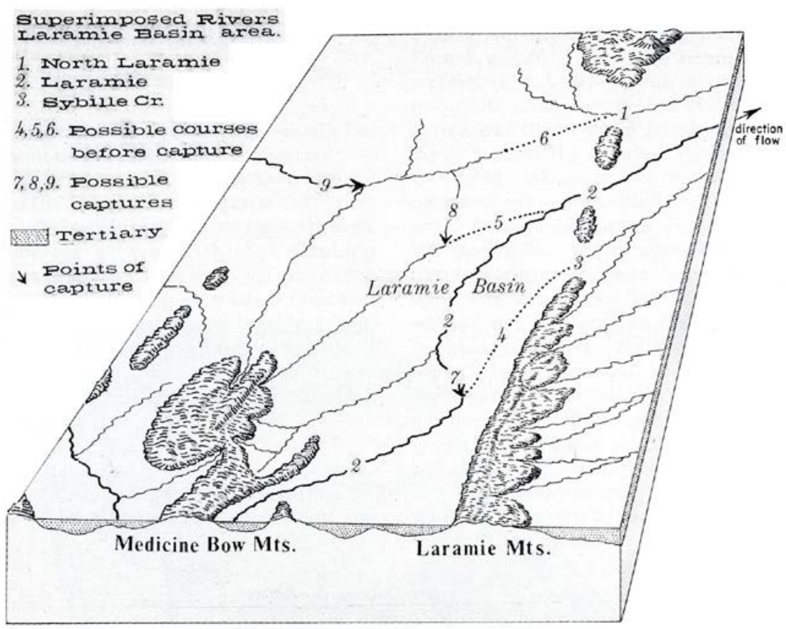
Broad, regional uplift began in the Early Oligocene and continued through Miocene. The entire region was uplifted about one mile, which closely approximates the basin floor elevations of today. The basins were filled upon uplift with some material from the highlands, but a very large percentage of the fill was in the form of volcanic ash. Since there are no known Oligocene age volcanoes in Wyoming, it is theorized that the source

Table 3-32: Chart Depicting Time vs. Sedimentation, and Deformation covering Notable Aspects of the Geologic History of Southeast Wyoming, Dahlgren 2001.
Only selected stratigraphic units are shown in the sedimentation column.

Age Millions of	Sedimentation	Deformation and/or		Epoch
	Glacial, alluvial, erosion and dissection	epeirogenic Uplift		HOLOCENE PLEISTOCENE
1.5-				PLIOCENE
5-	Ogallala Fm.	normal faulting		MIOCENE
10-	Arikaree	initiation of extensional regime		
25-		aggradation		OLIGOCENE
	White River Fm.	major erosion		
50-				EOCENE
		fold and thrust belt	Laramide orogeny	PALEOCENE
	Fox Hills Fm.			CRETACEOUS
	Pierre Shale			
100-				

for this ash came from volcanoes in the Great Basin region of Utah and Nevada. In some places around Wyoming, these ash deposits are several hundred feet thick and were probably deposited over tens to thousands of square miles representing an almost unfathomable amount of volcanic activity (Knight, 1990). This basin fill produced a landscape in which the basins were so filled with sediment that only the highest peaks were sticking out.

The basin filling ended in approximately the Late Miocene or Pliocene and the relatively high, low-relief landscape was excavated quickly by numerous streams flowing generally eastward. This produced a distinct package of poorly sorted cobbles and gravels in units of this age in the Denver Basin. Subsequent excavation has removed a large thickness of these deposits.



B. Close of the Pliocene.

Figure 3-62: Superimposed Rivers in the Laramie Basin and Laramie Mountains near the end of the Pliocene, from Knight, 1990.

Near the end of the Pliocene, more than 2 Ma, the region was again differentially uplifted and the present cycle of erosion began. It was during this period that Wyoming attained it's relatively high elevation.

The most significant events that occurred during Pleistocene were wide spread glaciation and the erosion that accompanied this event. Large amounts of relatively unconsolidated Pleistocene terrace deposits consisting of beds of coarse sand and gravel, with some scattered lenses of silt and clay were placed in the project area. These deposits were are most extensive in the areas near Carpenter and Pine Bluffs, including much of the area west of the present coarse of Muddy Creek.

These materials were deposited in channels cut into the underlying Ogallala or White River Formations. The thickest of these deposits do not necessarily underlie the present stream valleys.

To the south of the Colorado-Wyoming Stateline, is the Colorado Piedmont, which is an erosion surface several hundred feet lower than the Lodgepole Creek valley. Erosion has progressed northward from the lower surface into Wyoming and has captured the flow of streams that originally flowed to the east. The most significant steam that was captured is Crow Creek, which used to flow east and into Lodgepole Creek.

3.9.3 Lithologic Unit Description

The following are summary descriptions of the geologic units.

Cenozoic Era

Quaternary Deposits

The unconsolidated deposits of Quaternary age consist mainly of gravel and sand but also contain scattered lenses of silt and clay. Quaternary deposits in the project area have been mapped as three terrace deposits (the two oldest being Pleistocene age) and alluvium. Most of the unconsolidated deposits of Quaternary age are very permeable and, where a sufficient thickness is saturated, yield large quantities of water wells. Where the jointed and fissured strata of the Brule formation, i.e. the “pipes” are directly overlain by permeable saturated unconsolidated deposits; wells drilled into these formations tend to have higher yields. The Carpenter and Pine Bluffs areas are locations where this situation is present.

Tertiary age deposits

Ogallala Formation

This formation is Miocene and probably early Pliocene in age. It consists of sand and gravel lenses deposited by eastward flowing streams as well as silt, clay, and thin limestone beds deposited in ephemeral lakes. Many angular to subangular clasts in the Ogallala are composed of quartz, quartzite, gneiss, feldspar, and schist derived from the adjacent Laramie Range to the west. Many solution cavities are observed in this formation ranging in size from inches to several feet in diameter. The Ogallala has been reported by Lowry and Crist (1967) to be 330 feet thick on the west side of Laramie County, but thins to less than 150 feet on the Wyoming/Nebraska border. Some beds of Ogallala are cemented by calcium carbonate and are quite resistant cliff formers. Generally, this unit outcrops as swaley hills and valleys.

The spatial distribution of fine and coarse-grained sediments in the Ogallala Formation near Cheyenne has been described by Morgan (1946):

> The Ogallala Formation is composed largely of silt and clay with interbedded lenses and beds of sand and gravel. The proportion of sand and gravel to silt and

clay is highest near the mountains and decreases eastward toward Cheyenne. East of Ranges 67 and 68 West, gravel and sand beds form only a small part of the formation and near Cheyenne gravel lenses have been encountered by only a few wells. West of Ranges 67 and 68 West, gravel beds and lenses form a large part of the formation and appear to be interconnected. Eastward from the main mass of sand and gravel near the mountains, individual lenses and stringers of sand and gravel extend finger-like into the silt and clay beds of the eastern part of the formation. North of Crow Creek the textural gradation from west to east is not as pronounced as in the area south of Crow Creek and the entire formation [north of Crow Creek] is made up predominately of silt, clay, and fine sand."

Arikaree Formation

The name Arikaree was first used by Darton (1899) to describe an outcrop of gray sand characterized by layers of dark concretions exposed in northwestern Nebraska. This unit is predominantly massive, very fine to fine-grained sandstone, though local beds of siltstone or volcanic ash and a basal conglomerate associated with an erosional unconformity has been reported as well. It seems to be discontinuous across the Denver Basin and is absent where the Ogallala Formation rests directly on White River Formation.

White River Formation

The Oligocene White River Formation has been studied extensively in nearby areas, elevated to group status, and subdivided into separate formations. Locally, in eastern Laramie County, the White River Formation is known as the Brule. It has not been so subdivided for the purposes of this study. Lowry and Crist (1967) describe this unit as massive brittle siltstone containing a few beds of sandstone, conglomerate and volcanic ash. The base of the unit may be red and green shale and many paleo-valley or coarse channel deposits are seen as well. The rocks of this formation commonly form extensive, slightly sloping exposures, and rest with marked unconformity over older rocks of Late Cretaceous origin. The unconformity represents a hiatus in deposition throughout the Paleocene and Eocene spanning about 20 million years during which the Laramide orogeny occurred. The depositional environment of this unit has been characterized as chiefly fluvial and probably existed as a complex network of eastward flowing streams. These streams distributed approximately 300 feet of the White River Formation over southeastern Wyoming and up to 850 feet in northwestern Nebraska (Denson and Bergendahl, 1961).

The High Plains Aquifer and surficial terrace deposits have been the favored groundwater resource due to the high well yields, relatively shallow depth to water, and good water quality. However, declining water levels and water-rights permitting restrictions are limiting further groundwater development in the High Plains Aquifer.

The Upper Cretaceous Pierre, Lance, and Fox Hills formations are present in the Watershed below the High Plains aquifer. The Cretaceous age Lance and the Fox Hills formations that lie between the Tertiary and Paleozoic age aquifers are potential groundwater resources that have received relatively little attention in the Watershed.

In the Denver Basin along the Colorado Front Range, numerous wells produce water from the Laramie (equivalent to the Lance) and Fox Hills Formations. The Laramie-Fox Hills aquifer occurs primarily in the lower sandstone units of the Laramie Formation (i.e. Lance) and in the upper Fox Hills sandstone and siltstone units. Sandstones in the uppermost 100 to 200 feet of the Pierre Shale are likely hydraulically connected and are part of the Laramie-Fox Hills aquifer. Although the Lance and Fox Hills aquifers are not well developed in the SPRW, these formations are extensively used in the Denver area.

Mesozoic Era

Lance Formation

The Lance Formation consists of interbedded sandstones and shales with a few thin layers of coal. The lower part of the formation is gray siltstone and dark, carbonaceous shale with thin beds of sandstones. The deeper sandstone units have been proposed as potential targets for groundwater development, but very little data is available to assess actual production and water quality. The upper part of the formation is yellow brown fine-grained sandstones and shale. Locally the formation contains bentonite and oyster shell beds. In the BOPU wellfields the Lance Formation is 500 to 1,200 feet thick. No outcrops of the Lance Formation occur north of Interstate-80 in the Cheyenne area, and the formation is absent in the Federal wellfield. The depositional environment of the Lance Formation has been interpreted as marginal coastal and continental because of the presence of sands, shales, and coals.

Fox Hills Formation

The Fox Hills Formation is a medium-grained, friable, white to gray, silty, shallow marine sandstone, and contains black specks of biotite that give the formation a salt and pepper appearance. The formation has been eroded and is not present in the Federal wellfield.

The relatively deep and modest well production of the Fox Hills Formation has resulted in its limited exploration as a groundwater resource. If water availability declines and its value increases the Fox Hills Formation may become a viable groundwater development target. The financial viability of the Fox Hills Formation improves dramatically if the development is located near existing BOPU transmission infrastructure.

The Pierre Formation and older Cretaceous units hydraulically isolate the overlying Fox Hills, Lance, White River, and Ogallala formations from the underlying Casper Aquifer.

The town of Pine Bluffs has two wells completed in the Fox Hills Formation that produce approximately 200 - 225 gallons per minute with acceptable water quality. A few other wells have recently been completed in the Cretaceous aged formations within the Watershed.

Pierre Shale

This formation has a reported thickness of more than 5,000 ft. and is chiefly composed of interbedded shale, sandy shale, and lenticular sandstone. It is a slope former and is normally covered by pediment and alluvial terrace deposits. It is best exposed in stream valleys north of Crow Creek at the western basin margin. This unit becomes more sandy upwards and grades into the Fox Hills Sandstone representing a change in source during the Late Cretaceous from marine shales to a more continental-type deposits as the Laramide orogeny began to occur.

Paleozoic Era

Paleozoic hydrogeologic units underlie the Watershed. These deeper units tend to have highly mineralized groundwater that may not be suitable for some uses. However, along the Laramie Mountain Precambrian-Paleozoic contact where they occur at shallow depths, water quality is better. Aquifer permeability decreases and groundwater quality degrades rapidly downgradient from outcrop areas. Consequently, most wells in Paleozoic hydrogeologic units have been installed for oil and gas production, commonly at thousands of feet below land surface.

Groundwater development potential in in pre-Cenozoic units (i.e. units older than the Ogallala Aquifer) has focused on the Paleozoic Casper Aquifer (Richter and Huntoon, 1982; States West Water Resources Corporation, 2006; Lidstone and Associates, 2012). The thick saturated sequence of sandstone and dolomitic limestone generally have low production rates, but they have good water quality near recharge areas. Where high production wells exist, they are thought to contain significant secondary permeability in the form of open fractures or solution cavities (Richter and Huntoon, 1982).

In the SPRWS, Paleozoic rocks outcrop in the upper (western) part of the watershed near the contact with the Precambrian Sherman Granite basement rocks (Figure – geologic map). The Paleozoic units include the Casper Formation, Satanka Formation, and Goose Egg Formation (Table – stratigraphic units). In the Belvoir Ranch and Mesa Mountain areas, the Casper and Cloverly Formations are exposed at land surface and are largely covered by the Tertiary Ogallala and White River Formations

<u>Casper Formation</u>

The Casper Formation consists of two sequences that vary widely in lithology and thickness. The Casper Formation consists of interbedded sandstone, limestone, dolomite, gypsum, and occasional sandstone and shale (Lowry and Crist, 1967). The limestone, dolomite, and gypsum within the Casper Formation are prone to dissolution, particularly where the rocks are fractured. As a result, the Casper Formation can yield moderate to large quantities of water to wells.

The upper Casper Formation consists of an interbedded sandstone and dolomitic limestone sequence that varies in thickness from 198 to 895 feet. In contrast, the lower sequence of the Casper Formation consists primarily of dark reddish-brown siltstone and is correlative with the Fountain Formation of northern Colorado. The lower Casper ranges from 100 to 725 feet thick in the Belvoir Ranch area, it tends to be arkosic, and it interfingers with the upper Casper (Ver Ploeg and Boyd, 2007; Lidstone and Associates, 2012).

The Triassic-Permian redbed sequence of the Chugwater, Goose Egg, and Satanka Formations overlie the Casper Formation and generally act as confining layers that hydraulically separate the Casper Formation from the overlying High Plains Aquifer, Lance Formation, and Fox-Hills Formation. These Triassic-Permian redbed units are composed of dark red siltstone, shale, and clayey siltstone, but can have relatively thick interbeds of either anhydrite or gypsum which can pinch out over short distances.

The predominant lithologies of the lithostratigraphic units composing Paleozoic hydrogeologic units are sandstone, carbonates (limestone and dolomite), and shale. Primary porosity and intergranular permeability are much greater in the sandstones than in the carbonates and shale, where primary permeability is very low. Carbonate aquifers generally may be utilized only in areas where substantial secondary permeability is developed, most commonly in areas of structural deformation (for example, anticlines) and its associated faults and fractures.

The Casper Formation underlies the much of the eastern part of the Watershed, including the Cheyenne well fields. The Casper Aquifer near these well fields has not been extensively studied, likely due to the greater depths and potential for poor water quality with eastward distance from the recharge areas.

Over most of the SPRW, the Casper Aquifer is too deep to be considered a viable groundwater resource. The Casper aquifer's water quality degrades rapidly as the groundwater migrates east away from mountain front recharge areas. Within a few miles of the surface outcrops the eastward dipping Casper Aquifer can reach depths exceeding 10,000 feet.

The Cheyenne Board of Public Utilities has investigated the groundwater development potential of the Casper Aquifer on the Belvoir Ranch where the depths are feasible and the water quality is acceptable. During a Groundwater Exploration project conducted in 2005 and 2006, three test wells were drilled into the Casper Aquifer. One well yielded approximately 750 gpm; while the lowest yielding well only yielded approximately 24 gpm. Conclusions from this project (Lidstone, 2012) show that the development of high capacity Casper Aquifer wells depend in part into highly permeable water bearing features on geologic structures. Locating Casper wells is complicated by the fact that the Casper is covered by Tertiary formations.

Casper aquifer sandstone permeability in the Laramie Basin decreases toward the basins and with increasing depth. This is attributed to, at least partly, because of increased cementation of pore space by anhydrite and dolomite and interbedded anhydrite (Garland, 1996). Similarly, Stacy (1994, p. 41) noted that Casper aquifer sandstone intergranular permeability in deeply buried sub-crops in the Casper Mountain area "is locally being destroyed through recrystallization and cementation where ground waters are supersaturated with respect to various minerals." These same conditions may apply in the SPRW as the Casper aquifer depth increases into the basin from the outcrops near the Laramie Mountains.

Casper aquifer recharge occurs where the aquifer outcrop (exposed at the surface), although severing by faults near basin margins may disrupt basin ward aquifer continuity and prevent recharge from entering the aquifers downgradient from outcrop areas. Near recharge areas, water in these hydrogeologic units can be relatively fresh and may be suitable for most uses. This is where most domestic, stock, or public-supply wells are completed.

Elsewhere, and with increasing depth (as indicated by co-produced oil and gas water samples) and as the water moves away from the outcrop areas, the water can have TDS concentrations several times that of seawater and is not suitable for most uses or is only marginally suitable for some uses.

There is potential for faulting and fracturing to create groundwater flow paths from mountain front recharge areas into the Casper Aquifer. These types of areas identified by Richter and Huntoon (1982) is a selection was based on the presence of favorable geologic structures that have the potential for improving wells yields. Other selection criteria include: the presence of thick saturated sections of water bearing rocks, good water quality, shallow to moderate drilling depths, and good recharge. Drilling and aquifer testing in areas along the Laramie Range mountain front would be needed to evaluate these sites and other sites for their groundwater development potential. On the Laramie Range's eastern flank there are very few wells completed in the Casper aquifer and the aquifer's hydraulic isolation from the overlying High Plains Aquifer may simplify the water-rights permitting process.

Precambrian Era

Undifferentiated igneous and metamorphic rocks (including metasedimentary and metavolcanic rocks) of the Precambrian basement act as a basal unit for all aquifer systems in the Watershed. The Precambrian age Sherman Granite is exposed at land surface in the Laramie Range (Figure 3.63).

The overall permeability of the Sherman Granite is low and groundwater development is limited. Domestic wells are completed at relatively shallow depths in outcrop areas. Permeability is attributable to weathered, jointed, fractured, or faulted rocks (Berry, 1960; Whitcomb and Lowry, 1968; Lowry et al., 1973; Collentine et al., 1981; Richter, 1981a, b). These investigators also noted that fractures decreased in both size and number at greater depths. Lowry et al. (1973) noted that the shallow permeable zone typically is less than 100-ft deep.

Direct recharge from the high precipitation on the Laramie range Sherman Granite is unlikely to circulate deeply due to the low permeability. However, several streams collect runoff and flow off the mountain flanks. Some streams have been shown to lose significant discharge when they reach the contact with higher permeability Paleozoic and Tertiary units. These streamflow losses recharge the Paleozoic units through hydrologic sinks on the Belvoir Ranch. Stream losses and potential recharge to the Paleozoic, Cretaceous, and Tertiary units near Mesa Mountain, however, are limited.

The groundwater development potential of the Precambrian Sherman Granite is limited due to its overall unfavorable hydrogeologic conditions. Drilling deep wells in the granite is costly and the likelihood of high production wells to justify the cost is low. Groundwater development potential may be possible in faulted or tightly folded zones that have created permeable fractures. North-south trending drainages on the western flank of the Laramie Mountain and east-west trending drainages on the west flank can have perennial springs and streamflows (for example Figure 3.4-8 in Anderson 2016 - within the SPRW the relationship/data aren't available). Recharged precipitation is likely circulating on shallow and short flow paths discharging as groundwater through permeable fault zones and fractures in the low-lying drainages.

The crystalline Precambrian rocks generally have good water quality good due to the very low mineral solubility. The Precambrian groundwater in the Laramie Mountains has TDS concentrations that ranged from 45 to 282 mg/L. A few groundwater samples have approached or exceeded applicable USEPA or State of Wyoming water-quality standards that could limit suitability for some uses. Most environmental waters were suitable for domestic, livestock, and agricultural use.

Figure 3.63 shows the Generalized Potentiometric Surface, of the High Plains Aquifer in Laramie County (Plate 4 Platte River Basin Groundwater Report 2013).

Figures 3.64 and 3.65 are extracted from the USGS Scientific Investigations Map 3180, *Generalized Potentiometric Surface, Estimated Depth to Water, and Estimated Saturated Thickness of the High Plains Aquifer System March – June 2009, Laramie County, Wyoming by Bartos and Hallberg, 2011*. This map is a poster sized map and the figures presented in this report maybe difficult to read at the scale of this report. The readers are encouraged to review the original map https://pubs.usgs.gov/sim/3180/.

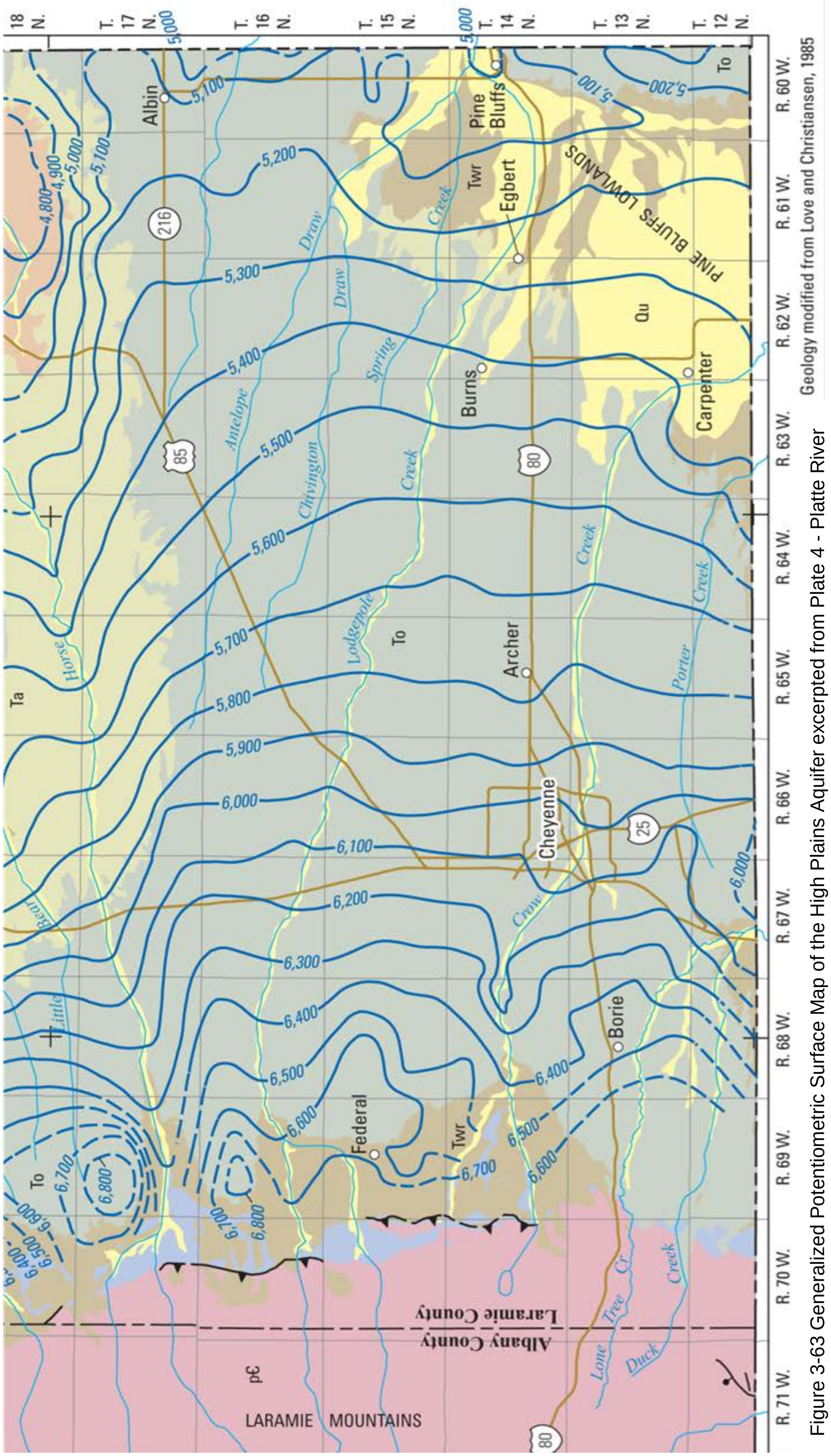


Figure 3-63 Generalized Potentiometric Surface Map of the High Plains Aquifer excerpted from Plate 4 - Platte River Basin Groundwater Report, 2013

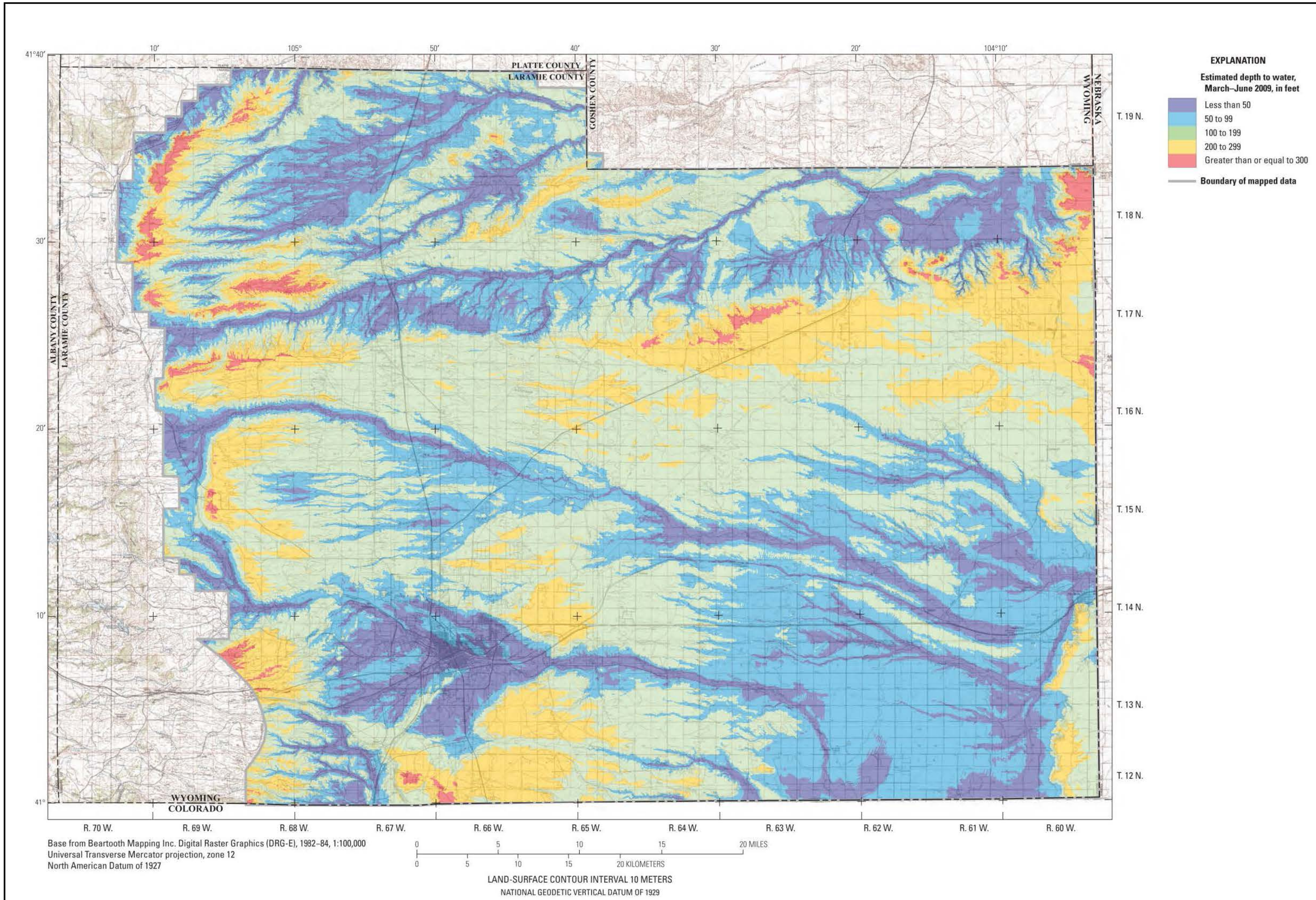


Figure 3.64 – Estimated Depth to Water in 2009 (Bartos and Hallberg, 2011)

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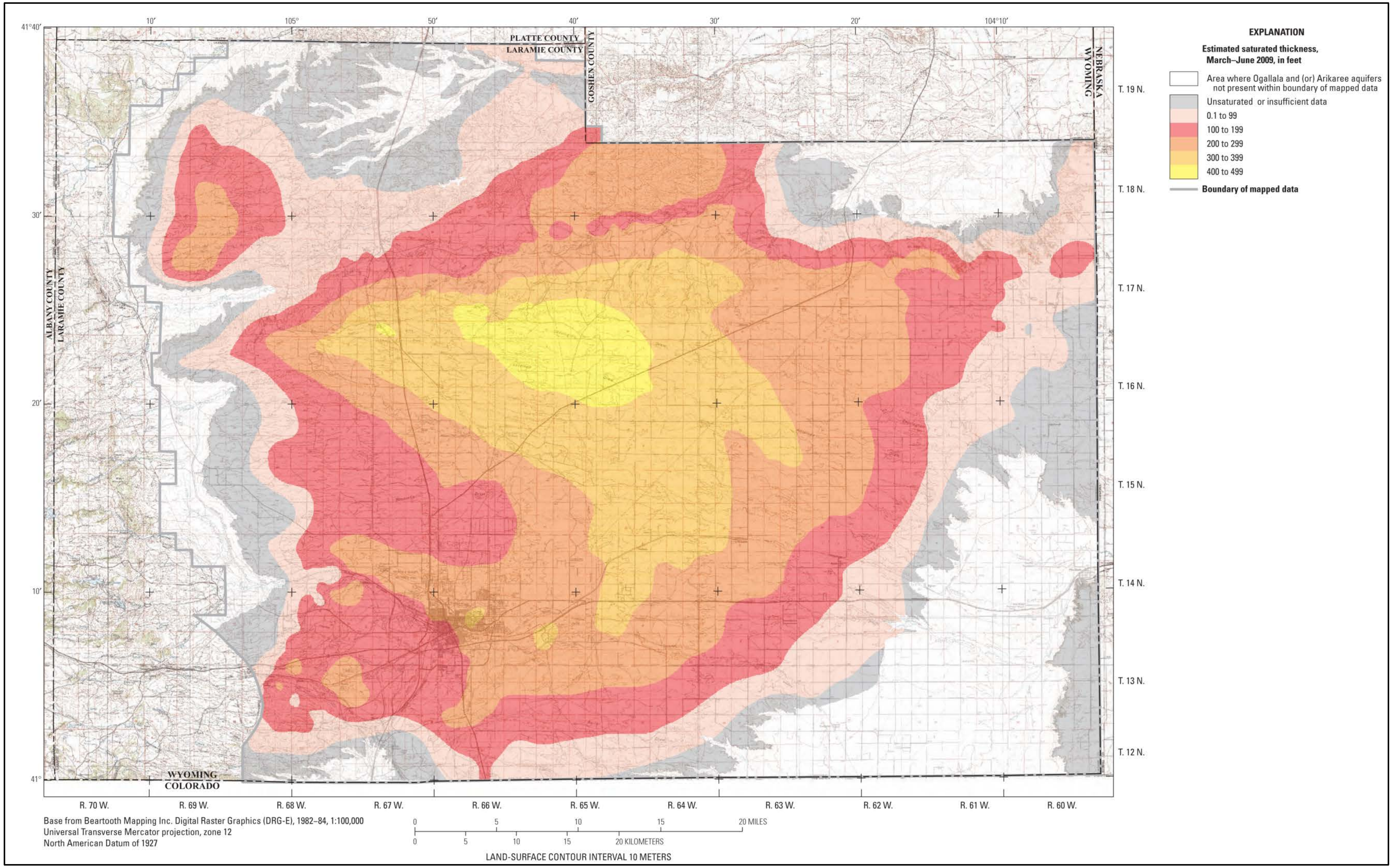

Figure 3.65 – Estimated Saturated Thickness in the Ogallala and Arikaree in 2009 (Bartos and Hallberg, 2011.

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Section 3.10 - Description of the Water Use within the Watershed

Section 3.10.1 Introduction

Current water uses within the South Platte River Watershed includes irrigation, municipal, miscellaneous use at small public water systems, domestic, industrial, recreational, and environmental uses. Estimates and quantification of these uses was an important component of this Study. Several figures and tables have been prepared during this Study to illustrate the water uses. Each use is discussed in the following sections of the report.

Figure 3.66 shows the location of the major irrigation ditches, those ditches diverting 5 cfs or more, within the Watershed. This information is summarized in Tables 3.33 and 3.34 below.

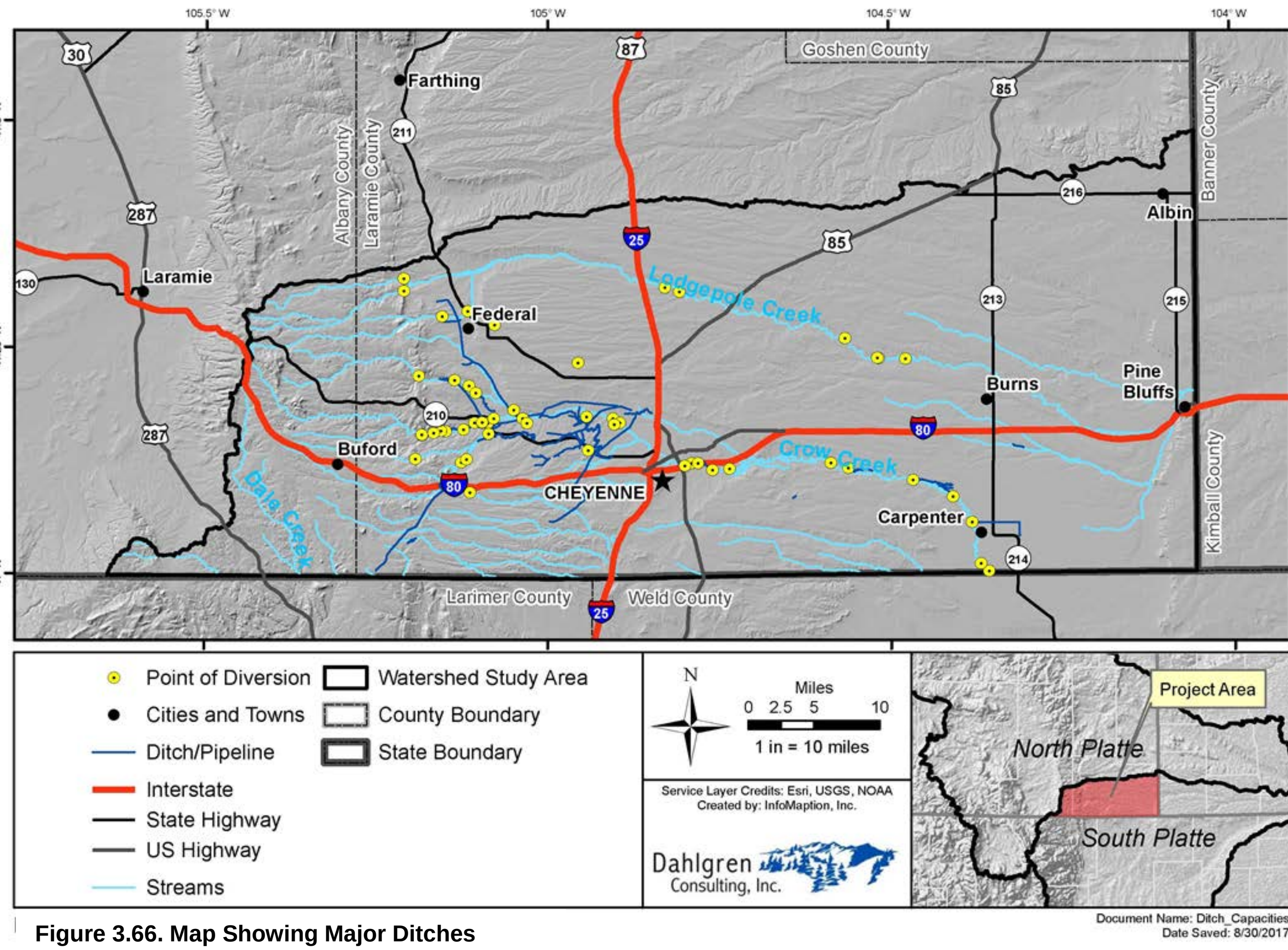

Figure 3.66. Map Showing Major Ditches

Table 3.33. Ditches Diverting From Crow Creek & Tributaries

Permit No.	Ditch	Priority	CFS	Sec-Town-Range	Comments
K1.0-	City Ditch & Pipe Line	Priority No. 1	12,481	21-14-67	Crow Creek Court Decree
K1.0-	City Ditch & Pipe Line	Priority No. 1	12,481	21-14-67	Crow Creek Court Decree
K3.0-	Anderson Ditch	Priority No. 3	23.1	28-14-69	Crow Creek Court Decree
K4.0-	Simmons Ditch	Priority No. 4	11.36	25-14-70	Crow Creek Court Decree
K4.5-	Hopkins Ditch	Priority No. 4A	6.72	30-14-69	Crow Creek Court Decree
K6.0-	Beaver Dam Ditch	Priority No. 6	5.12	30-14-69	Crow Creek Court Decree
K7.0-	Matthews and McGee Ditch	Priority No. 7	5.2	4-13-69	Crow Creek Court Decree
K8.0-	Severs & Berger Ditch	Priority No. 8	7.29	21-14-67	Crow Creek Court Decree
K8.5-	Home No. 2 Ditch	Priority No. 8	5.37	18-14-67	Crow Creek Court Decree
K10.0-	Matthews, McGee & Stone	Priority No. 10	6.2	4-13-69	Crow Creek Court Decree
K16.0-	Gilchrist No. 4 Ditch	Priority No. 16	37.5	26-14-69	Crow Creek Court Decree
K17.0-	Gilchrist No. 5 Ditch	Priority No. 17	8	23-14-69	Crow Creek Court Decree
K18.0-	Gilchrist No. 6 Ditch	Priority No. 18	6.6	23-14-69	Crow Creek Court Decree
K19.0-	Kingman Ditch	Priority No. 19	5.06	2-13-66	Crow Creek Court Decree
K21.0-	Dater Nos. 3 & 4	Priority No. 21	7.67	18-14-68	Crow Creek Court Decree
K23.0-	Gilchrist No. 7	Priority No. 23	14.17	23-14-69	Crow Creek Court Decree
K24.1-	Gilchrist No. 9 Ditch	Priority No. 24A	7.81	10-14-69	Crow Creek Court Decree
K24.3-	Home Ditch	Priority No. 24B	31.9	3-14-69	Crow Creek Court Decree
K25.0-	Ullman Nos. 1	Priority No. 25	5.5	6-13-64	Crow Creek Court Decree
K25.0-	Ullman No. 2 Ditch	Priority No .25	5.48	5-13-64	Crow Creek Court Decree
K29.0-	Home No. 2 Ditch	Priority No. 29	5.01	18-14-67	Crow Creek Court Decree
K31.0-	Ketcham Ditch	Priority No. 31	7.2	21-14-67	Crow Creek Court Decree
K33.0-	Granger Ditch	Priority No. 33	14.4	5-13-66	Crow Creek Court Decree
K35.0-	Phillips Ditch	Priority No. 35	8.34	20-14-68	Crow Creek Court Decree
K39.0-	Gilchrist #8 Ditch	Priority No. 39	26.8	22-14-69	Crow Creek Court Decree
K40.0-	Hord Ditch	Priority No. 40	7.22	22-14-69	Crow Creek Court Decree
K41.0-	Beaver Dam	Priority No. 41	10	7-13-63	Crow Creek Court Decree
K42.0-	North Crow Ditch	Priority No. 42	6.25	5-14-69	Crow Creek Court Decree
K45.0-	Anderson Ditch	Priority No. 45	10	28-14-69	Crow Creek Court Decree
K50.0-	Kuykendall Ditch	Priority No. 50	12.5	4-13-66	Crow Creek Court Decree
P150.0E	Enl. City Ditch	9/18/1895	12.48	21-14-67	Crow Creek
P8113.0D	Mackley Ditch	11/11/07	41.86	18-12-62	Crow Creek
P9038.0D	Cheyenne Pipe Line	5/27/09	9.5	25-14-70	Middle Crow Creek
P9070.0D	Hammond Ditch	5/22/09	5.08	4-13-66	Crow Creek
P9071.0D	Wood Ditch ACT Hammond Pipeline	5/22/09	6.07	4-13-66	Crow Creek
P10191.0D	North Crow Pipe Line	9/26/10	12.5	36-15-70	North Crow Creek
P10192.0D	South Crow Pipe Line	9/26/10	7	1-13-70	South Crow Creek
P2150.0E	Enl. Granger Ditch	1/21/10	5.11	5-13-66	Crow Creek
P2338.0E	Hereford Ditch No. 1	11/30/10	88.57	18-12-62	Crow Creek
P4743.0E	Enl. Cheyenne City Pipe Line	3/11/31	6.32	36-15-70	North Crow Creek
P28274	King No. 1 Ditch	11/10/82	36.5	31-14-67	King Draw

Table 3.34 Ditches Diverting from Lodgepole Creek and Tributaries

Permit No.	Ditch	Priority	CFS	Sec-Town-Range	Comments
T607.0-	Agnes Ditch	4/30/1883	8.57	35-16-70	Lodge Pole Creek
T608.0-	Tait & Mcdonald Ditch	5/15/1883	5.71	26-16-70	North Lodge Pole Creek
T609.0-	Islay No. 1 Ditch	10/20/1883	6.15	8-15-69	South Lodge Pole Creek
T611.0-	Lodge Pole Ditch	3/22/1884	42	32-16-66	Lodge Pole Creek
T613.0-	North Lodge Pole Ditch	11/11/1884	20.57	36-16-67	Lodge Pole Creek
T614.0-	Hillsdale Irrigating Co. No. 1 Ditch	4/1/1885	5.71	17-15-64	Lodge Pole Creek
T615.0-	Hillsdale Irrigating Co. No. 4	4/1/1885	5.71	26-15-64	Lodge Pole Creek
T618.0-	Hillsdale Irrigation Co. No. 2 Ditch	7/2/1885	5.3	30-15-63	Lodge Pole Creek
T620.0-	Hillsdale Irrigation Co. No. 5 Ditch	7/25/1885	5.23	26-15-64	Lodge Pole Creek
P1655.0E	Enl Chadwick No. 4 Ditch	1/14/07	10.83	3-15-69	South Lodge Pole Creek
P4825.0E	1st Enl Agnes Ditch	10/8/32	6.35	35-16-70	Lodge Pole Creek

Figure 3.67 shows the major reservoirs within the Watershed. This data is summarized in the Table 3.35 below.

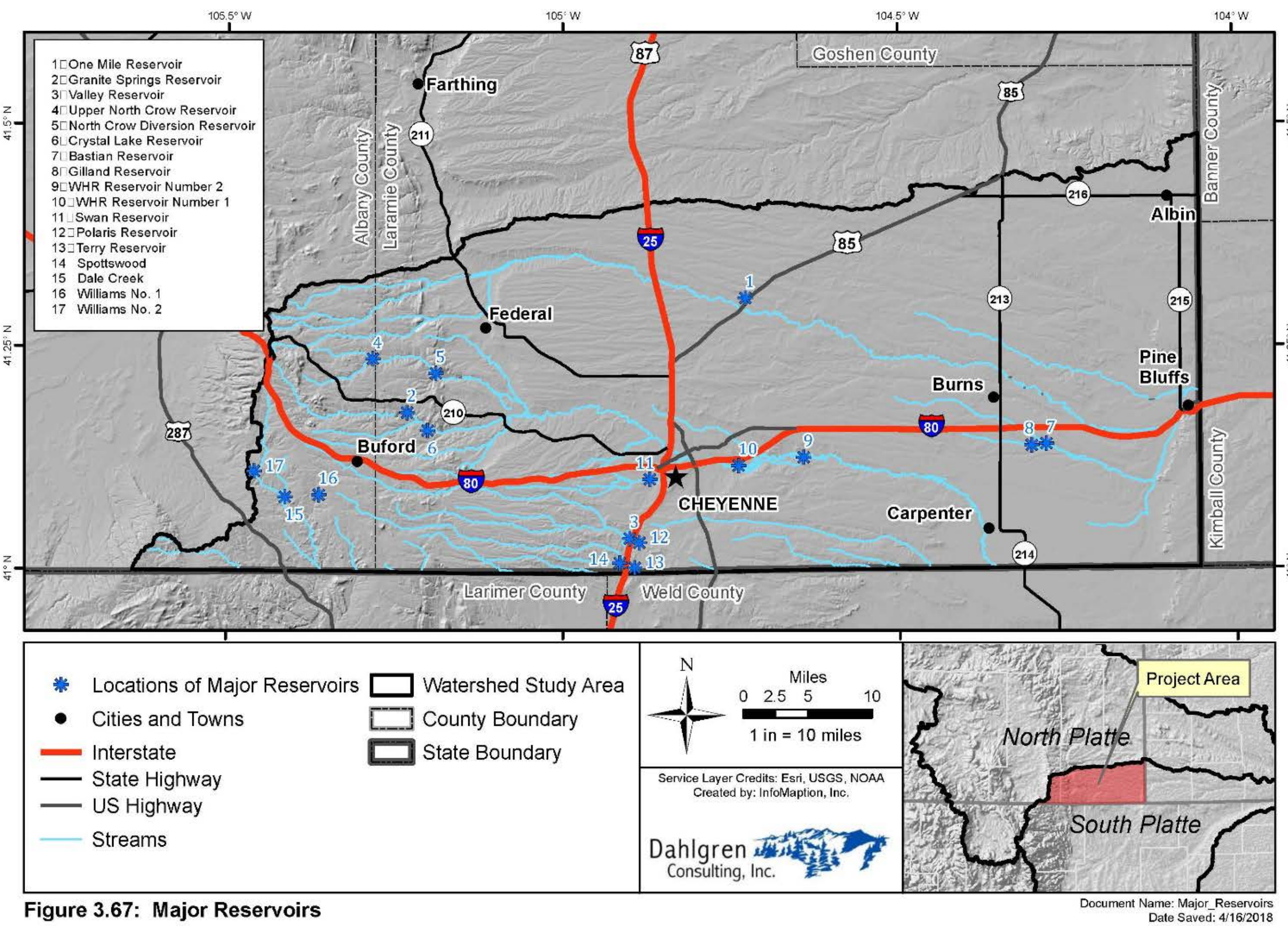

Figure 3.67: Major Reservoirs

Table 3.35 – Major Reservoirs within the South Platte River Watershed Study

	Permit No.	Facility Name	Priority Date	Location	Capacity: ac-ft	Source
1	928R	One Mile Reservoir	10/5/1906	1-15-66	127	Lodge Pole Creek
1a	1060R	Enl. One Mile Reservoir	6/8/1907	1-15-66	2,120	Lodge Pole Creek
2	261R	Granite Springs Reservoir	11/9/1901	22-14-70	7,367	Middle Crow Creek
3	1474R	Gleason No. 2 (Valley)	3/20/1909	4-12-67	160	Lone Tree Creek
4	4152R	Upper North Crow Reservoir	10/24/1912	30-15-70	1,868	North Crow Creek
5	10191D	North Crow Diversion Reservoir	9/26/1910	6-15-70	Diversion Dam	North Crow Creek
6	1317R	Crystal Lake Reservoir	10/10/1906	26-14-70	3,618	Middle Crow Creek
6a	3684R	Enl. Crystal Lake Reservoir	1/31/1921	26-04-70	895	Middle Crow Creek
7	6404R	Bastian No. One Reservoir	5/10/1957	35-14-62	27	South Muddy Creek
8	91R	Gilland Reservoir	12/08/1897	34-14-62	40	Muddy Creek
9	4032R	WHR Reservoir Number 2	12/11/1925	3-13-65	795	Crow Creek
9a	4640R	Enl WHR Reservoir No. 2	2/10/1936	3-13-65	83	Crow Creek
10	3984R	WHR Reservoir Number 1	9/25/1924	2-13-66	204	Crow Creek
10a	4402R	Enl WHR Reservoir No. 1	10/8/1929	2-13-66	674	Crow Creek
11	942R	Swan Reservoir	10/6/1906	15-13-67	247	Clear Creek
12	994R	Polaris Reservoir	12/22/1906	9-12-67	440	Lone Tree Creek
12a	1476R	Enl. Polaris Reservoir	3/30/1909	9-12-67	608	Lone Tree Creek
13	1475R	7xL Reservoir (Terry)	3/20/1909	16-12-67	157	Lone Tree Creek
14	993R	Spottswood	12/22/1906	17-12-67	336	Lone Tree Creek
15	275R	Dale Creek	1/11/1902	24-13-72	41	Dale Creek
16	6428R	Williams No. 1	8/5/1952	21-13-71	35	Texas Creek
17	6644R	Williams No. 2	9/18/1962	10-13-72	175	Dale Creek

Figure 3.68 shows the Bedrock Geology and Permitted Well Locations for the South Platte River Watershed Study."

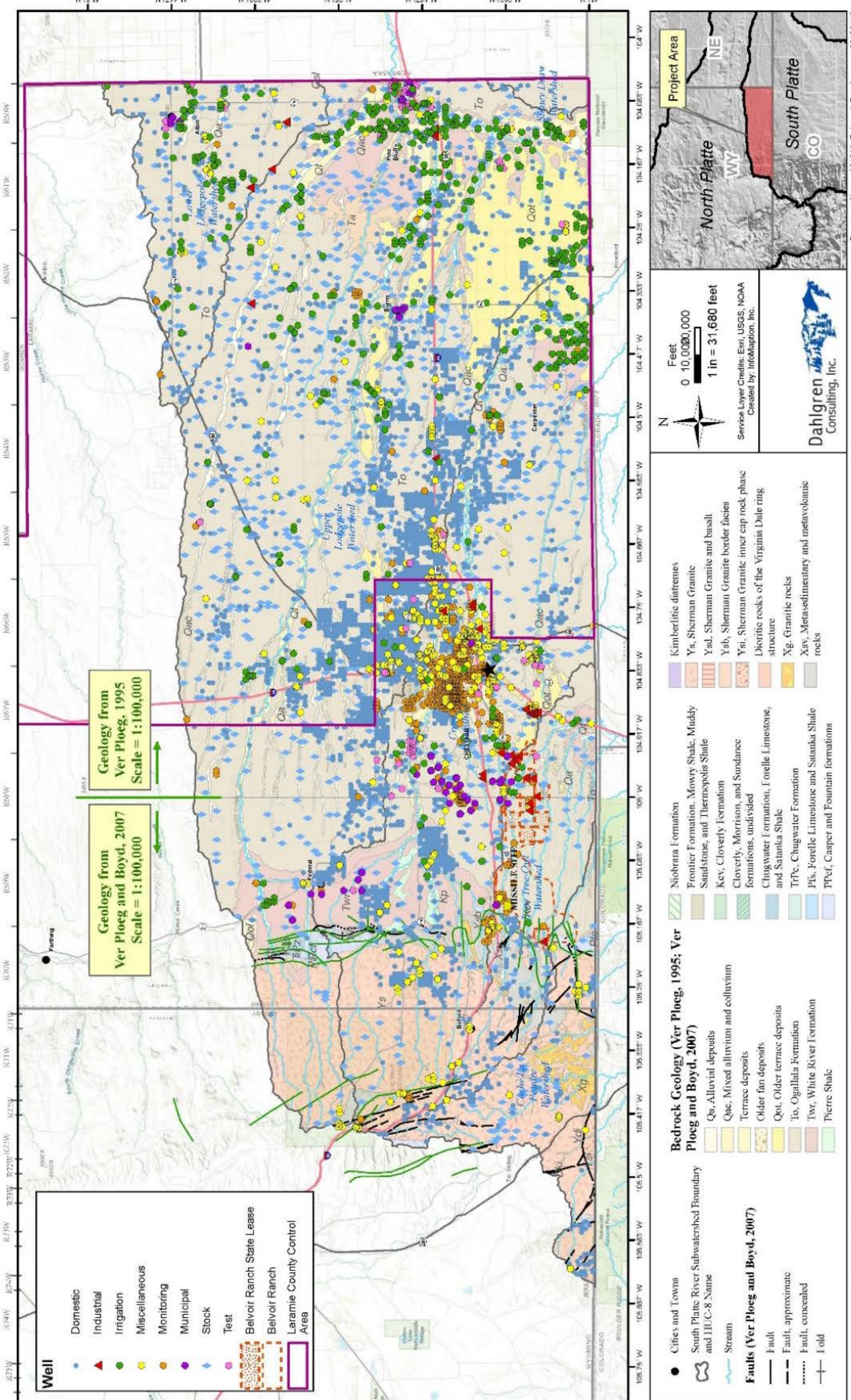

Figure 3-68 Bedrock Geology and Permitted Well Locations for the South Platte River Watershed Study

Section 3.10.2 Irrigation

This section of the Study presents the analyses used to estimate the amount of irrigation within the watershed. Irrigated acres were estimated by manually digitizing areas identified visually from aerial photography. Also, an attempt was made to determine irrigated lands using remotely sensed data.

These efforts were not specifically in the Scope of Work for this Study but developing an accurate estimate of the irrigation within the Watershed was a key issue for the Laramie County Conservation District. Also, the breakdown between surface water irrigation and groundwater irrigation needed to be determined.

There are no irrigation districts within the South Platte River Watershed, however, approximately 45,120 acres are irrigated within the watershed. A major emphasis of this Study was to review the irrigated lands within the Watershed and to provide an updated estimate of amount of land irrigated. Also, the source of the water, whether surface water or groundwater, for the irrigated lands was determined during this effort.

Delineation of the amount of land irrigated by groundwater and surface water sources was made by reviewing water rights, field conditions, and by review of the data by the Laramie County Conservation District and NRCS personnel. In addition, irrigation estimates from previous studies were compared to evaluate the reliability and consistency of the estimates.

Figure 3.69 shows the “current or existing” irrigated land within the Watershed, estimated during this Study. A mapbook containing 12 maps (including index), showing the irrigated lands at a larger scale, is presented in Appendix B of this Study. These maps differentiate between surface water and groundwater sources. These maps were prepared using 2015 aerial photographs.

This study estimates 45,120 irrigated acres in the Watershed of which 36,612 acres were irrigated by groundwater and 8,507 acres were irrigated by surface water. Table 3.36 summarizes this data.

Table 3.36 SPRWS Irrigated Acreage Estimates

Sub-basin	Groundwater Irrigated Acres	Surface-Water Irrigated Acres	Total
Crow Creek	5,281	4,766	10,047
Lower Lodgepole (Albin)	9,495	0	9,495
Upper Lodgepole (Pine Bluffs)	21,836	2,110	23,946
Cache La Poudre	0	466	466
Lone Tree-Owl	0	1,165	1,165
Total	36,612	8,507	45,119

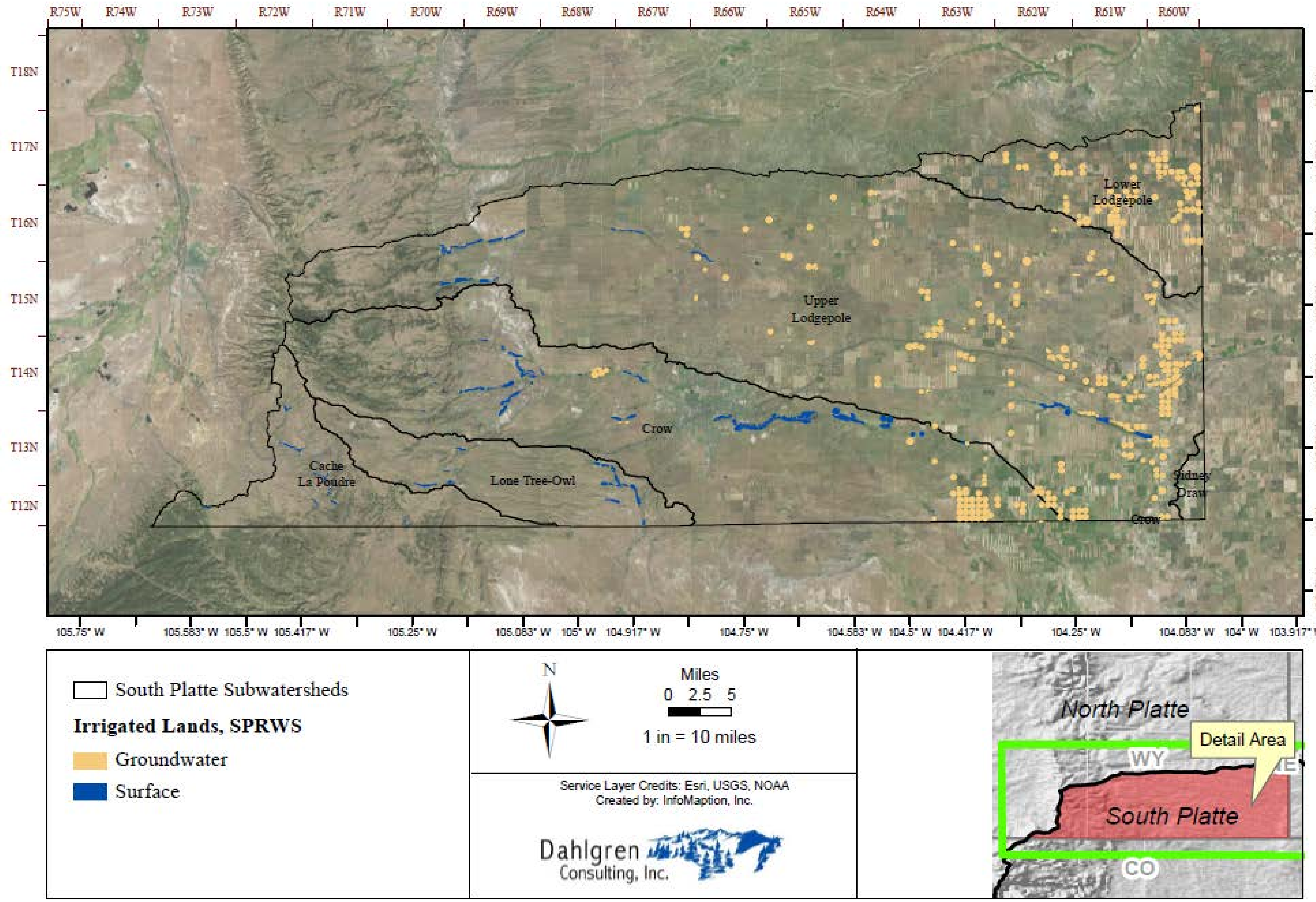

Figure 3.69. Irrigated Lands in the South Platte River Watershed

The information presented in Table 3.36 was made using 2015 air photos, so the data should be considered an estimate of “current or existing irrigation”. Based on the data in Table 3.66, groundwater accounts for 81-percent of the irrigation in the Watershed. The Upper Lodgepole sub-basin has the largest amount of groundwater-irrigated land with 21,836 acres or 48-percent of the watershed total. Crow Creek has the most of the surface-water irrigation in the watershed. The Crow Creek sub-basin has 10,047 acres of irrigated land and is nearly evenly split between groundwater (52.6-percent) and surface water (47.4-percent).

As part of the Platte River Basin Studies there have been previous estimates of irrigation within the South Platte Watershed (SPRW). In 2006, Trihydro estimated total irrigated land in SPRW to be 45,454 acres (Trihydro, 2006). The Platte Basin update by Wenck estimated 43,221 irrigated acres (Wenck, 2016). The irrigated-land estimates reported in Trihydro (2006) did not distinguish between acreage irrigated by groundwater and surface water.

During this Study, GIS data compiled by the Trihydro (2006) and Wenck (2016) studies were associated with the WSEO water-rights permit database to identify groundwater and surface-water irrigated acreage and these results are shown in Table 3.37.

The irrigated land acreages reported in this Study are the most up-to-date estimates available in the SPRW. This was due, in part, to the more focused efforts of the Study, i.e. only reviewing the South Platte River Watershed. Also, detailed knowledge of the watershed and review with local personnel allowed accurate classification of the irrigation sources for each land parcel. For example, in there are several fields near Crow Creek with center-pivot irrigation systems that are supplied by surface-water not by groundwater. On an air photo these fields could look like a groundwater supplied irrigated field, when they are actually supplied using surface water.

The total amount of irrigated land reported in the Trihydro 2006 report is similar to the amount estimated in this Study. The irrigated land estimate in this Study is nearly 2,000 acres more than the 43,221-acre estimate reported in the 2016 Wenck update to the Platte Basin Study. Due to drought or surface water shortages, there could have been less surface water irrigation occurring during the Wenck Study. Also, it appears that some of the surface irrigation near Crow Creek could have been counted as groundwater in the Wenck study, because many of the fields in this area are irrigated using center pivots, as mentioned above.

The focus of this effort was to determine the actual number of irrigated acres and to delineate between the land that is currently irrigated with surface water and groundwater sources. This Study did not review water rights and there may be land that has both surface water and groundwater rights. However, the irrigated land values and specifically the summary of surface verse groundwater sources, reflect the current situation on the ground.

No attempt was made to analyze or summarize water rights. Such an effort is beyond the scope and budget for this study.

Table 3.37 Irrigated-acreage Estimate Comparison

Sub-basin	2016 SPRWS	Wenck (2016)1	Trihydro (2006)1
Groundwater Irrigated Acres			
Crow Creek	5,281	6,098	5,762
Lower Lodgepole (Albin)	9,495	9,713	9,723
Upper Lodgepole (Pine Bluffs)	21,836	22,851	23,367
Cache La Poudre	0	0	0
Lone Tree-Owl	0	0	0
Totals	36,612	38,662	38,852
Surface-water Irrigated Acres			
Crow Creek	4,766	2,238	3,281
Lower Lodgepole (Albin)	0	116	0
Upper Lodgepole (Pine Bluffs)	2,110	1,097	2,326
Cache La Poudre	466	148	378
Lone Tree-Owl	1,165	961	689
Totals	8,507	4,560	6,674
Total	45,119	43,222	45,526

Acres reported in this table were based on GIS data compiled for the listed references. The irrigation-water source and sub-basin classification was compiled during this study and may differ from reported values due to rounding.

3.10.2.1 Methods used in the SPRWS to Estimate Irrigated Lands

Estimates of irrigated acreage were attempted using two methods, manually digitizing air photos and using remote sensing data. The comparison between the digitized irrigated acreage estimate and the estimate made using remote sensed data showed that there were significant differences in the estimates of irrigated acres between the two methods. The manually digitized acreage is considered the most accurate method, as described below.

Once the irrigated acres were delineated on the aerial photographs, this data was correlated with water-right permits and then the areas irrigated by groundwater and areas irrigated by surface water were estimated. As noted in the previous section, no attempt to resolve water rights was attempted during this study. Review of the air photographs, digitizing the irrigated land and the follow-up discussions with the Laramie County Conservation District staff provides the most current data on the irrigated lands within the South Platte Watershed.

<u>Digitizing Air Photos</u>

During this study, irrigated croplands were manually digitized using the 2015 National Agriculture Imagery Program (NAIP) data. Since the irrigated lands estimates were made using 2015 images, the estimates of irrigated land made during this Study was only a “snap shot” of the irrigated land in the SPRWS.

Estimating the cropland irrigated by groundwater and surface water required identification of the water right permit associated with the land parcel. By associating specific water rights to land parcels, an accurate accounting of acreage irrigated by groundwater and surface water was obtained. Irrigated lands were originally associated with water-right permits by the Wyoming State Engineers Office (WSEO).

This database was updated with the 2016 water rights and individual irrigated lands were verified using the WSEO water right maps. Some irrigated areas bordering Crow Creek and Lodgepole Creek were known to be irrigated by surface water and these areas were correlated with the water rights database (WSEO, 2017).

Remotely Sensed Data

Manually digitizing cropland using aerial photography is time consuming, which limits the practicality of obtaining yearly cropland estimates. An alternative method that could automate the cropland acreage estimate would allow more frequent estimates at lower costs.

During this Study, we attempted to estimate irrigated acres using the USDA National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL). The CDL is a remotely sensed data product collected during each growing season. The CDL estimates the crop type based on the reflective properties of each crop. The data is ground checked for reliability by the NRCS. The nationwide coverage categorizes agricultural land by crop type. CDL data were available for Wyoming annually for years 2008 through 2015 and it was used to estimate irrigated land areas.

As mentioned previously, the manually digitized acreage off the air photos is considered the most accurate method. To illustrate this issue, Figure 3.70 is presented. Irrigated areas and crop types from the 2015 CDL for an area near Pine Bluffs, Wyoming are shown. The background image is the NAIP image from August 10, 2015. The manually digitized irrigated crops are outlined in green and the irrigated land and type of crops identified by the CDL are shown in blue. There are significant variations between the two estimates of irrigated fields. In this example, the CDL data underestimates the irrigated acreage.

Another concern with using the CDL data is that it does not explicitly differentiate between irrigated and non-irrigated fields. Therefore, further estimates or determinations must be made concerning irrigated vs. non-irrigated fields. This is illustrated on Figure 3.70. For example, dry beans, sunflowers and corn are seen in the aerial photo in both irrigated and dry land fields.

To determine irrigated fields, it appears that you would have to manually review the CDL data to determine what fields are irrigated. This can be a difficult and can add errors. Considering these limitations, using the CDL data is considered to be less reliable than manual review and digitizing of air photos, particularly when the goal is to determine irrigation.

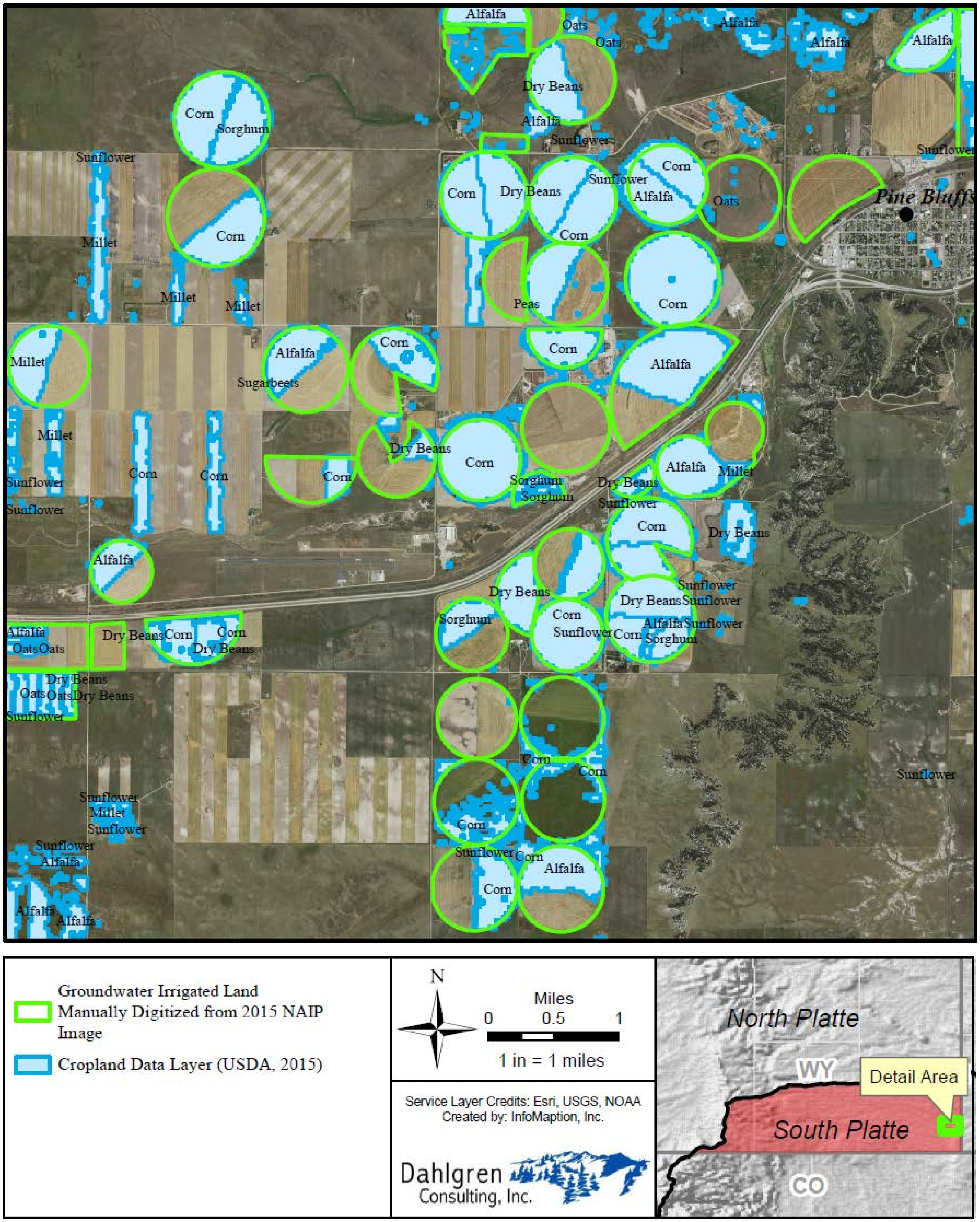

Figure 3.70. Compares Manual Digitized Data with CDL data

We did not look for alternative data to assist with the mapping and summarizing of irrigated acres. There may be other GIS, satellite, or other data that would be useful for tracking and updating the irrigated lands information.

Tables 3.38 and 3.39 show estimates of the number of acres for the different types of crops grown in the Watershed.

Table 3.38 Average Number of Irrigated Acres by Crop Type for the Period 1993-2000 (from Dahlgren 2001)

Crop	Estimated Acres	Percent of Total
Winter Wheat	4,032	8.9%
Spring Wheat	419	0.9%
Barley	362	0.8%
Oats	258	0.6%
Dry Beans	2,393	5.3%
Sugar Beets	1,411	3.1%
Corn	6,510	14.4%
Alfalfa	16,107	35.7%
Pasture Hay	13,629	30.2%

Table 3.39 Irrigated Crops in South Platte Watershed (Wenck 2016)

Crop	Estimated Acres	Percent of Total
Winter Wheat	3,610	8.0%
Spring Wheat	451	1.0%
Barley	2,254	5.0%
Oats	900	2.0%
Dry Beans	2,254	5.0%
Sugar Beets	900	2.0%
Corn	2,254	5.0%
Alfalfa	13,534	30.1%
Pasture Hay	15,973	35.5%
Irrigated Pasture	2,870	6.4%

The total amount of irrigated acreages and the types of crops grown have been used to estimate total irrigation use. The number of acres of each type of crop grown and the irrigation requirements for each crop is multiplied and summed to obtain an estimate of the total amount of irrigation.

The consumptive irrigation use in the SPRW was reported as 40,197 acre-feet (Wenck, 2016). Although crop water use estimates are available for each crop type the Wenck (2016) estimate used an average crop water use of 0.93 acre-feet/acre. This consumptive use estimate does not consider irrigation return flow that may decrease the net water use.

An average of 1 acre-foot per acre of irrigated land is an appropriate approximation for the irrigation use in Laramie County. This value is accepted by the Wyoming State Engineer's Office when allowing water to be transferred for irrigation water rights to other uses via temporary water use agreements. Once the irrigation well meter data has been collected and reviewed, as required by the State Engineer's Order concerning wells in the Laramie County Control Area, better estimates of the irrigation water use in the Watershed will be available.

During this Study, Dahlgren Consulting had the opportunity to review irrigation water use for one farm in the in the Carpenter area. This farm irrigates approximately 921 acres using 8 wells. Alfalfa, corn, winter wheat, and sunflowers were grown on this farm. For the period 2009 – 2016 (8 years), the average amount of water pumped corresponds to 1.02 feet per acre per year, i.e. approximately 939 acre-feet per year total. Table 3.40 presents the actual water use.

Table 3.40 Irrigation Water Use for One Farm

Year	Water pumped – Acre-feet per acre
2009	1.44
2010	0.76
2011	0.74
2012	1.15
2013	1.61
2014	1.04
2015	0.78
2016	0.62
	Average 1.02 acre-feet per acre

Also during this Study, Dahlgren Consulting contacted High West Energy, the Rural Electric Association serving most of Laramie County and obtained data concerning the amount electricity used (i.e. sold) for irrigation for the period 2008 through 2017 (10 years of data). This information is presented in Table 3.41 below.

Table 3.41 Irrigation Power use in Laramie County From High West Energy

Year	Electric Power Use (kWh)
2008	20,350,980
2009	15,202,860
2010	16,064,600
2011	15,589,110
2012	26,590,760
2013	18,640,450
2014	13,518,570
2015	12,586,900
2016	15,766,350
2017	16,328,310

3.10.2.2 Irrigation Summary

In this Study irrigated land areas were estimated using manually digitized aerial photographs. Using a combination of manual digitizing and correlating the land parcels with water right records, this study was able to differentiate the land irrigated by groundwater verses the land irrigated by surface water. Groundwater-irrigated land in 2015 was estimated to be 36,612 acres for the SPRW, which is 81-percent of the total irrigated land. The irrigated land estimate is expected to be similar in other years.

Measured groundwater pumping will soon be reported by the irrigators. This data will allow the accuracy of estimated pumping based on irrigated-land estimates and crop type to be directly determined. Combining measured pumping, crop type, and irrigation acreage will improve irrigation water use estimates. Groundwater pumping variations related to precipitation may aid in developing water-management strategies during wet periods and drought conditions.

The South Platte River Watershed, the Laramie County Control Area, and the area modelled in the AMEC Study (AMEC 2017) are not the same areas. Estimates of irrigated land have been independently made for each of these areas. This study did not attempt to determine the amount of irrigation in the three areas. Estimates of the total amount of irrigated land and the source of water, i.e. surface water or groundwater, were done for the Watershed during this Study. The GIS data files and other information created and used during this Study can be used to estimate irrigated lands for the other areas.

Currently, there are 422 irrigation wells in the Laramie County Control Area. Often an irrigation well has more than one permit primarily due to enlargements of the well, therefore, there are many more irrigation well permits than there are actual wells.

Figure 3.68 shows the wells within the Watershed. The various types of uses of the wells irrigation, domestic, stock, industrial and miscellaneous use) are delineated on this figure.

There is another agricultural water use, in addition to irrigation, that is sometime overlooked. That is water for livestock. Recent US Department of Agricultural data (NASS, 2016) shows that there are approximately 85,000 head of cattle in Laramie County. These cows must be provided with stock water, often which is supplied using stock wells. Assuming each cow uses 20 gallons per day, the annual demand for stock water for cattle is approximately 1900 acre-feet per year. Other livestock such has hogs or horses will use additional stock water, but data concerning the numbers of hogs and horses grown within the Watershed is not well documented.

Section 3.10.3 Municipal Water Use

3.10.3.1 City of Cheyenne Board of Public Utilities System

The Cheyenne Board of Public Utilities provides water to the City of Cheyenne, FE Warren Air Force Base, and the South Cheyenne Water and Sewer District. The raw water supply includes water obtained from the Crow Creek basin, a trans-basin diversion that brings water from the Laramie River and North Platte drainages into the Crow Creek drainage, and groundwater well fields. The trans-basin diversion system is known as the Stage I and Stage II pipelines.

City of Cheyenne Raw Water Supply Overview

The following exert from the “2013 Water and Wastewater Master Plan” prepared by HDR et. al. provides a general description of the City of Cheyenne, Board of Public Utilities’ (BOPU) raw water collection system:

> The raw water collection system for BOPU is extensive, involving several surface storage reservoirs, pipelines from multiple watersheds providing surface water, well fields supplying groundwater, and arrangements for water exchanges between watersheds. Surface water sources come from multiple watersheds. The local Crow Creek Basin provides for roughly 20% of the raw water supply. Crystal Lake Reservoir and Granite Springs Reservoir both collect native water from the Middle Crow Creek Basin, as well as storing non-native water brought through the Stage I and Stage II pipelines from Rob Roy Reservoir.
>
> Intake pipelines to the Sherard Water Treatment Plant (WTP) begin at the Crystal Lake Reservoir dam. Smaller reservoirs on the North Fork of Crow Creek (Old North Crow and Upper North Crow reservoirs) and South Fork of the Crow Creek (South Crow reservoir) collect water that can be transmitted to Round Top for use as irrigation water.
>
> Additional surface water is imported from the Douglas Creek watershed through the Stage I and II pipeline system. The system starts at Rob Roy Reservoir in the North Platte drainage basin. Stored water may be diverted into the Stage I/II pipelines that transfer water to Lake Owen and then onward to Granite Springs and Crystal Lake Reservoirs. A schematic diagram of the surface water collection system is shown as Figure 3.71.
>
> Prior to any diversion, impacts to downstream North Platte basin water right holders must be prevented. BOPU operates a diversion tunnel that transfers water from the Little Snake river watershed in the Yampa-White basin into the North Platte basin. This imported water is stored in Hog Park Reservoir. Hog Park Reservoir passes a minimum flow of 15 cfs downstream, with additional flows released based on natural runoff. If

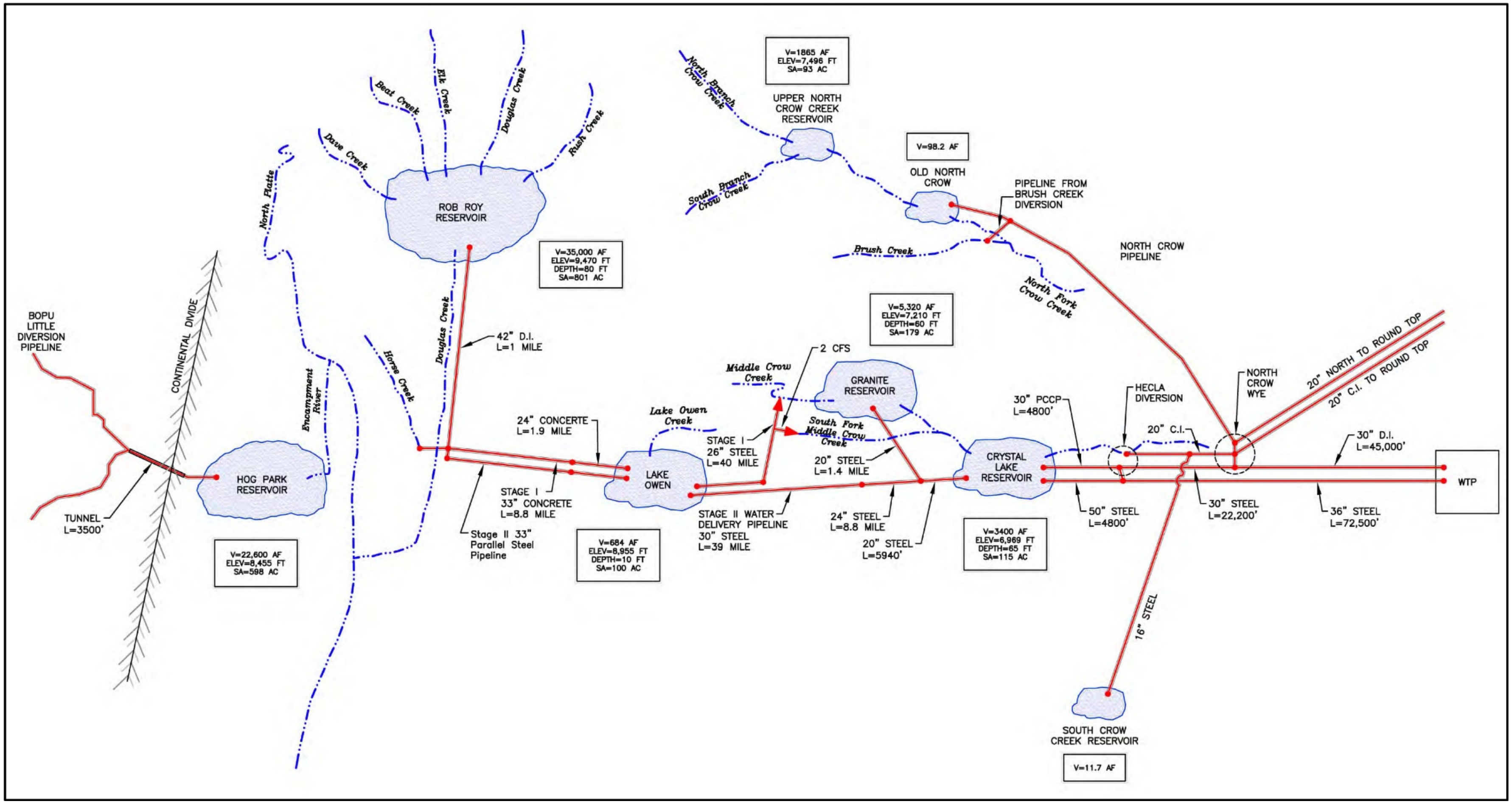

Figure 3.71 Existing Cheyenne BOPU Surface Water Supply System Schematic

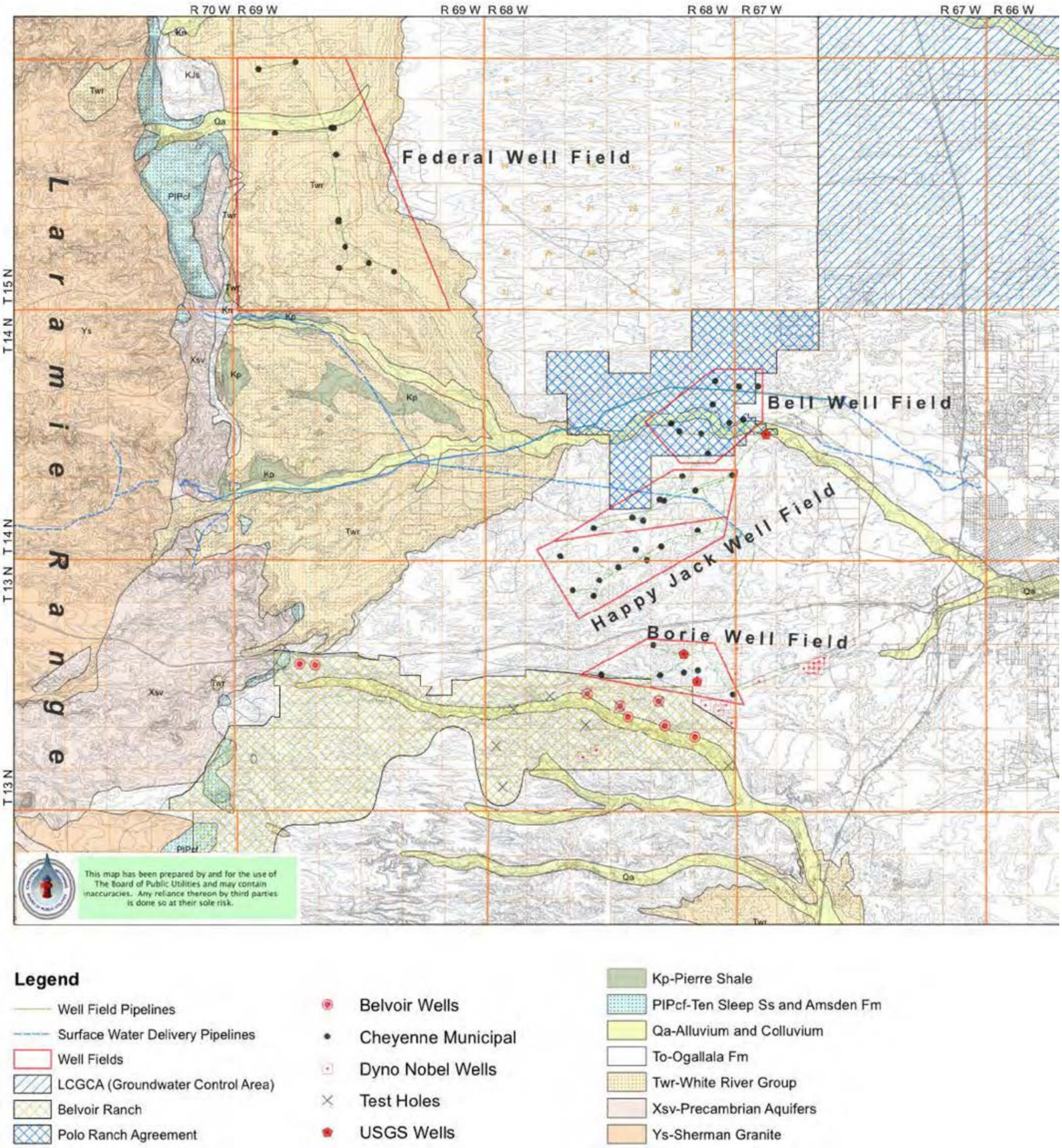

Figure 3.72: Cheyenne BOPU Wells and Well Fields

inadequate water is stored in Hog Park Reservoir or the U.S. Forest Service restricts the amount of water that can be released at a given time, it may not be possible to offset Stage I/II diversion impacts on North Platte water users using Hog Park Reservoir alone. BOPU has contracted 15,700 acre-feet of storage space in the U.S. Bureau of Reclamation-operated Seminoe Reservoir as a secondary supply for offsets.

In addition to the surface water supply, the BOPU operates well fields located in the South Platte drainage. The map shown as Figure 3.72 shows these well fields. Groundwater provides approximate 30% of the BOPU water supply. Figure 3.73 shows the water supply for the Cheyenne BOPU

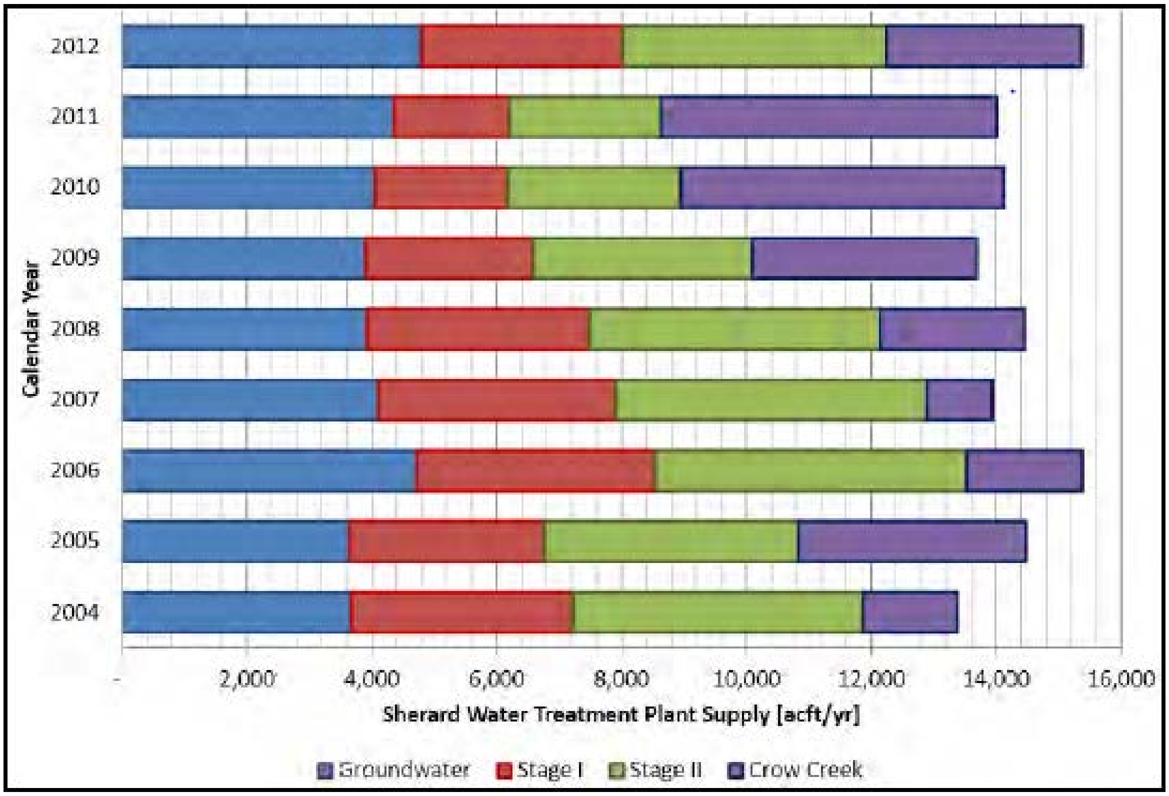

Figure 3.73 Cheyenne BOPU Water Supply

Table 3.42 Summary of BOPU Water Supply

Sherard Water Treatment Plant Supply (acft/yr)									
Year	Total AF	Groundwater		Stage I		Stage II		Crow Creek	
		AcFt /Yr	% of Total	AcFt /Yr	% of Total	AcFt /Yr	% of Total	AcFt /Yr	% of Total
2004	13,359	3692	27.6	3536	26.5	4632	34.7	1499	11.2
2005	14451	3625	25.1	3133	21.7	4050	28.0	3643	25.2
2006	15385	4722	30.7	3793	24.6	5001	32.6	1869	12.1
2007	13940	4106	29.5	3759	27.0	4979	35.7	1096	7.8
2008	14456	3932	27.2	3556	24.6	4626	32.0	2342	16.2
2009	13670	3916	28.6	2627	19.2	3513	25.7	3614	26.4
2010	14120	4052	28.7	2118	15.1	2768	19.7	5140	36.4
2011	14030	4377	31.2	1810	12.9	2455	17.5	5388	38.4
2012	15384	4831	31.3	3200	20.8	4231	27.5	3123	20.3
Ave	14,310	4140						3080	

Table 3.43 BOPU Projected Water Needs

Year	**Planning Period**	**Source Water Projected Total Demand (ac-ft/yr)**
2013	Existing	18,378
2023	Near-Term	21,056
2033	Mid-Term	24,753

The following table shows the water source, the average, maximum and minimum water supply for several of the BOPU Basins.

Table 3.44 Water Source and Supply for BOPU Basins

Location	Average (ac-ft/yr)	Maximum (ac-ft/year)	Minimum (ac-ft/year)
Little Snake River Basin			
Stage I/II Diversion to Hog Park Reservoir	18,862	23,250 (1984)	3,180 (1934)
Hog Park Reservoir Natural inflow (Hog Park Creek)	18,533	34,308 (2011)	7,110 (1977)
Douglas Creek Basin			
Rob Roy Reservoir Inflow	24,287	46,024 (2011)	1,420 (2002)
Horse Creek Flow	2,973	5,634 (2011)	840 (2002)
Other Douglas Creek Diversions	1,540	2,918 (2011)	440 (2002)
Lake Owen Inflows	393	843 (2012)	100 (2002)
Crow Creek Basin			
Granite Springs Reservoir Natural Inflow	3,830	9,510 (1965)	660 (1954)
Crystal Lake Reservoir Natural Inflow	498	1,300 (1965)	90 (1954)
Upper North Crow Reservoir Inflow	1,713	5,240 (1965)	240 (1974)
Brush Creek Flow	468	1,430 (1965)	70 (1974)
Upper North Crow Reservoir Inflow	269	820 (1965)	40 (1974)
South Crow Creek Reservoir Inflow	940	2,860 (1942)	320 (1954)

In addition to the Cheyenne water system, there are three other cities or towns within the Watershed, Pine Bluffs, Albin and Burns. Table 3.45 shows the information extracted from the 2016 WWDC Public Water System Survey Report and updated and verified during discussions with personnel from these Towns. The water source for these municipal water systems is groundwater.

Table 3.45: Water Use in 2016 for Small Towns in the Watershed

	Albin	**Burns**	**Pine Bluffs**
Number of Wells	4 active wells	4	5
System Capacity gallons per day	9,000	662,400	2,800,000
Population Served	180	593	1150
Water Use/Yr (gallons)	7,500,00 to 10,000,000	27,500,000 to 37,000,000	130,150,000
Annual Water Use (Ac-Ft)	23 - 31	85 – 114	400
Average Gallons per Day	24,000	88,500	356,500
Population Served – 2016 census estimate	200	300	1150
Ave Gal/Day/Capita	120	295	310

Pine Bluffs

Burns

Albin

3.10.3.2 Small Miscellaneous Water Systems

There are a total of 46 public water supply systems (PWS) in Laramie County (USEAP 2010). Of these Public Water Systems; one system, the Cheyenne Board of Public Utilities, is classified by the USEAP as a large system, because it serves more than 50,000 customers a day. Two systems, the South Cheyenne Water and Sewer District and the FE Warren AFB water system are classified as medium sized systems, because they serve between 3,000 and 10,000 people per day.

Although the FE Warren and South Cheyenne Systems are public water systems, because of the water distribution systems they operate, they obtain their source water through the Cheyenne BOPU. The water use for the FE Warren and South Cheyenne systems are included in the water demands of the BOPU. The BOPU water system is summarized separately. The water use in the three other municipalities in the Watershed, Albin, Burns and Pine Bluffs, also is summarized separately.

In this section of the report, the water use for the remaining small PWS is summarized. These uses are categorized as miscellaneous uses in the State Engineer's Office. This water use includes water systems such as Carpenter Water and Sewer District, truck stops, Curt Gowdy State Park, the Little America Resort, the Winchester Hills Utility, and several mobile home parks.

Table 3.46: Small Public Water Supply Systems

PWS number	Name	Population Served	Source	Average Daily Use (gpd)	Est. Annual Use AF
Various PWS Permits	Curt Gowdy State Park	20	Wells	1500	5
WY5601504	Love's Travel Center	1500	2 wells	9000	10
WY5601464	Carpenter Water District	100	2 wells	20,500	25
WY5601267	Terry Bison Ranch	250	3 wells	20,000	20
WY5601034	Sapp Brothers	200	2 wells	6500	8
WY5601008	Flying J	2100	3 wells	10,000	12
WY5600779	Winchester Hills Utility	1200	4 wells	120,000	135
WY5600485	Little America Resort	250	5 wells	12,500	20
	Other small Systems				Est. 50 AF per year total
			Total		285

3.10.3.4 Winchester Hills Utility Water System

The Winchester Hills Utility (PWS ID# WY5600779) is located in southern Laramie County near the intersection of Terry Ranch Road and US Highway 85. Water is supplied for the Winchester Hills Utility Public Water System by three wells. For the most recent 5 year period (2011 – 2015), the average existing daily use of the Utility is approximately 133 acre-feet per year, or 118,600 gallons per day. The average use for each household within the Winchester Hills Utility service area is approximately 305 gallons per day (GPD) per lot or 0.34 acre-feet per lot per year.

3.10.3.5 Industrial Water Use

The Dyno-Nobel plant uses approximately 500,000,000 gallons of water per year (approximately 1,535 ac-ft/yr). This water is obtained from 11 production wells. Dyno-Nobel also owns approximately 3,400 acres and has surface water rights associated with this property.

3.10.3.6 Domestic Wells

The AMEC report listed 7,155 domestic wells in the modelled area. This data was from 2010. Currently the State Engineer's Office e-permit database lists approximately 7,900 "active" domestic wells located in the Watershed in Laramie County. There are approximately 140 domestic wells in Albany County in the Watershed. Therefore, there is a total of approximately 8,040 domestic wells.

There have been various estimates concerning the amount of water pumped from a domestic well in Wyoming. The Wyoming State Engineer's Office estimates approximately 1 acre-feet per year (325,851 gallons). The AMEC report estimates the consumptive use of a rural domestic well at approximately 0.17 of an acre-foot. The States West report estimated approximately 0.40 of an acre-foot of use for each domestic well. Data from the Winchester Hills Utility shows that each lot at the subdivision uses approximately 0.35 acre-feet per year.

US Census Data (2010 data) estimates that there are approximately 31,000 rural residents in Laramie County. Using the Wyoming DEQ criteria of 125 gallons per day per person, results in a water use estimate of approximately 0.14 acre-feet per year per person. Multiplying the value of 0.14 acre-feet per year per person by 31,000 rural residents in Laramie County, results in an estimate of 4,340 acre-feet of domestic use per year for the rural residents.

The WWDC Platte Basin Water Atlas estimates that there are approximately 5,030,000 gallons of water per day used by rural domestic users in the South Platte Watershed. This corresponds to 5,600 acre-feet per year.

Section 3.11 Water Availability and Water-Use Analysis for the Albin, Wyoming Area, Lower Lodgepole Watershed

This section of the Study presents the results of a water budget and groundwater availability estimates for Lower Lodgepole Sub-basin (Lower Lodgepole). This subwatershed includes the Albin, Wyoming area in the northeastern part of the South Platte River Watershed (refer to Figure 3.74).

Lower Lodgepole was selected for this investigation because the physical processes are relatively simple compared to other parts of the watershed. There are no perennial surface-water inflows or outflows. There is limited riparian vegetation to consume groundwater in this subwatershed. Groundwater pumping is predominately (96 percent) for agricultural uses and is from the Ogallala and White River Aquifers. Additionally, there are three monitoring wells with long-term data that document groundwater changes under a variety of conditions.

Lower Lodgepole has an area of about 99,200 acres and drains east into Nebraska where it merges with the Upper Lodgepole Sub-basin. Agriculture, municipal water supply, domestic users, and stock users rely on groundwater throughout the South Platte River Watershed. Agriculture is the major groundwater user within Lower Lodgepole.

This investigation considered the relationships between precipitation, groundwater levels, recharge, geology, groundwater flow, and groundwater pumping in Lower Lodgepole. Understanding the interactions between these processes that control groundwater availability are important for developing effective water-resource management practices that support the sustainability of the agricultural industry.

3.11.1 Water Budget

The approach to the water budget presented in this section of the report needs to be viewed in the context of a Level I study. The Study team believes that the approach presented in this report can be used as a template for other area in the Watershed and can be modified to estimate groundwater availability in other sub-watersheds in the SPRW. The water budget presented in this Study is not the final product. Additional information and refinement is necessary; including basic data about the actual amount of groundwater that is being pumped.

The approach to determining a water budget and preliminary results are presented in this section of the Study.

A water budget quantifies the inflow and outflow components of the hydrologic system. The magnitude of these components assists in identifying areas that are most important for groundwater availability, planning, and water-resource management. The water budget components for a generalized small watershed can be expresses as:

Equation 1

$$P + Q_{in} = ET + \Delta S + Q_{out}$$

where P is precipitation, Q_{in} is water flow into the watershed, ET is evapotranspiration, ΔS is the change in water storage, and Q_{out} is water flow out of the watershed (Healy and others, 2007). Water-budget equations can be written in terms of volumes (for a fixed time interval), fluxes (volume per time, such as cubic meters per day or acre-feet per year), or flux densities (volume per unit area of land surface per time, such as millimeters per day).

Equation 1 can be refined and customized depending on the goals and scales of the study (Healy and others, 2007). Precipitation can be written as the sum of rain, snow, and irrigation. Water flow into or out of the site could be surface or subsurface flow resulting from both natural and human-related causes. Groundwater can flow across topographic divides and watershed boundaries and result in subsurface inflows and outflows. Groundwater pumping is an example of an outflow.

Evapotranspiration could be differentiated into evaporation and plant transpiration. Further refinement could be based on the source of the water that is evapo-transpired. Evaporation can occur from open water, bare soil, or snowpack (sublimation). Plant transpiration can remove groundwater from shallow water tables and it can remove infiltrating water from the unsaturated zone.

Groundwater recharge, or simply recharge, is water that infiltrates and reaches the water table. In this study recharge is the difference between precipitation falling on the land surface and the amount of water consumed by evapotranspiration in the near surface and unsaturated zone (ET^{uz}) as represented by Equation 2.

Equation 2

$$R = P - ET^{\mathrm{uz}}$$

This relationship assumes that there is no surface runoff and that precipitation infiltrates and reaches the water table or is removed by ET. However, large magnitude and intensity precipitation events would result in temporary runoff. It is assumed that these events occur infrequently and that the majority of runoff would ultimately be lost to ET.

Precipitation infiltrates into the subsurface when the soil water content exceeds the specific yield or field capacity, which is the amount of water held in the soil after it is allowed to freely drain. This means that in low precipitation years when the soils are dry it takes more precipitation to wet the soil before infiltration past the root zone will occur. Conversely, in wet years when the soil is consistently at or near the field capacity, it requires less precipitation to result in infiltration and recharge.

It is assumed that water infiltrating water past the root zone and evaporation depth will reach the water table and become recharge. In aquifers with the water table at shallow depths this is a reasonable assumption. However in the Lower Lodgepole area (the Albin area), the depth-to-water can be 150 to 200 feet, which creates the potential for water to be lost due to other processes.

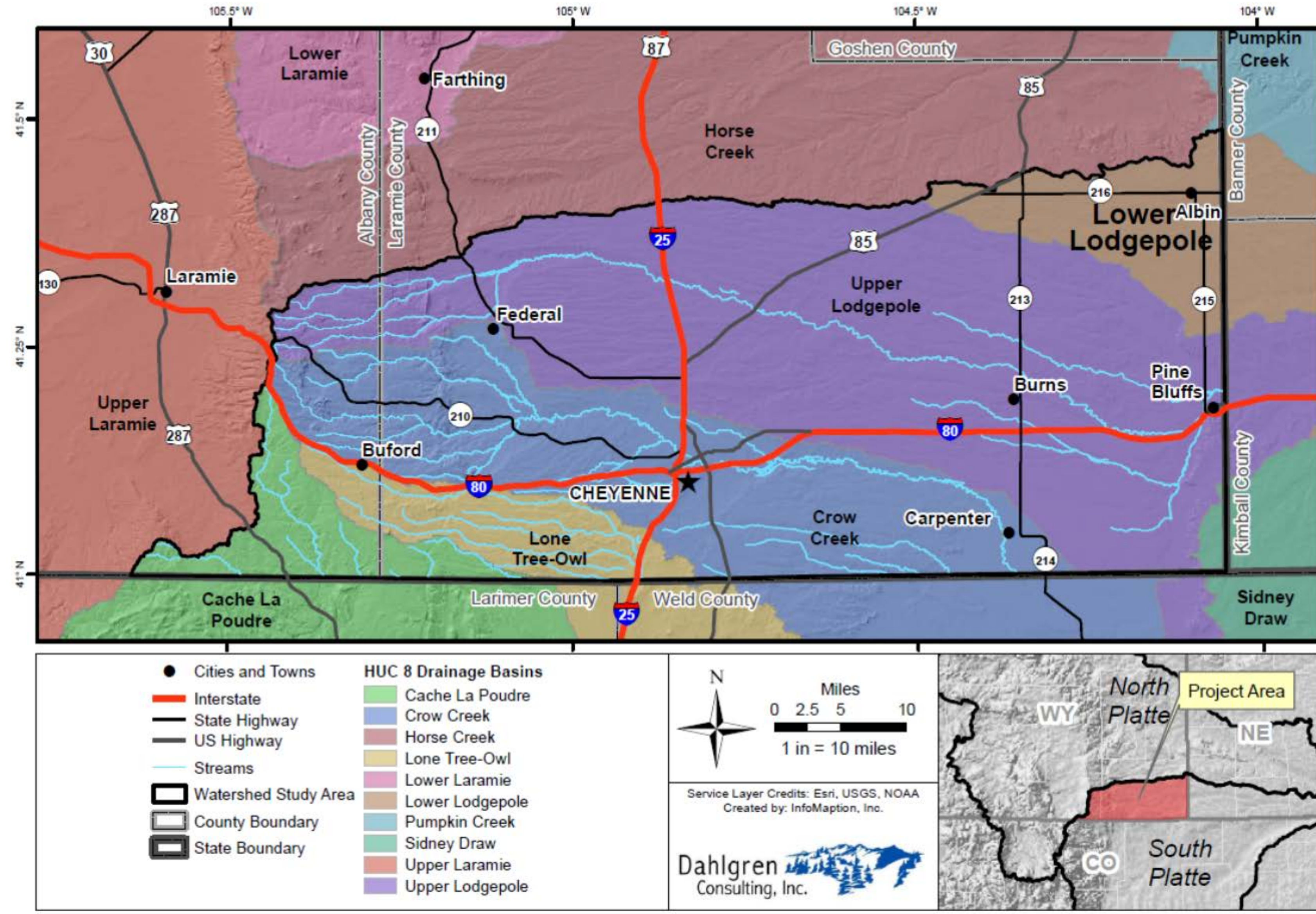

Figure 3.74 Location of Lower Lodgepole Subwatershed within the Study Area

For this study, it was assumed that over long-time periods infiltration (and recharge) is consistently occurring even if the infiltration rate varies due to changing precipitation and ET conditions in the near surface.

Also, it was assumed that irrigation return flows (irrigation water that is not consumed by the crops or evaporation) do not significantly change the recharge values. This assumption is a simplification but is reasonable in this initial estimate for a water budget in the Albin area, because of two factors: 1) the depth to water and 2) sprinkler irrigation is the typical irrigation method in the area. These factors likely minimize the impacts of irrigation return flow on recharge. Further studies can evaluate this issue, which may be of more significance in the Carpenter area where the groundwater levels are higher and closer to the surface.

Water storage occurs within the atmosphere, surface waters, and subsurface waters (Healy and others, 2007). The amount of water stored in the atmosphere is small compared to that on land surface and in the subsurface. Surface water is stored in rivers, ponds, wetlands, reservoirs, icepacks, and snowpacks. Subsurface storage can be categorized into various sub-units, such as the root zone, the unsaturated zone as a whole, the saturated zone, or different geologic units. The change in storage is flow in minus flow out.

Refinement of components must be balanced with available measurement techniques, which often are not designed, or lack sufficient resolution, to distinguish among sub-components. A viable water-budget requires estimates for each of the relevant components, which are preferably obtained from measurements and data analysis in the specific watershed being studied.

The water balance equation can be customized for Lower Lodgepole by omitting irrelevant and small magnitude components. For example, there are no perennial surface water bodies or flows into or out of the subwatershed and, therefore, no change in surface-water storage.

AMEC (2014) estimates that during steady state conditions approximately 9,100 acre-feet per year of groundwater flows from the modeled area in Laramie County, Wyoming into Nebraska. The area modeled by AMEC extends from the Lower Lodgepole Basin on the north to the Colorado-Wyoming-Nebraska boundary at the south. Assuming that the groundwater flow is constant and proportional along the entire length of the Wyoming – Nebraska stateline in Laramie County, than the groundwater flow from the Lower Lodgepole or Albin area basin would be approximately 3,940 AF per year from Wyoming into Nebraska. The groundwater flow from Wyoming into Nebraska is offset, at least partially, by the groundwater flow from areas to the west.

It was assumed that plant transpiration from the groundwater table does not occur due to the large depth-to-water and it can be ignored. Evaporation and transpiration in the near surface does reduce the amount of precipitation that infiltrates and becomes recharge (Equation 2).

Customizing the water balance to conditions in Lower Lodgepole allows estimates of recharge and groundwater availability. The water balance (Equation 1) was modified by making substitutions (Equation 2), removing the small magnitude components, and solving for recharge.

Equation 3

$$R = \Delta S^{gw} + \Delta Q^{gw}$$

where R is recharge, ΔS^{gw} is change in groundwater storage, and ΔQ^{gw} is groundwater removed by pumping and subsurface flow out of the subwatershed (Healy and others, 2007). The change in groundwater storage (ΔS^{gw}) can be estimated by groundwater-level changes in wells with a long period of observation.

Equation 3 allows recharge estimates based on the available data. Independent measurement of other water balance components were not available and this approach meets the objectives by providing reasonable recharge estimates and insights into groundwater availability.

3.11.2 Groundwater Availability

Estimating, measuring, or simulating each component of a water budget model for the entire SWRW or the Lower Lodgepole subwatershed would require a significant effort and was beyond the scope of this investigation. This analysis relied solely on available data and there was no new field data collection. This investigation is intended to provide insights into groundwater availability, its changes under various precipitation conditions, and to develop a methodology for other watersheds.

As groundwater-levels decline the groundwater available to wells declines and pumping rates may decline. Agricultural practices (e.g. crops, irrigation practices, etc) may change and adapt to changing groundwater availability, precipitation, and temperature conditions. Water-management and irrigation practices, however, were not considered in this investigation. It was assumed that pumping remains constant regardless of the annual precipitation.

3.11.2.1 Precipitation

Historical precipitation for Lower Lodgepole is available from the town of Albin COOP precipitation station (#480080), which was operational from August 1, 1948 through July 18, 2009. The average annual precipitation at the Albin station for the period of record was 17.7 inches, The PRISM Climate Group from Oregon State University calculates average annual or time series precipitation data for the United States. The PRISM (2017) precipitation data for the Lower Lodgepole drainage for 1985 through 2014 are shown on the Figure 3.75. The PRISM data were used because the period of record matches the time-period for available groundwater levels and the storage-estimate analysis.

3.11.2.2 Groundwater Storage Estimate

Changes in groundwater storage were estimated in Lower Lodgepole using water-table fluctuations as described by Healy and Cook (2002). This water-table fluctuation method assumes that groundwater-level increases in unconfined aquifers are due to recharge water arriving at the water table (Healy and Cook, 2002).

The U.S. Geological Survey has used this approach to estimate recharge to the Ogallala aquifer south of Cheyenne by measuring groundwater-level fluctuations in wells (Bartos and others, 2013). The change in volume of groundwater storage (ΔS^{gw} in Equation 3) is calculated as:

Equation 4

$$\Delta S^{gw} = S_y \frac{dh}{dt} * A$$

where S_y is specific yield, *dh* is change in height of the water table, *dt* is change in time, and A is the surface area that represents the change in groundwater level. It was assumed that specific yield is known and consistent over the study area.

Three monitoring wells; USGS South of Albin, Well number 17-60-33cbb, USGS Southwest of Albin, Well number 16-60-7bbb2, and Laramie County No. 5, Well number 16-61-17aaa have monitored groundwater levels in the saturated part of the unconfined Ogallala in Lower Lodgepole since the 1970’s.

Groundwater pumping and water-level changes are not uniform over Lower Lodgepole. Consequently, groundwater storage changes are also not uniform. Since the groundwater-level changes used to estimate the storage change were measured in saturated Ogallala aquifer monitoring wells the corresponding area was used in storage-change calculation. This saturated Ogallala area is approximately 30,750 acres (Figure 3.76). A specific yield (Sy) of 20 percent was assumed for the Ogallala deposits, and this estimate is consistent with the Bartos and others (2013) study.

Four periods were evaluated to estimate groundwater storage changes for the purpose of developing an approach to estimate storage availability for resources and crop management. These periods represent groundwater-level trends measured in monitoring wells. Groundwater-level fluctuations and trends for the three Lower Lodgepole wells are illustrated in Figures 3.77 through 3.79. The average annual conditions (“average annual”) are represented by the entire period of record, 1985 through 2015. Stable groundwater-level conditions (“stable period”) occurred from 1990 through 1993. Declining groundwater levels (“dry period”) occurred from 1999 through 2002. A period of rising groundwater levels (“wet period”) occurred from 2009 through 2011.

The average precipitation for these analysis trend periods, groundwater-level changes (Figures 3.77 to 3.79), and the estimated change in storage calculated using Equation 4 for each analysis period are provided in Table 3.47.

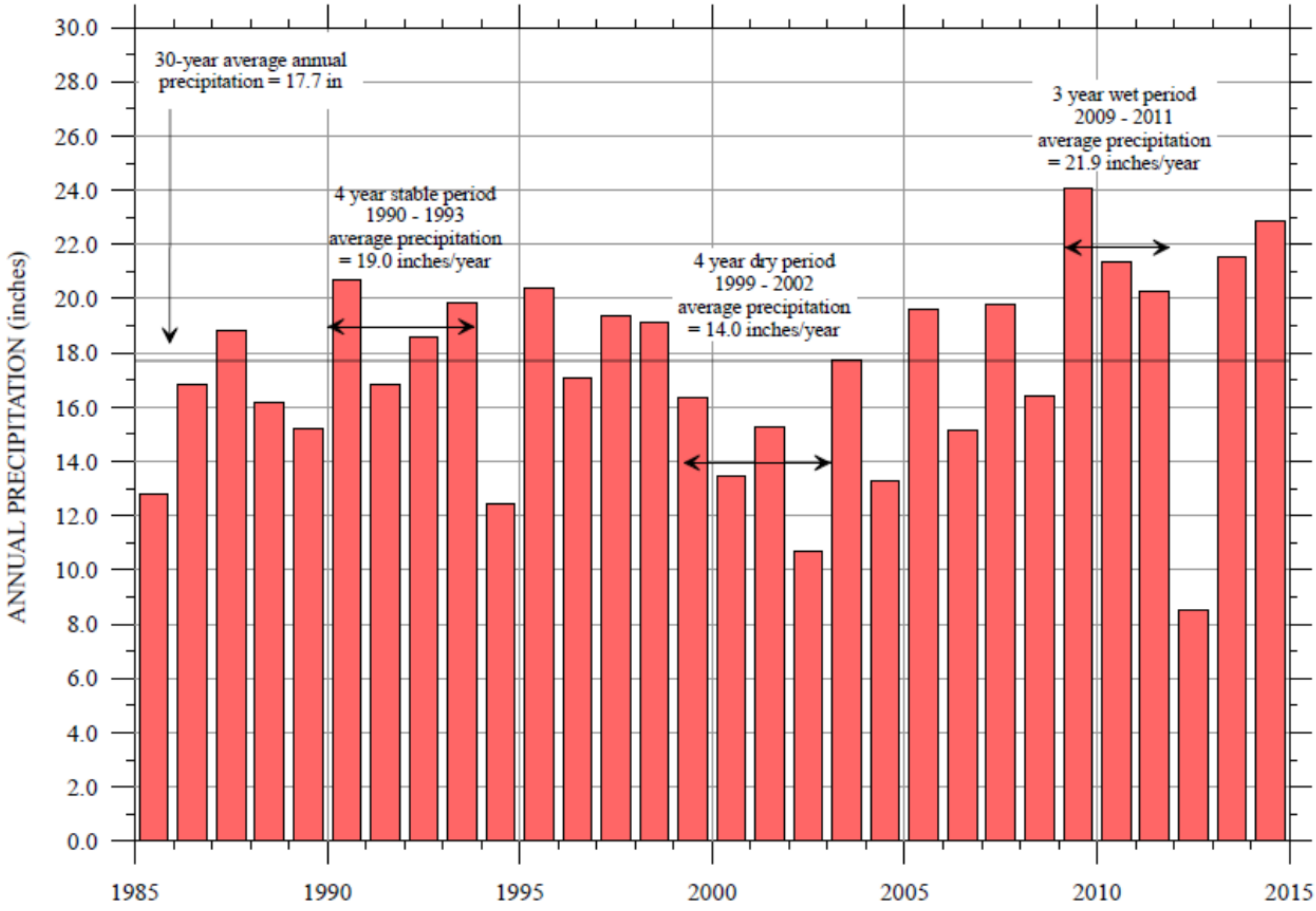

Figure 3.75. Annual precipitation for Lower Lodgepole Subwatershed (PRISM, 2017)

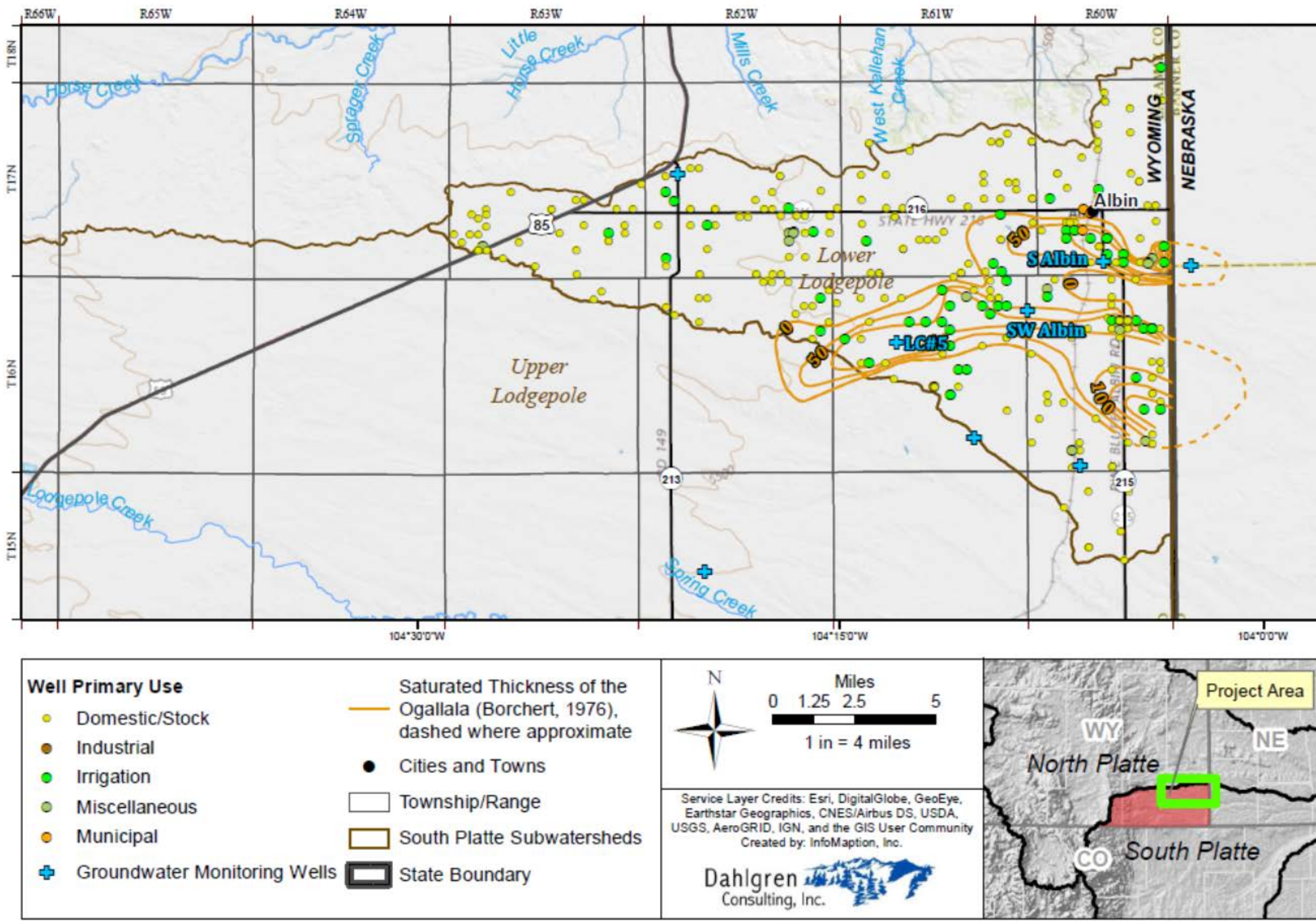

Figure 3.76. Well Locations and saturated extent of the Ogallala Formation in Lower Lodgepole Subwatershed

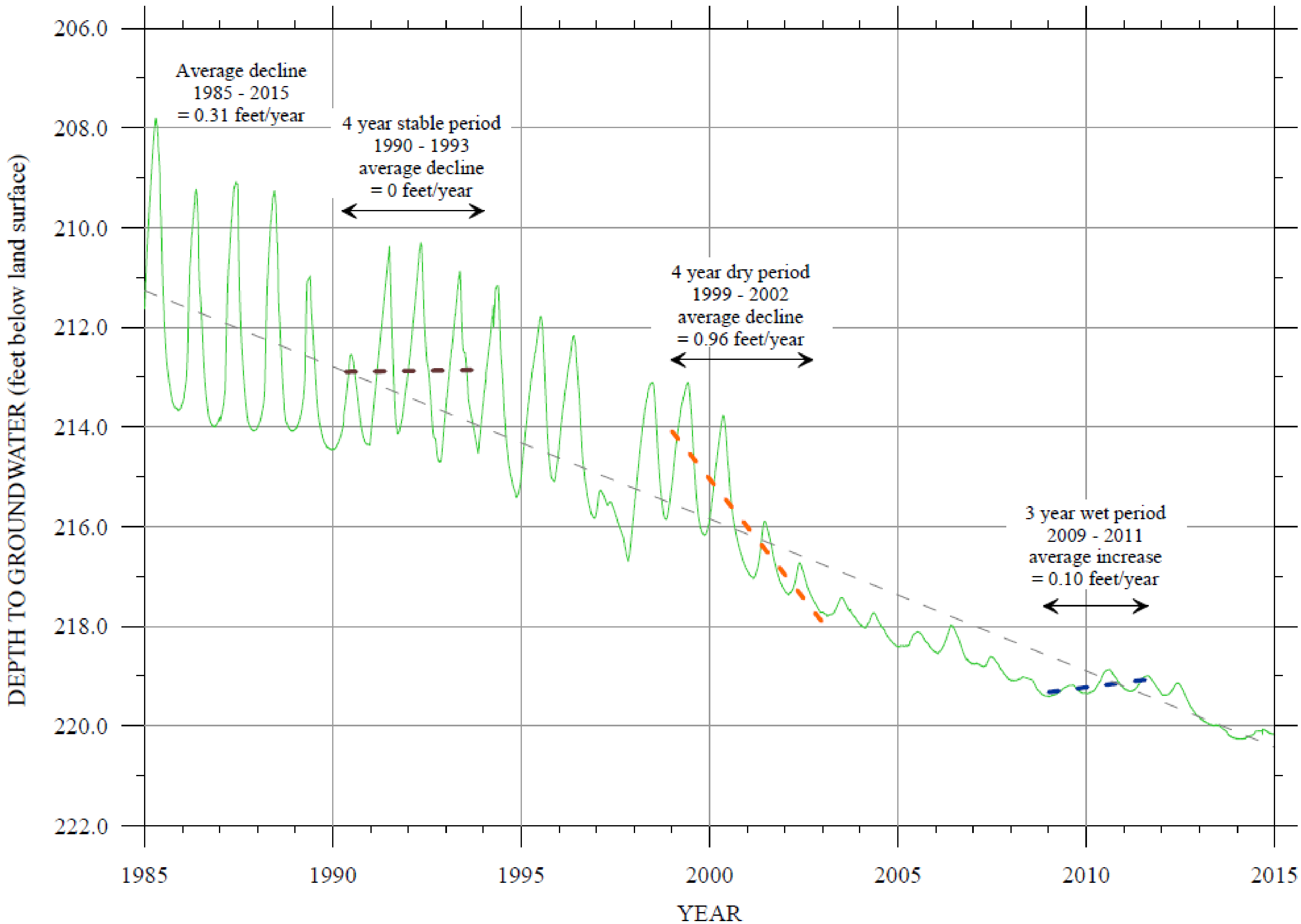

Figure 3-77. Depth to groundwater in well "S Albin" from 2005 to 2017

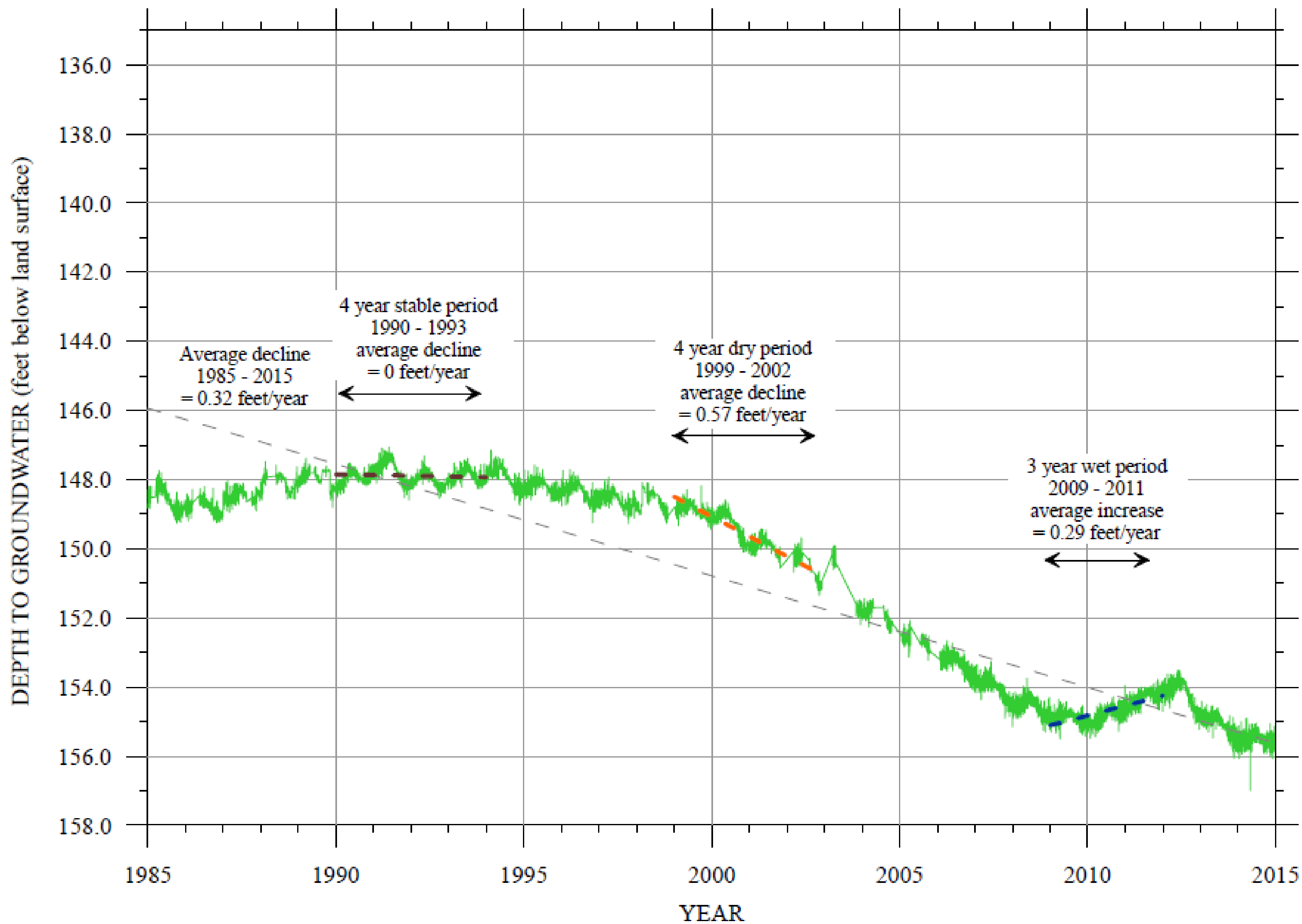

Figure 3.78 Depth to groundwater in well "SW Albin" from 2005 to 2017

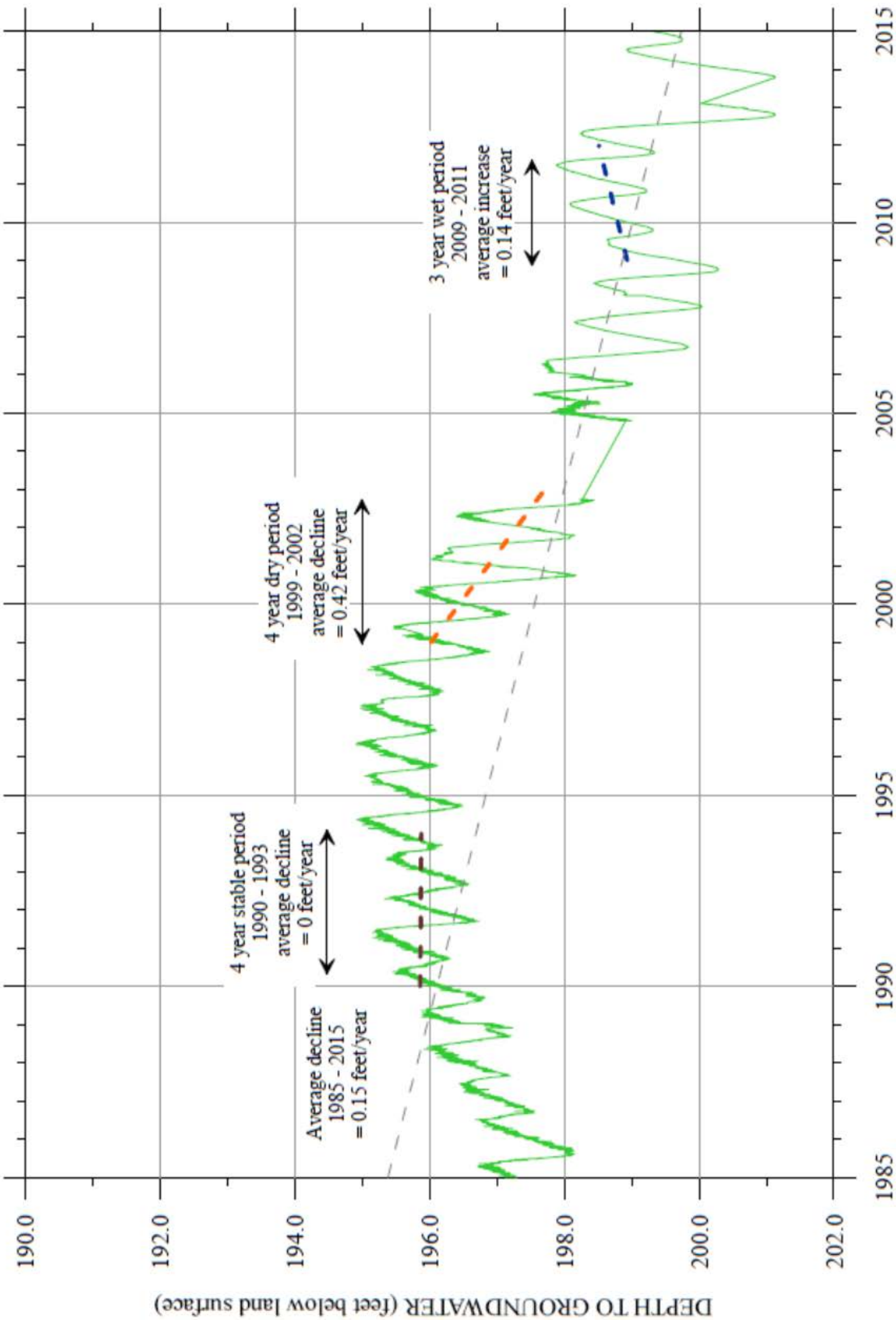

Figure 3.79. Depth to groundwater in well "LC#5" from 2005 to 2017

Table 3.47. Analysis Periods, Precipitation, Groundwater-level Fluctuations, and Estimated Changes in Groundwater Storage

Period	Condition	Annual Precipitation Rate (inch/year)	Total Groundwater Level Change (feet)	Groundwater Level Change Rate (*dh/dt*) (feet/year)	Change in storage (acre feet/year)
1985 - 2015	Average Annual	17.7	-7.7	-0.26	-1,586
1990 - 1993	Stable Period	19	-0.02	0	-27
1999 - 2002	Dry Period	14	-2.6	-0.65	-4,013
2009 - 2011	Wet Period	21.9	+0.52	+0.17	1,071

3.11.2.3 Groundwater Pumping Estimate

Groundwater withdrawal from Lower Lodgepole comes from pumping groundwater wells. Lower Lodgepole contains 323 permitted wells, including 56 irrigation wells, 4 municipal supply wells, 1 industrial use, 16 miscellaneous use, and 246 domestic and stock wells (WSEO, 2016, Figure 3.76).

Since metered groundwater pumping data was not available at the time of the South Platte Study estimates of pumping rates needed to be made. The following subsections provide pumping estimates based on groundwater irrigated acres and average crop water use. Total groundwater withdrawal from all wells in Lower Lodgepole is about 9,870 acre-feet/year (Table 3-48).

Table 3.48. Groundwater Pumping Estimates in the Lower Lodgepole area by Water Use in 2016

Primary Well Use	Number of wells	Total Pumping Rate (acre-feet/year)
Irrigation	56	9,495
Municipal	4	31
Industrial	1	65
Miscellaneous	16	32
Domestic / Stock	246	246
	Total	9,869

Irrigation Pumping Estimate

Prior to 2017, irrigation wells in Wyoming were not required to be metered for usage. As part of this investigation, groundwater pumping for irrigation was estimated by determining the amount of irrigated land and assuming a rate of water use per acre. Lower Lodgepole contains about 9,495 acres of land irrigated by groundwater. An average irrigation use of 1.0 feet per year per acre of irrigated land was assumed.

Municipal, Industrial, Miscellaneous, and Domestic/Stock Pumping Estimate

In 2016, the Town of Albin pumped approximately 10 million gallons, or 31 acre-feet of groundwater from its four municipal wells (WWDC, 2016). One industrial well, owned by Union Texas Petroleum, is permitted for a maximum of 40 gallons per minute, or 65 acre-feet/year (WSEO, 2016). Miscellaneous wells are permitted to pump a maximum of 2 acre-feet/year (AMEC, 2014), for a total of 32 acre-feet/year from the 16 miscellaneous wells. Stock and domestic wells were assumed to use 1 acre-feet/year per well (AMEC, 2014), for a total of 246 acre-feet/year from the 246 domestic and stock wells in the subwatershed.

3.11.3 Recharge Estimates

The primary mechanism for water entering the groundwater system in Lower Lodgepole is by recharge from precipitation. Recharge can be quantified as a percentage of precipitation or specified directly in terms of volumes (for a fixed time interval), fluxes (volume per time, such as acre-feet per year), or flux densities (volume per unit area of land surface per time, such as inches per year).

Recharge in the saturated part of the Ogallala aquifer in Lower Lodgepole was estimated by calculating the difference between the change in groundwater storage (ΔS^{gw})) and groundwater pumping (ΔQ^{gw}) as shown in Equation 3, Recharge estimates were obtained for the four-analysis periods identified by groundwater-level trends; 1985 through 2015, 1990 through 1993, 1999 through 2002, and 2009 through 2011 (Table 3-49). These time periods correspond to average annual conditions from 1985 to 2015, stable water levels, below average precipitation (dry conditions), and above average precipitation (wet conditions).

Groundwater pumping was assumed to be constant from 1985 through 2015 and for each of the four analysis periods. The change in groundwater storage, based on groundwater-level changes in three monitoring wells, varied for each of the analysis periods.

The recharge rate (inches/year) calculated for the saturated Ogallala aquifer area was extrapolated to the entire Lower Lodgepole subwatershed area, which is 99,205 acres. The average annual recharge estimate was 8,267 acre-feet/year or 1.0 inches/year (Table 3-49) and this represents a long-term recharge estimate. Recharge estimated during the dry period was 5,857 acre-feet/year. The wet period recharge estimate was 10,940 acre-feet/year and the stable period recharge was 9,842 acre-feet/year. Estimated recharge for each analysis period ranged from 0.71 to 1.32 inches/year.

In addition to the total recharge changing under varying precipitation rates, this suggest that the recharge rate increases with increasing precipitation. In low precipitation years the soil has less moisture and it requires more precipitation to wet the soil before infiltration past the root zone will occur. Conversely, in wet years the soil has higher moisture content and it requires less precipitation to result in infiltration and recharge. During the dry period the recharge rate was

5.1-percent of precipitation and during the wet period it increased to 6.0-percent (Figure 3.80, Table 3-49). These small percentage changes result in large recharge changes when applied over large areas such as sub-watersheds and entire watersheds.

The measured groundwater-level changes indicate that above average precipitation is needed to prevent further groundwater availability declines. Groundwater levels have been declining when annual precipitation is less than approximately 19 inches/year (Figure 3.81, Table 3-49). Rising water levels may occur when annual precipitation is greater than approximately 19 inches/year. From 1985 to 2015 precipitation has exceeded 19 inches/year in 12 of the 30 years (40-percent). However, rising groundwater levels have occurred for one 3-year period. This indicates that individual years of wet conditions are not sufficient to reverse declining water-level trends. Several consecutive years of wet conditions are needed to produce a sufficient surplus of water to replenish aquifer storage assuming pumping rates remain constant.

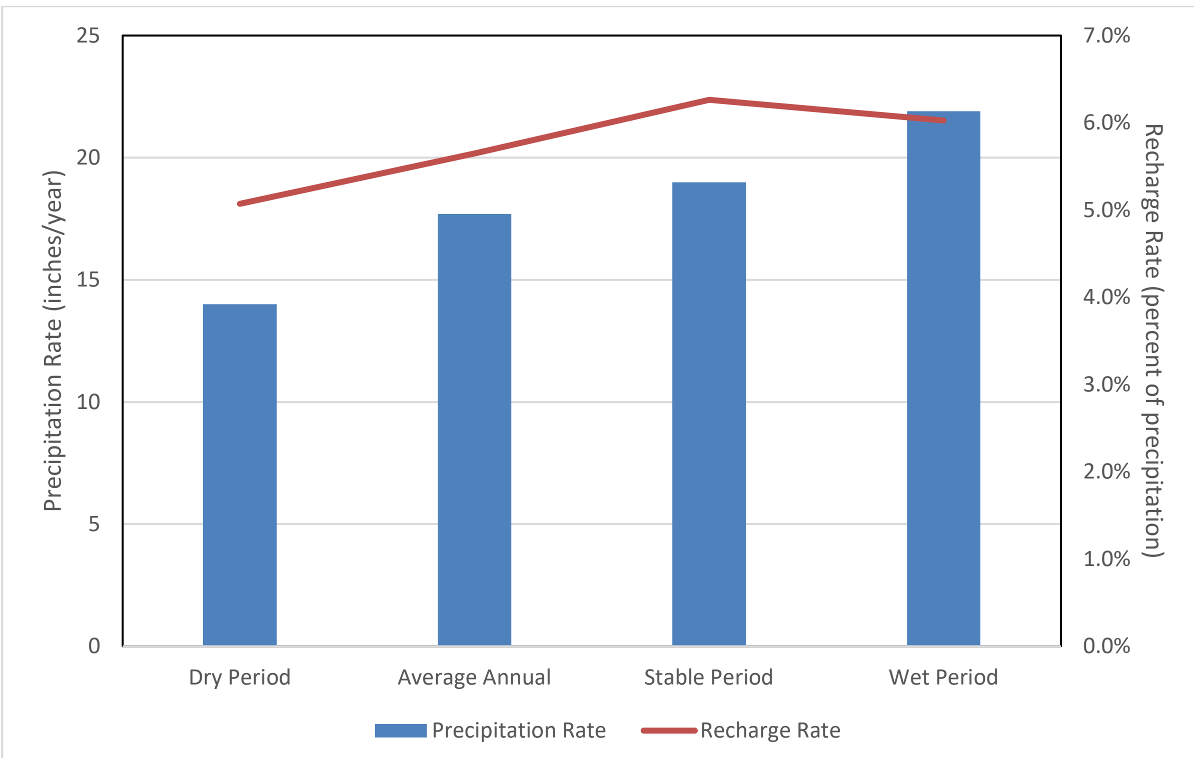

Figure 3.80. Recharge rate changes under changing precipitation conditions

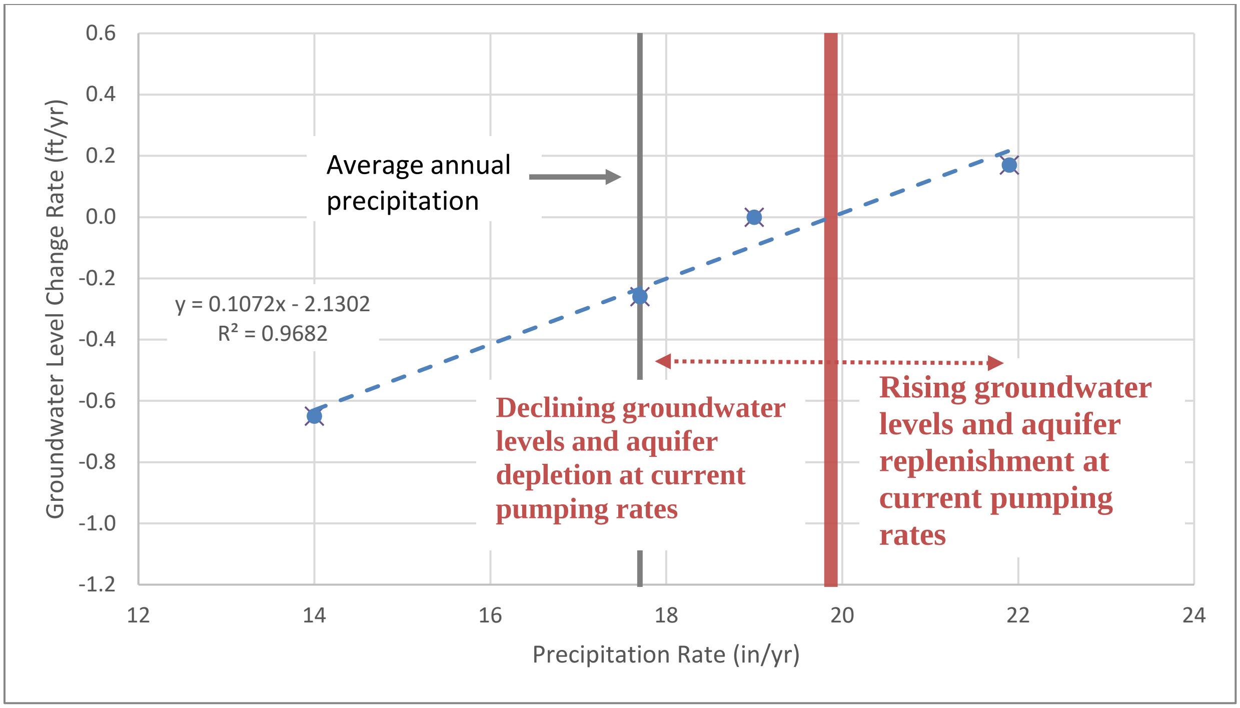

Figure 3.81. Rate of groundwater-level change over a precipitation range

Previous investigations have estimated recharge rates in the South Platte River Watershed and nearby areas. Recharge estimates have ranged from 0.06 to 2.0 inches/year. (Table 3.50, AMEC, 2014). The average recharge rate for these nearby areas was 0.63 inches/year or 4-percent of average annual precipitation. When these rates are applied to the Lower Lodgepole area (99,205 acres) the recharge estimates range from 496 to 16,500 acre-feet/year with an average of 5,208 acre-feet/year (Table 3.50). For comparison, the average annual recharge rate from this investigation was 1.0 inches/year (8,267 acre-feet/year), which is 58-percent higher than the average for the other studies.

The recharge estimates summarized in Table 3.50 were based on a variety of methods, hydrogeologic conditions, assumptions and approximations. Differences in recharge estimates are, therefore, to be expected. The recharge estimates for this investigation are higher than most of the estimates in Table 3.50. This investigation estimated recharge for the saturated part of the Ogallala aquifer in Lower Lodgepole. The recharge rate was then applied to the entire Lower Lodgepole area to obtain a total recharge volume. If the average recharge rate is lower for the entire subwatershed than in the saturated Ogallala area, then the recharge would be overestimated. However, the assumption that the recharge rate is similar over the entire Lower Lodgepole subwatershed is reasonable and the recharge estimate is useful for this groundwater availability evaluation.

Table 3-49. Recharge rates and estimated pumping reductions to prevent further aquifer depletion

Analysis Period	Conditions	Annual Precipitation Rate (inches/year)	Groundwater Withdrawal Rate (acre-feet/year)	Recharge Rate			Reduction in pumping required for stable groundwater levels	
				Acre-feet/year	Inches/year	Percent of precipitation	Percent	Acre-feet/year
1985 - 2015	Average Annual	17.7	9,869	8,283	1.0	5.6	16	1,586
1990 - 1993	Stable Period	19	9,869	9,842	1.19	6.3	0	0
1999 - 2002	Dry Period	14	9,869	5,857	0.71	5.1	41	4,012
2009 - 2011	Wet Period	21.9	9,869	10,940	1.32	6.0	--	--

Table 3.50. Previous estimates of recharge (Modified from AMEC, 2014, Table 4.3)

Recharge Rate (inches/year)	Percent of Annual Precipitation	Recharge Volume* (acre feet/year)	Recharge Estimate Method	Source
0.06	N/A	496	Silt loam soil type infiltration rate	Luckey (1986). RASA model of the northern High Plains Aquifer, recharge rate for Laramie Co.
0.17	2%	1,405	Computer-model analysis	Borchert (1977). Arikaree Formation, Central WY
0.25-0.5	5%	2,067 to 4,134	Soil water balance model	Dugan (2000). Great Plains regional contour maps, recharge rate for Laramie Co.
0.46	3%	3,803	Groundwater flow model calibration	AMEC (2014). Groundwater Flow Model for Laramie County Control Area
0.53	N/A	4,382	Base Flow Index	USGS (Wolock) (2003) estimated mean annual natural groundwater discharge for U.S. This is the recharge rate for the Laramie Co. area.
0.56	3.60%	4,630	Water budget	Crist (1977) High Plains Aquifer, Niobrara Co., WY
0.24-0.6	N/A	1,984 to 4,960	Vertical gradients in groundwater age	McMahon (2007). Long term average for High Plains Aquifer, study site in Lincoln and McPherson Counties, NE
0.75	5%	6,200	Direct infiltration (5% precip.) + 5,000 ac-ft from streamflow infiltration	Lowry and Crist (1967). Laramie Co., WY
0.83	5.50	6,862	Water budget	Rapp (1953). Egbert-Pine Bluffs-Carpenter area, WY
0.6-1.0	N/A	4,960 to 8,267	Soil Water Balance Model	USGS (2011). High Plains Aquifer Water Budget Components report, recharge rate for Laramie Co.
2.0	N/A	16,500	Soil type infiltration rates	WY GW Vulnerability Assessment Handbook (1998), used in the WY GW Atlas (JR Engineering et al., 2008)
0.63	**4.0**	**5,208**	**Table Averages**	

*Lower Lodgepole Subwatershed is 99,205 acres

3.11.4 Conclusions

Evaluating the Lower Lodgepole Subwatershed water budget components provides insights into groundwater availability that could be applied to other subwatersheds within the South Platte River Watershed. The Lower Lodgepole water budget was selected for this investigation because it could be simplified due to the subwatershed's unique hydrogeologic conditions. The lack of surface water inflows, outflows, and storage allowed these components to be ignored. The large depth-to-water eliminates the potential for losses due to ET from the water table. Inflows to the aquifer are limited to precipitation related recharge. Groundwater inflows were assumed to be insignificant and this component was ignored. These assumptions and simplifications may not be applicable in other subwatersheds.

An overall declining groundwater-level trend has occurred in Lower Lodgepole since 1985 (Figures 3.77 – 3.79). This indicates that over the long-term, groundwater outflows (pumping withdrawals and subsurface outflows) are exceeding groundwater inflows (recharge). At the current pumping rates groundwater levels will continue to decline.

Average annual water budget components were estimated from 1985 to 2015. Groundwater outflows (ΔQ^{gw}) that were assumed to be solely from pumping and was estimated to be 9,869 acre-feet/year. Average annual recharge (R) was estimated to be 1.0 inches per year, or 8,267 acre-feet/year. Average annual precipitation was 17.7 inches/year. This results in an estimated change in storage (ΔS) of 1,586 acre-feet/year. This indicates, that on average from 1985 to 2015, there was 1,586 acre-feet more groundwater removed from the aquifer than added. This deficit can be seen in the overall groundwater-level declines and reflects diminishing groundwater availability. If these trends continue, which would be expected unless water-management practices change, groundwater availability will continue to decline. As aquifer dewatering progresses and aquifer thickness decreases the volume of groundwater that can be extracted by wells will decrease. These effects would be greatest near irrigation wells pumping at high rates and in areas where the aquifer is thin. This will ultimately decrease the cropland acreage that can be irrigated by groundwater.

Shorter time periods were evaluated to estimate the hydrogeologic conditions that result in stable, rising, and declining groundwater availability. A stable groundwater level trend occurred from 1990 through 1993. During this period, the average precipitation rate was 19 inches/year, or 1.3 inches/year higher than average. This higher than average precipitation resulted in more recharge that offset the average deficit due to pumping. This indicates that under the current groundwater pumping practices precipitation needs to be approximately 19 inches/year to maintain stable groundwater levels and prevent further aquifer dewatering. Reducing groundwater pumping by 1,586 acre-feet/year (a 16 percent reduction in current pumping) would be expected to maintain the current groundwater level and prevent further declines in Lower Lodgepole groundwater availability.

A rising groundwater-level trend occurred from 2009 through 2011. During this period, the average precipitation rate was 21.9 inches/year, or 4.2 inches/year higher than average (24-percent above average). This significant increase in precipitation resulted in enough recharge to reverse the overall declining groundwater-level trend and increase the volume of water in storage. This indicates that under the current groundwater pumping practices precipitation needs to be approximately 21.9 inches/year over an extended period for groundwater levels to consistently rise at an average rate of approximately 0.18 feet/year.

A declining groundwater-level trend occurred from 1999 through 2002. This trend was more dramatic than the overall declining trend, in part, due to the average precipitation rate of 14.0 inches/year, which was 3.7 inches/year below average. This precipitation decrease resulted in less recharge and a decrease in the volume of water in storage. This indicates that under the current groundwater pumping practices consecutive years of below average precipitation results in accelerated aquifer depletion and declining groundwater availability. A reduction in pumping of approximately 4,012 acre-feet/year during consecutive below average annual precipitation years would be expected to result in a stable groundwater-level trend.

Several consecutive years of wetter than average precipitation are needed to stabilize or reverse the overall declining groundwater levels in Lower Lodgepole. Two such periods occurred between 1985 and 2015. One extremely dry year, such as 2012 when there was approximately 8.5 inches of precipitation (less than 50-percent of average), likely resulted in a significant loss of aquifer storage. Replenishing this aquifer depletion may take several consecutive years of above average precipitation.

Recharge estimates in this analysis suggest that the recharge rate is not a constant percentage of precipitation. A lower percentage of precipitation becomes recharge during dry periods because the soil water content is lower and more precipitation is required to wet the soil before infiltration can occur. Conversely, a higher percentage of precipitation becomes recharge during wet periods because the soil water content is higher and less precipitation is required to wet the soil before infiltration occurs. These results also indicate that several consecutive dry or wet years has a dramatic cumulative effect on groundwater storage and groundwater availability.

Limiting the analysis area for this investigation was advantageous because it simplified the water balance and minimized potential errors. For example, it was assumed that recharge was the only inflow and that groundwater pumping was the only groundwater outflow from the system. This was a reasonable assumption for the saturated part of the Ogallala aquifer. In larger, less constrained areas, there will likely be some groundwater inflows and outflows.

This type of water-balance analysis can be applied to the other subwatersheds in the SPRWS to gain insight into changes in groundwater availability. The water balances in other subwatersheds would likely be more complicated than Lower Lodgepole. Streamflows, infiltration from streams into the groundwater system, surface water diversions, irrigation return flows, groundwater inflows and outflows, and evapotranspiration from riparian vegetation may have to be considered.

Table 3-51 presents a summary of a general groundwater budget. These concentrate on the Albin, Pine Bluffs and Carpenter areas, which are the key irrigation areas in the watershed and the “Drawdown Areas” outlined in the Wyoming State Engineer’s Laramie County Groundwater Control Area April 1, 2015 Order. (Reference Figure 3.82)

Table 3.51. Summary of Water Budget

Agricultural Center	Area (acres)	Recharge Rate (in/yr)[1]	Recharge vol (af/yr)	Irrigated Lands (acres)	Irrigated Pumping (af/yr)[2]	Other pumping (af/yr)[3]	Total pumping (af/yr)	Flow in stream[4]	Evapo-transpiration	Groundwater removed from storage (pumping - recharge)	Reduction required for stable groundwater levels (% of groundwater pumping)
Albin	99,205	1.00	8,267	9,495	9,495	374	9,869	0	0	1,602	16%
Pine Bluffs	138,729	1.00	11,561	14,292	14,292	825	15,117	?	0	3,556	24%
Carpenter	28,731	1.00	2,394	4,796	4,796	135	4,931	2,000	0	537	11%

[1]From average trend for Lower Lodgepole (Groundwater Availability Memorandum, Albin Area)

[2]Assumed 1 acre-foot per acre of irrigation, based on SEO requirements

[3]Details for pumping from non-irrigation wells provided in other sheets in this workbook

[4]Flow in stream estimated. Should be updated with seepage data.

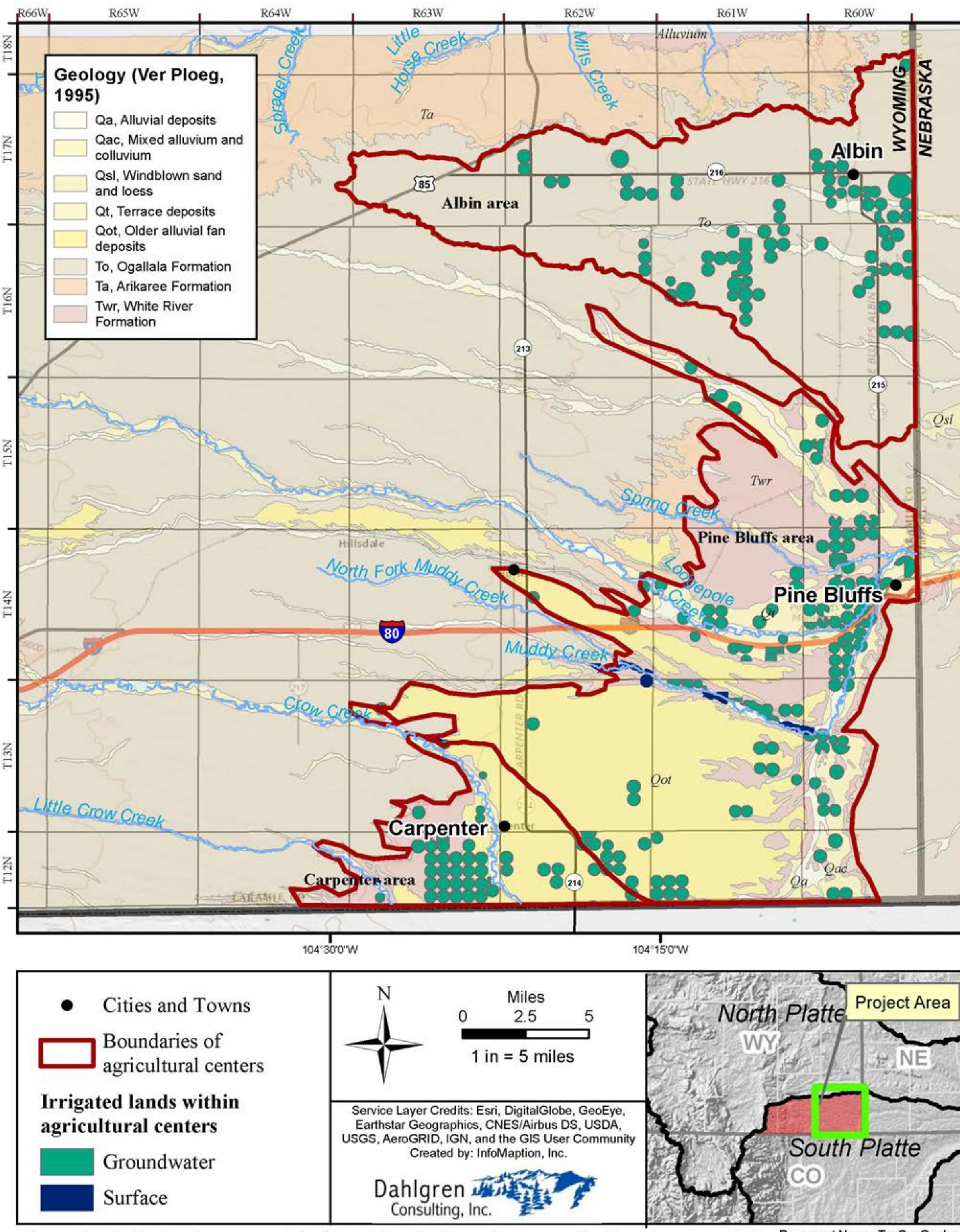

Figure 3-82. Geologic map and irrigated lands for primary agricultural areas within the Laramie County Control Area

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Figures 3.83 and 3.84 illustrates these estimates as a bar graph and as a modified tea cup diagram, respectively.

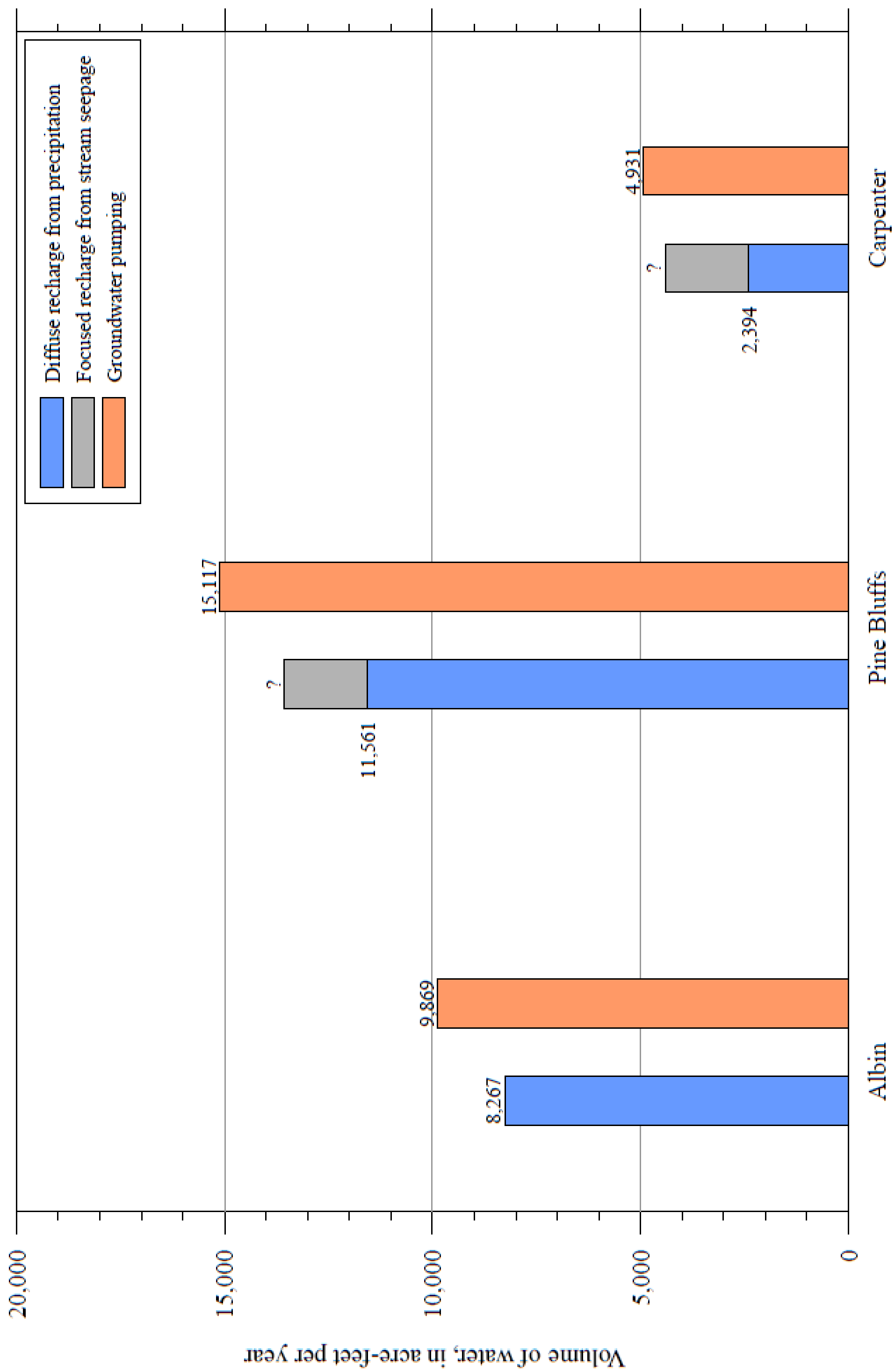

Figure 3.83 Water Availability in Primary Agricultural Areas within the Laramie County Control Area

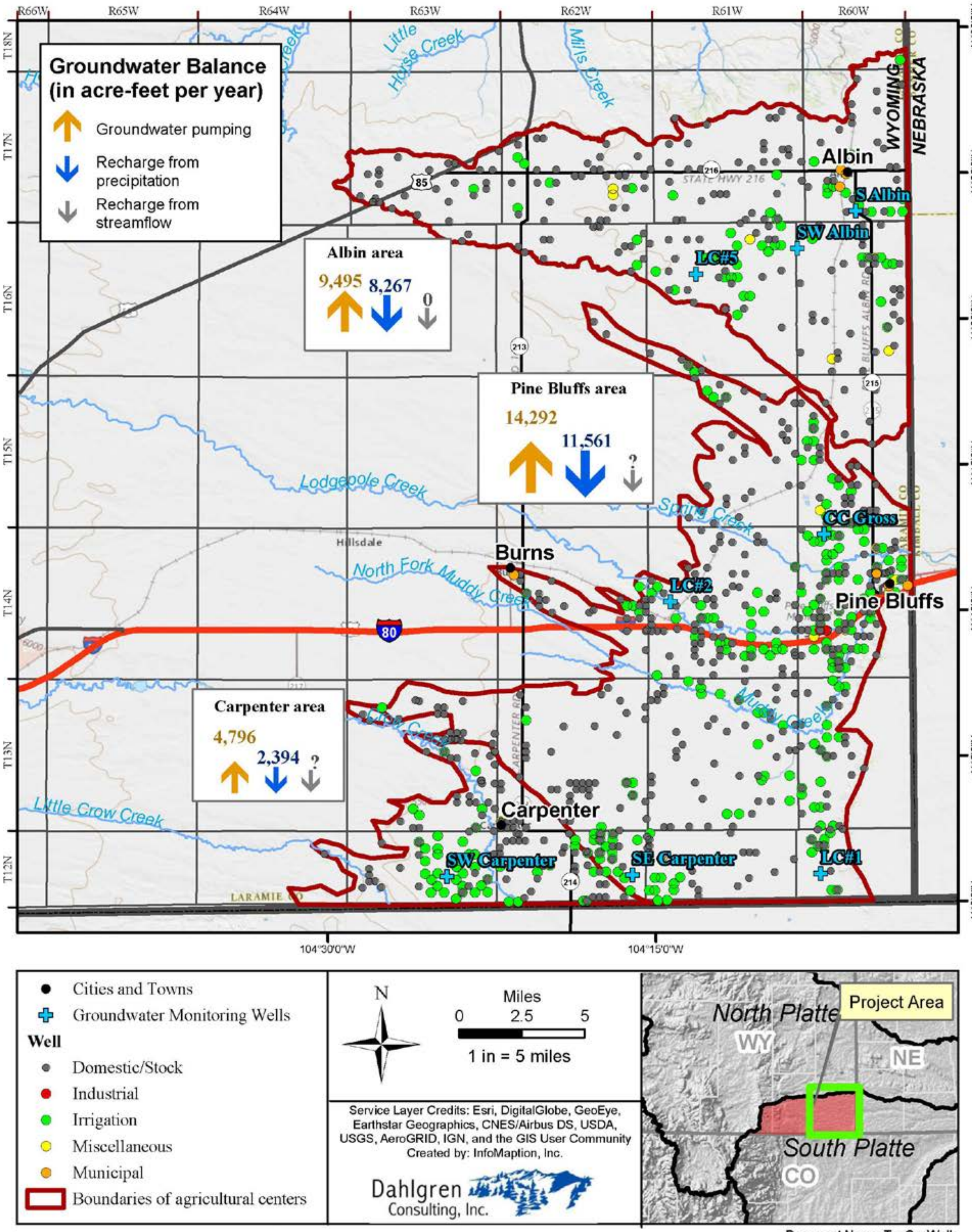

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Figure 3-84. Water Budget Diagram and Well Locations for Primary Agricultural Areas within the Laramie County Control Area

Chapter 4 – Geophysical Survey Pilot Project

4.1 Introduction

The scope of work for the South Platte River Watershed Study provided for a Discretionary Fund Task, allowing for changes in the scope of the project, as new issues were discovered, or as additional work was identified.

The White River Formation (specifically, the Brule Member of the White River Formation) is a primary aquifer in the Pine Bluffs and Carpenter areas. The yields of wells in these areas are highly variable and often depend on whether or not a well intercepts fractures, “pipes”, or other zones with secondary permeability.

One of the options for use of the Discretionary Fund that was identified early on in the project was a geophysical survey pilot project to investigate if geophysical tools could provide useful mapping of the sub-surface geology in the Watershed, particularly the Brule.

If successful, the geophysical pilot study could demonstrate that the geophysical tools could help define the subsurface characteristics of the White River and furthermore could be used during water well siting projects. If the geophysical survey pilot project did not show that the geophysical tools were helpful, this data would also be useful, in the characterization of the aquifer.

The effort on the SPRWS geophysical pilot study started in-earnest following a meeting in Laramie between Dr. Brad Carr, with the University of Wyoming Near Surface Geophysics Instrument Center (UWNSG); the acting WWDC project manager, Kevin Boyce; LCCD staff; and Dahlgren Consulting staff. This initial meeting was held in February 2017. Following review of scope of work and budget for the “Geo-physical Pilot Study to Image the top of the Brule Formation near Pine Bluffs, WY”, the UWNSG was hired to complete the pilot study during the SPRWS as a sub-consultant to Dahlgren Consulting. The main objectives of this project are:

> (1) to provide a pilot study of basic surface geophysical techniques (seismic refraction and DC resistivity) to image the interface between unconsolidated sediments and the top of the Brule Fm.,
> (2) to collect borehole geophysical logging data (acoustic and optical tele viewer image data) in an open section of the upper Brule Fm. to determine the fracture density and fracture orientations, and
> (3) collect data useful for the teaching and research mission of the University of Wyoming Dept. of Geology and Geophysics and the UW Near-Surface Geophysics Instrument Center - UWNSG.

Previous studies by Barrash and Morin (1987) of the Brule Formation in western Nebraska provides useful background for the geophysical pilot study conducted during the SPRWS. Barrash and Morin description of the Brule follows:

> The Brule Formation (Oligocene) is used as an aquifer in the High Plains (western Nebraska, eastern Wyoming, northeastern Colorado) where younger units are thin, unsaturated, or missing. In places, the Brule Formation has been developed heavily for irrigation in the past 25 years. In some areas, this development has resulted in management problems (long-term water-level declines, abandonment of shallow wells, well interference, and seasonal decreases in well productivity). The Brule Formation is predominantly siltstone; sandstone lenses and stringers occur but are not extensive. In general, ground- water yields adequate for irrigation are possible only where wells intercept highly conductive, secondary permeability zones in the Brule.

Key findings from the Barrash and Morin study, pertinent to the SPRWS, are summarized below:

1. Vertical or horizontal hydraulic conductivity in the un-fractured Brule Formation likely is enhanced by several types of features. Pedotubules (tubular openings in soil that may have been made by plant roots, worms or other animals) are abundant in the section and provide pathways for enhanced vertical hydraulic conductivity. Sub-horizontal parting planes are present and likely enhance horizontal hydraulic conductivity.
2. Using the caliper log, the major fracture zone could be recognized in wells as a region with significantly enlarged borehole diameter.
3. Interpretation of acoustic tele viewer logs suggests that the major fracture zone consists of one or more layers of densely fractured siltstone. Fracture zones correlate with locations of enlarged borehole diameter.
4. Tele viewer images of the major fracture zone show fracture networks and voids. Data generated in this study neither clearly support nor refute an interpretation of piping for the origin and/or the nature of the major fracture zone.
5. The influence of the major fracture zone can be recognized in temperature and heat-pulse flowmeter logs.
6. Data from drilling, lithologic analysis of core, and geophysical logs indicate that the major fracture zone can be traced as a hydro-stratigraphic unit in the subsurface.
7. The hydraulic conductivity of un-fractured siltstone in the field is an order of magnitude greater than the hydraulic conductivity measured in the lab on core samples. The presence of sub-horizontal parting planes and of secondary permeability features may explain the greater hydraulic conductivity values from field measurements relative to laboratory measurements on core samples without these features.

Dahlgren Consulting Inc., with assistance from the Wyoming State Engineer's Office staff and Dale Bowman, reviewed several wells and contacted landowners to obtain permission to conduct the geophysical pilot study on their property. The ideal location has an onsite well to calibrate and correlate the geophysical tools, the well was open hole (at least for a significant length of the borehole) so the borehole geophysical tools could be deployed, the well borehole was small enough diameter (no larger than approximately 8") to allow use of the borehole geophysical tools, the site would be located away from subsurface utilities that would affect the geophysical tools, and that the site be located some distance from the railroad tracks and interstate, so the vibration from these would not affect the geophysical tools.

A site that met these criteria was located on property owned by Dave Duello in the NE ¼ Section 8, T14N, R60W. This property is approximately 2 miles northwest of Pine Bluffs. Figure 4.1 shows the location of pilot study.

The field work and data collection for the pilot study was completed on June 21 – 22, 2017. Geophysical tools were installed on the surface. Also borehole geophysical tools were deployed in an existing well at this location. The well is an abandoned stock well, which formerly had a windmill installed in it. Prior to the field work by the UWNSG, this well was "videoed" on June 6, 2017 by Dahlgren Consulting with assistance from Bowman Irrigation. The video determined that the well was approximately 43' deep, 6" in diameter and that the well was cased to a depth of approximately 12'.

Photo shows geo-phones installed for the seismic survey.

Photo shows the electrodes installed for the resistivity survey.

A detailed report prepared by Dr. Carr describes the objectives, field collection, methodology and results of the pilot study. This report is presented in Appendix D of this Watershed Study report. The summary of the report is presented below:

> *The results of this study show that surface geophysics can detect the top of the White River (Brule) Formation as well as be used as a tool for predicting zones in the upper White River (Brule) Formation that have interpreted higher porosity/permeability capability (as shown by lower measured seismic velocities in combination with lower measured DC resistivity). Groundwater resource potential in this area is highly variable and understanding the White River fracturing is critical for siting water wells with increased productivity.*

The geophysical pilot study demonstrated that surface and borehole geophysical tools can help to define subsurface conditions in the White River Formation and help locate zones with higher porosity and permeability that could be favorable wells sites.

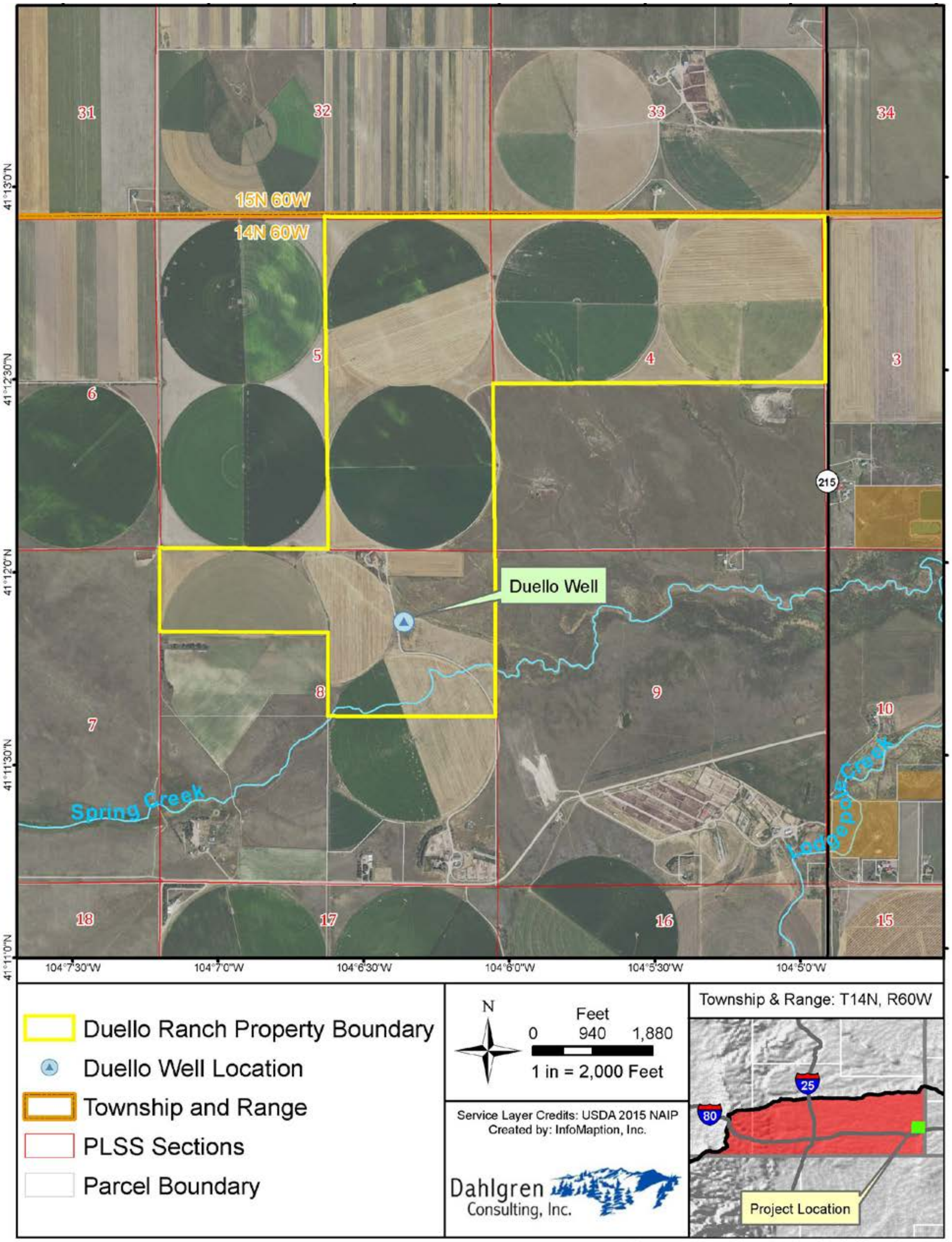

Figure 4.1. Geophysical Survey Location

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Chapter 5 - Management and Rehabilitation Plan

5.1 Introduction

One of the key objectives of the South Platte River Watershed Study is to develop a list of projects that can improve conditions in the watershed. In coordination with landowners, the Laramie County Conservation District, the Laramie Rivers Conservation District, the Natural Resources Conservation Service, and other agencies; over one hundred projects were developed and are included as part of the Study. The projects are described in the following sections of this report.

This chapter of the report outlines site specific projects that may remediate existing watershed impairments or address opportunities beneficial to the watershed. The projects outlined in this section of the report will improve conditions and function of the Watershed 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.

The projects described in Section 5.2 of the report appear to meet the criteria of the Wyoming Water Development Commission Small Water Project Program (SWPP). These projects are shown in Figure 5.1 and summarized in Table 5.1.

Eleven stock water projects proposed for the Pole Mountain area of the Medicine Bow National Forest are included in Section 5.3 of this report. These projects are summarized in Table 5.2.

Section 5.4 describes "Other Projects." The Other Projects, described in Section 5.4, are projects that are larger in scope and costs and likely will not be Small Water Projects. Additional study and design will be necessary to advance these projects. These projects are also shown on Figure 5.1.

Chapter 6 discusses Funding Sources and Options. Permitting Issues are discussed in Chapter 7 and Cost Estimates are discussed in Chapter 8

5.2 Small Water Project Program Eligible projects

This section of the report describes projects that appear to meet the criteria of the SWPP. 50% grants up to a maximum of $35,000 are available for eligible projects that provide adequate public benefit and improve watershed health. The projects include the construction or rehabilitation of small reservoirs, wells, pipelines and conveyance facilities, springs, solar platforms, irrigation works, windmills, wetland developments, rural community fire suppression, and recreational. Funding priority in the SWPP is given for projects that are "shovel ready", i.e. projects that are ready to move forward to construction with completed design, permitting, land owner access or other efforts.

The following Table 5.1 provides a list of small water projects within the SPRWS that were proposed by landowners and/or agencies. These projects should qualify as a Small Water

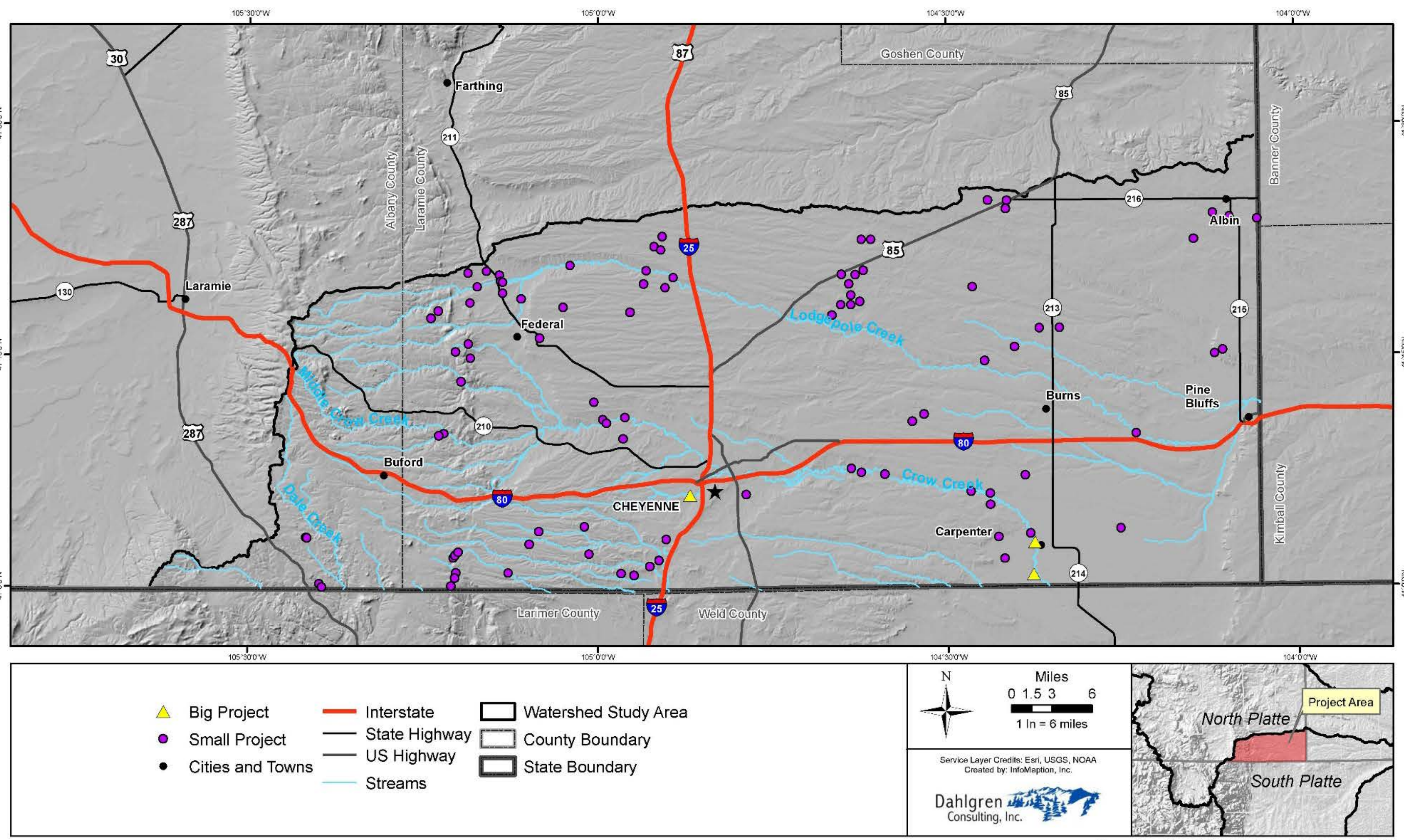

Figure 5.1 South Platte River Watershed Projects

project under the Wyoming Water Development Commission program. The site visits and project descriptions were completed prior to the new Small Water Program changes, which were adopted in October 2017. No rural water suppression system projects and no recreation projects are included in this list.

Table 5.1: South Platte River Watershed Study Small Water Projects

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
1	Laramie	12-63-3.1	Grace Valley Stock & Wildlife Project	Well New	Grace Valley Farm LLC	Dale Martin	SESW 3 T12N R63W	41.0316 N	104.4191 W
2	Laramie	12-67-5.1	Duck Creek Section 5 New Stock Reservoir	New Stock Reservoir	Duck Creek Grazing Association	Jerry Sidwell	SWSE 5 T12N R67W	41.0305 N	104.9125 W
3	Laramie	12-67-7.1	Duck Creek Section 7 New Stock Reservoir	New Stock Reservoir	Duck Creek Grazing Association	Jerry Sidwell	SENE 14 T12N R67W	41.0240 N	104.9256 W
4	Laramie	12-68-4.1	Duck Creek Section 4 Well & Stock Water System	Well New	Duck Creek Grazing Association	Jerry Sidwell	SENE 4 T12N R68W	41.0372 N	105.0122 W
5	Laramie	12-68-11.1	Duck Creek Section 11 Spring Development	Spring Rehab	Duck Creek Grazing Association	Jerry Sidwell	SESE 11 T12N R67W	41.0161 N	104.9667 W
6	Laramie	12-68-13.1	Duck Creek Brush Creek Well Solar	Solar New	Duck Creek Grazing Association	Jerry Sidwell	NENE 13 T12N R68W	41.0144 N	104.9481 W
7	Laramie	13-67-33.1	Duck Creek Section 33 Well	Well New	Duck Creek Grazing Association	Jerry Sidwell	NWSW 33 T13N R67W	41.0530 N	104.9020 W
8	Laramie	12-70-2.1	Shiverdecker Section 2.1 Stock Reservoir	New Stock Reservoir	Shiverdecker	Jean Shiverdecker	SWSW 2 T12N R70W	41.0328 N	105.2061 W
9	Laramie	12-70-2.2	Shiverdecker House Spring	Spring Rehab	Shiverdecker	Jean Shiverdecker	NESW 2 T12N R70W	41.0355 N	105.2038 W
10	Laramie	12-70-2.3	Shiverdecker North Project Hosack # 3 and #4 Ditches	Spring Rehab	Shiverdecker	Jean Shiverdecker	SWNE 2 T12N R70W	41.0389 N	105.1992 W
11	Laramie	12-70-11.1	Sand Creek Section 11 New Stock Reservoir	New Stock Reservoir	Sand Creek Ranch	Robert Green	SESW 11 T12N R70W	41.0169 N	105.2026 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
12	Laramie	12-70-14.1	Sand Creek Ranch Stock Reservoir Rehab	Stock Reservoir Rehab	Sand Creek Ranch	Robert Green	SENW 14 T12N R70W	41.0113 N	105.2042 W
13	Laramie	12-70-14.2	Sand Creek Section 14 New Stock Reservoir	New Stock Reservoir	Sand Creek Ranch	Robert Green	SWSW 14 T12N R70W	41.0025 N	105.2094 W
14	Albany	12-71-18.1	Raisbeck Stock Reservoir	New Stock Reservoir	Merl Raisbeck	Merl Raisbeck	SESW 18 T12N R71W	41.0045 N	105.3975 W
15	Albany	12-71-19.1	Raisbeck Spring Development	New Spring	Merl Raisbeck	Merl Raisbeck	NENW 19 T12N, R71W	41.0012 N	105.3940 W
16	Laramie	13-61-30.1	Martin Stock & Wildlife Project	New Well, Solar Pumps and Tanks	David Martin	David Martin	NWSE 30 T13N, R61W	41.0634 N	104.2530 W
17	Laramie	13-63-1.1	Smith Section1 Stock Well & Tank	Well New, Pipeline & Tank	Cody Smith	Cody Smith	NWSW 1 T13N R63W	41.1214 N	104.3889 W
18	Laramie	13-63-7.1	Beaver Dam Ditch Rehabilitation	Irrigation Rehab	Red Baldy Ranch	Ed Ferguston	SESE 7 T13N, R63W	41.1043 N	104.4664 W
19	Laramie	13-63-9.1	Beaver Dam Ditch Pipeline	Irrigation Rehab	Red Baldy Ranch	Ed Ferguston	S 1/2 Sec 9 T13N R63W	41.1019 N	104.4394 W
20	Laramie	13-63-16.1	Evans State Section 16 Stock Water	Stock Well & Tank	State of Wyoming	Jeremy Evans	SESW 16 T13N R63W	41.0898 N	104.4389 W
21	Laramie	13-63-25.1	Smith Section 25 Stock Reservoir	Stock Reservoir	Gary Smith	Gary Smith	SESW 25 T13N R63W	41.0586 N	104.3817 W
22	Laramie	13-63-34.1	Smith Section 34 Stock Well & Tank	Well New, Pipeline & Tank	Cody Smith	Cody Smith	NWNW 34 T13N R63W	41.0550 N	104.4275 W
23	Laramie	13-64-6.1	Ullman #1 Reservoir Rehabilitation	Irrigation Rehab	Red Baldy Ranch	Ed Ferguston	SE NE 6 T13N R64W	41.1230 N	104.5896 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
24	Laramie	13-64-6.2	Ullman #1 and #2 Ditch Rehab	Irrigation Rehab	Red Baldy Ranch	Ed Ferguston	SE NE 6 T13N R64W	41.1230 N	104.5896 W
25	Laramie	13-65-2.1	Blue Ribbon Section 2 Ponds	New Reservoir	Blue Ribbon Estates	Will Edwards	Sec 2 T13N R65W	41.1250 N	104.6230 W
26	Laramie	13-65-2.2	Blue Ribbon Section 2 Environmental	Enviro	Blue Ribbon Estates	Will Edwards	Sec 2 T13N R65W	41.1277 N	10406333 W
27	Laramie	13-65-3.1	WHR No. 2 Reservoir Spillway Rehab	Irrigation Rehab	Red Baldy Ranch	Ed Ferguston	NENE 3 T13N R65W	41.1295 N	104.6374 W
28	Laramie	13-66-16.1	Sweetgrass	Enviro	Sweetgra ss	Larry Gallagher	NWNW 16 T13N R66W	41.1014 N	104.7879 W
29	Laramie	13-68-28.1	Belvoir Ranch Section 28 Well & Tanks	New Well, Solar Pumps and Tanks	City of Cheyenne	City of Cheyenne	SWNE 28 T13N, R68W	41.0667 N	105.0189 W
30	Laramie	12-69-9.1	Soapstone Section 9 Well & Stock Water	Well New, Tanks	Soapston e Grazing Associatio n	Mike Gallegos	SESW 9 T12N 69W	41.0167 N	105.1276 W
31	Laramie	13-69-26.1	Soapstone Goose Camp Well & Stock Water	Well, Solar Pump, Tanks	Soapston e Grazing Associatio n	Mike Gallegos	SWSE 26 T13N R69W	41.0616 N	105.0842 W
32	Laramie	13-69-34.1	Soapstone Flattery Windmill Replacement	New Well, Solar Pumps and Tanks	Soapston e Grazing Associatio n	Mike Gallegos	SESE 34 T13N R69W	41.0478 N	105.0979 W
33	Albany	13-72-36.1	Bath State Spring Development	Spring Develop	Bath Family LTD	Nancy Bath	SENW 36 T13N R72W	41.0547 N	105.4167 W
34	Albany	13-72-36.2	Bath State Stock Reservoir	New Stock Reservoir	Bath Family LTD	Nancy Bath	SENW 36 T13N R72W	41.0542 N	105.4152 W
35	Laramie	14-61-20.1	Bowman Wildlife Habitat	Enviro	Dale Bowman	Dale Bowman	SENW 20 T14N R61W	41.1659 N	104.2300 W
36	Laramie	14-63-14.1	Mead Irrigation	New Irrigation Res	Western Skys Ranch	Les Mead	SWSW 14 T15N R63W	41.2600 N	104.4033 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
37	Laramie	14-64-10.1	McWilliams Sec 10 Pump	New Solar Pump	Chris McWilliams	Chris McWilliams	SESW 10 T14N R64W	41.1880 N	104.5331 W
38	Laramie	14-64-16.1	McWilliams State Sec 16 Stockwater	New Solar Pump and Tank	Chris McWilliams and State of Wyoming	Chris McWilliams	NWSE 16 T16N R64W	41.1802 N	104.5503 W
39	Laramie	14-68-8.1	Polo Ranch Sections 8, 9, and 10 Stock Water	New stock well, pipeline and tanks	Polo Ranch	Brian Harvey	NENE 8 T14 N R68W	41.2013 N	105.0052 W
40	Laramie	14-68-13.1	Polo Ranch Bell Ditch and Home Ditch Head Gates	Irrigation Rehab	Polo Ranch	Brian Harvey	SWNW 13 T14N R68W	41.1847 N	104.9613 W
41	Laramie	14-68-15.1	Polo Ranch Section 15 Stock Pipelines and Tanks	New pipeline and stock tanks	Polo Ranch	Brian Harvey	SENW 15 T14N R68W	41.1827 N	104.9927 W
42	Laramie	14-68-15.2	Polo Ranch Section 15 Road Crossing and Erosion Control	Enviro	Polo Ranch	Brian Harvey	SESE 15 T14N R68W	41.1787 N	104.9877 W
43	Laramie	14-68-23.1	Polo Ranch Section 23 Stock Water Project	New pipeline and stock tanks	Polo Ranch	Brian Harvey	SESE 23 T14N R68W	41.1617 N	104.9637 W
44	Laramie	14-70-22.1	Jawbone Gulch Bramford Ditch Rehab	Irrigation Rehab	Jawbone Gulch Ranch	Guy Landers	NWSE 22 T14N R70W	41.1670 N	105.2204 W
45	Laramie	14-70-22.2	Jawbone Gulch Bramford #1 & #2 Ditch Rehab	Irrigation Rehab	Jawbone Gulch Ranch	Guy Landers	NWSW 22 T14N R70W	41.1650 N	105.2272 W
46	Laramie	15-60-20.1	R&K Farms Stock Pipeline & Tank	Stock pipeline and tanks	R&K Farms, Inc	Travis Freeburg	SWNE 20 T15N R60W	41.2556 N	104.1050 W
47	Laramie	15-60-20.2	R&K Farms Stock Well & Tank	New Well, Solar Pumps and Tanks	R&K Farms, Inc	Travis Freeburg	SWNW 20 T15N R60W	41.2517 N	104.1169 W
48	Laramie	15-62-5.1	Kathleen Lyon Stock & Wildlife Water	New Well, Solar Pumps and Tanks	Kathleen Lyon	Kathleen Lyon	SENW 5 T15N R62W	41.2976 N	104.3431 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
49	Laramie	15-62-7.1	Gary Lyon Stock & Wildlife Water	New Well, Solar Pumps and Tanks	Gary Lyon	Gary Lyon	NWSW 7 T15N R62W	41.2803 N	104.3675 W
50	Laramie	15-62-8.1	Larry Lyon Stock Water	Stock Water	Larry Lyon	Larry Lyon	NWSE 8 T15N R62W	41.2805 N	104.3388 W
51	Laramie	15-63-20.1	Keenan Stock Water	Stock Well and Tank	William Keenan	William Keenan	SESE 20 T15N R63W	41.2455 N	104.4464 W
52	Laramie	15-65-4.1	Hallock Section 4 Stock Water	Stock Well and Tank	Rosalie Hallock	Laurel Paul	NESW 4 T15N R65W	41.2950 N	104.6644 W
53	Laramie	15-68-18.1	Dudash Section 18 Stock Water Pipeline	Pipelines and Tanks	Nick Dudash	Nick Dudash	SWSW 18 T15N R68W	41.2707 N	105.0831 W
54	Laramie	15-70-3.1	Lorenz Ranch North 3/4 Spring	Spring Develop and Tank	Lorenz Ranch	Tom Twiford	SWNW 3 T15N R70W	41.2997 N	105.2286 W
55	Laramie	15-70-4.1	Lorenz Section 4 Spring Development	Spring Develop and Tank	Lorenz Ranch	Tom Twiford	SWSE 4 T15N R70W	41.2920 N	105.2389 W
56	Laramie	15-70-13.1	Lorenz Section 13 Well & Tank	Well, Solar Pump, Tanks	Lorenz Ranch	Tom Twiford	NESW 13 T15N R70W	41.2642 N	105.1850 W
57	Laramie	15-70-23.1	Lorenz Sect 23 Spring Development, Pipeline and Tank	Spring Development, Pipeline and Tank	Lorenz Ranch	Tom Twiford	SESW 23 T15N R70W	41.2557 N	105.2036 W
58	Laramie	15-70-25.1	Lorenz Ranch Hill Horse Spring Pipeline	Spring Development, Pipeline and Tank	Lorenz Ranch	Tom Twiford	NENE 25 T15N R70W	41.2486 N	105.1821 W
59	Laramie	15-70-35.1	North Crow Creek Wetlands	Enviro	City of Cheyenne	Jeff Geyer	E 1/2 35 T15N R70W	41.2235 N	105.1957 W
60	Laramie	16-61-1.1	Albin - Bushnell Draw Stock Reservoir	New Stock Reservoir	Debra Childress	Jim Lerwick	SW SE 1 T16N R61W	41.3756 N	104.1458 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
61	Laramie	17-60-31.1	Ablin - Forester Mills Creek Stock Reservoir	New Stock Reservoir	David Forester	Jim Lerwick	NW NE 31 T17N R60W	41.4036 N	104.1182 W
62	Laramie	17-60-32.1	Ablin - Hanson Mills Stock Reservoir	New Stock Reservoir	Diedre & Dennis Hanson	Jim Lerwick	SE NE 32 T17N R60W	41.3995 N	104.0941 W
63	Laramie	17-60-34.1	Albin - Bella Farms Stock Reservoir	New Stock Reservoir	Bellla Farms	Jim Lerwick	SE NE 34 T17N R60W	41.3967 N	104.0544 W
64	Laramie	16-63-29.1	Spatz Stockwater	New Well, Solar Pumps and Tanks	Craig Spatz	Craig Spatz	SW NE 29 T16N R63W	41.3252 N	104.4632 W
65	Laramie	16-65-1.1	Berry Ranch Windmill Section 1	Convert Windmill to Solar Pump	Berry Ranch, LLC	Jeff Berry	SESW 1, T16N, R65W	41.3767 N	104.6084 W
66	Laramie	16-65-2.1	Berry Ranch Windmill Section 2	Convert Windmill to Solar Pump	Berry Ranch, LLC	Jeff Berry	SWSE 2 T16N, R65W	41.3769 N	104.6220 W
67	Laramie	16-65-22.1	Berry Ranch Windmill Section 22	Convert Windmill to Solar Pump	Berry Ranch, LLC	Jeff Berry	NWSW 22, T16N, R65W	41.3391 N	104.6508 W
68	Laramie	16-65-23.1	Berry Ranch Windmill Section 23	Convert Windmill to Solar Pump	Berry Ranch, LLC	Jeff Berry	NWSW 23, T16N, R65W	41.3389 N	104.6307 W
69	Laramie	16-65-23.2	Berry Ranch Section 23 Pipeline & Tanks	Pipelines and Tanks	Berry Ranch, LLC	Jeff Berry	NENE 23, T16N, R65W	41.3436 N	104.6194 W
70	Laramie	16-65-27.1	Berry Ranch Solar Conversion Section 27	Convert Windmill to Solar Pump	Berry Ranch, LLC	Jeff Berry	SWNE 27, T16N, R65W	41.3288 N	104.6399 W
71	Laramie	16-65-34.1	Kahler #2 Well Tank	Stock Tank, New	Paul Life Trust	Laurel Paul	SESE 34 T16N R65W	41.3061 N	104.6374 W
72	Laramie	16-65-34.2	Paul Ranch The Bam Bam Well Solar Pump & Tank	Solar New, Tank	Paul Life Trust	Laurel Paul	SWSW 34 T16N R65W	41.3061 N	104.6517 W
73	Laramie	16-65-34.3	Paul Ranch North Section 34 Stock Water	Well New	Paul Life Trust	Laurel Paul	NENE 34 T16N R65W	41.3167 N	104.6372 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
74	Laramie	16-65-35.1	Kleiman Section 35 Well & Stock Water	Well New & Stock Water	Alice Kleiman	Jim Cochran	NWSE 35 T16N, R65W	41.3099 N	104.6245 W
75	Laramie	15-68-1.1	Hollingsworth South Pipelines & Tanks	Stock pipelines and tanks	Lindsey Hollingsworth	TJ Hollingswort h	SENE 1 T15N, R68W	41.2987 N	104.9538 W
76	Laramie	16-67-5.1	Hollingsworth North Stock Water	New Stock Well, pipelines and tanks	Lindsey Hollingsworth	TJ Hollingswort h	SESE 5 T16N R67W	41.3805 N	104.9075 W
77	Laramie	16-67-19.1	Hollingsworth Erosion Protection	Environ	Lindsey Hollingsworth	TJ Hollingswort h	SENE 19 T16N R67W	41.3436 N	104.9306 W
78	Laramie	16-67-30.1	Hollingsworth Middle Pipelines & Tanks	Stock pipelines and tanks	Lindsey Hollingsworth	TJ Hollingswort h	SENW 30 T16N R67W	41.3290 N	104.9345 W
79	Laramie	16-67-8.1	LF Enterprises Section 8 Stock Water	Stock water	LF Enterprises, LLC	Frank Falen	SWSE 8, T16N, R67W	41.3696 N	104.9190 W
80	Laramie	16-67-8.2	LF Enterprises Section 8 Irrigation Well	New Irrigation Well, Not in Control Area	LF Enterprises, LLC	Frank Falen	SESE 8, T16N, R67W	41.3658 N	104.9096 W
81	Laramie	16-67-21.1	Falen #2 Stock Reservoir	Stock Reservoir	LF Enterprises, LLC	Frank Falen	SWSE 21, T16N, R67W	41.3360 N	104.8920 W
82	Laramie	16-67-28.1	Baccei Section 28 Stockwater System	Stock Well and Pipeline	Barry Baccei	Frank Falen	NWSW 28, T16N, R67W	41.3251 N	104.9034 W
83	Laramie	15-68-6.1	Vercelli Section 6 Pipeline & Tank	Tank, Pipeline	Vercelli, Michelle, ET al	Chris Vercelli	NWNE 6 T15N R68W	41.3041 N	105.0493 W
84	Laramie	16-68-19.1	Vercelli Section 19 Stock Water	New Stock Well, Pipeline and Tank	Vercelli, Michelle, ET al	Chris Vercelli	NENE 19 T16N R68W	41.3491 N	105.0397 W
85	Laramie	16-69-34.1	Vercelli Section 34 Well & Stock Water	New Stock Well, Pipeline and Tanks	Vercelli, Michelle, ET al	Chris Vercelli	NESW 34 T16N R69W	41.3129 N	105.1099 W
86	Laramie	16-69-191	Y Cross Section 19 Pipelines & Tanks	Pipelines and Tanks	Y CROSS	Tyler Kimzey	SENE 19, T16N, R69W	41.3427 N	105.1592 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
87	Laramie	16-69-30.1	Y Cross Section 30 Stock Well & Tank	Stock Well, Tank, Pipeline and Tanks	Y CROSS	Tyler Kimzey	NWSW 30 T16N, R69W	41.3259 N	105.1727 W
88	Laramie	16-70-24.1	Y Cross Islay Draw #1 Reservoir Rehab	Stock Reservoir Rehab	Y CROSS	Tyler Kimzey	SENE 24, T16N, R70W	41.3408 N	105.1857 W
89	Laramie	16-70-36.1	Y Cross Tabletop Reservoir Rehab	Reservoir and Irrigation System Rehab	Y CROSS	Tyler Kimzey	SWSE 36 T16N, R70W	41.3085 N	105.1826 W
90	Laramie	16-69-21.1	Islay North Pasture Stock Well & Tank	Stock Well and Tank	Islay Ranch	T.C. Berry	NWSE 21, T16N, R69W	41.3388 N	105.1408 W
91	Laramie	16-69-29.1	Islay Chadwick Reservoir #3	Reservoir Rehab	Islay Ranch	T.C. Berry	NENE 29, T16N, R69W	41.3318 N	105.1391 W
92	Laramie	16-69-29.2	Islay Chadwick #1 Ditch	Irrigation Rehab	Islay Ranch	T.C. Berry	SENE 29 T16N R69W	41.3310 N	105.1361 W
93	Laramie	16-69-32.1	Islay Ranch Road Pasture Spring	Spring Development and Tank - Road Pasture	Islay Ranch	T.C. Berry	NENE 32 T16N R69W	41.3191 N	105.1361 W
94	Laramie	17-63-27.1	Anderson Section 27 Well & Solar	Well Rehab	Dale Anderson	Dale Anderson	NESW 27 T17N R63W	41.4094 N	104.4150 W
95	Laramie	17-63-27.2	Anderson Section 27 Ditch	Irrigation Rehab	Dale Anderson	Dale Anderson	NWNE 27 T17N R63W	41.4181 N	104.4132 W
96	Laramie	17-63-28.1	Anderson Section 28 Contour Ditch	Irrigation	Dale Anderson	Dale Anderson	NWNW 28 T17N R63W	41.4186 N	104.4407 W

These projects are organized using a South Platte River Watershed Project number; which is corresponds to the location of the project. The first number is the Township, then Range, then Section, and finally the project number within that section. For example the first project on the list is the Grace Valley Stock and Wildlife project No. 12-63-3.1, which indicates that the project is located in Township 12 north, Ranch 63 west, and Section 3 and that this project is the first one proposed in Section. For convenience, a few projects on this list are grouped together by the landowner.

A short summary of each of the projects is presented below. More detailed project descriptions, including maps and cost estimates are contained in Appendix D of this report.

1. Grace Valley Stock & Wildlife Project (12-63-3.1)

   This project involves construction of a new stock watering system, including new well; solar pump, panels and associated equipment; a stock tank approximately 500' east of the well; a pipeline to the tank and miscellaneous valves. Wildlife habitat benefits will be included in this project by the construction of a small wildlife watering reservoir with a capacity of approximately 0.25 to 0.5 AF. The reservoir will be approximately 50' x 100' at the top and have an average depth of approximately 2.5'. The reservoir would be fenced with wildlife friendly fencing, but to prevent use by cattle. Vegetation will be planted around the reservoir to provide wildlife habitat.

2. Duck Creek Section 5 New Stock Reservoir (12-67-5.1)

   This project creates a small dam and stock reservoir by constructing an approximately 10' high x 200' long dam near the Railroad Spring Tank # 8, WY SEO Permit No. 123251S. Construction of the reservoir and rehabilitation of the existing 20' stock tank and pipeline from the spring to the tank would provide a water source for the area. Additional design work is required to advance this project.

3. Duck Creek Section 7 New Stock Reservoir (12-67-7.1)

   This project involves the construction of a stock reservoir located near Duck Creek and along the Spotswood Supply Ditch, WY SEO Permit No. 8943. This project involves constructing an approximately 10' tall by 250' long dam. Additional design work is required to advance this project.

4. Duck Creek Section 4 Well & Stock Water System (12-68-4.1)

   This project involves the construction of a new well and a stock water pipeline system. The well would serve as a primary water source for a stock water pipeline system, consisting of four tanks and associated pipelines. It includes a solar pump and panels to pump water from the well, as there is no accessible power source. Little additional design or permitting effort is required to advance this project.

5. Duck Creek Section 11 Spring Development (12-68-11.1)

   This project involves the development of a spring. The development of the spring, fencing it, and installing a stock tank, located out of the riparian area, will provide relief for the riparian area. Little additional design or permitting effort is required to advance this project.

6. Duck Creek Brush Creek Well (12-68-13.1)

   This project involves the installation of a solar pump and panels into the existing Brush Creek Well, WY SEO Permit No. 119967. Currently the landowner operates the well pump using a portable generator. This requires frequent visits to the site to run the pump and fill the tanks. The solar pump will result in a more efficient system. Little additional design or permitting effort is required to advance this project.

7. Duck Creek Section 33 Well (13-67-33.1)

   This project involves the construction of a new well and the installation of solar platforms, pipeline and stock tanks. The well would serve as a primary water source for stock watering in an area that is currently under grazed due lack of water and electricity. Little additional design or permitting effort is required to advance this project.

8. Shiverdecker Section 2.1 Stock Reservoir (12-70-2.1)

   This project involves construction of a stock reservoir and stock water pipeline system. The pipeline will run from the outlet of the dam to a new stock tank located to the east. The stock reservoir will be located downstream of a spring. There is an existing adjudicated water right for the Hosack No. 5 Ditch, Permit No. 10650, which irrigates 8 acres, at the location of the proposed stock reservoir. In addition to providing the stock water storage, the new stock reservoir could also provide a diversion dam for the Hosack No. 5 Ditch. Additional design work is required to advance this project.

9. Shiverdecker House Spring (12-70-2.2)

   This project includes rehabilitation a spring located in Section 2, Township 12 North, Range 70 West; construction of a stock water pipeline and tank; fencing around the spring; and improvements to a drainage ditch, which also will improve drainage and mitigate flooding. Stock drink directly from the spring and the riparian area around the spring is impacted by the grazing. The spring also provides domestic water to the house on the property; however no work on the domestic system is proposed.

   The spring will be fenced off to protect the spring and the riparian areas around the spring. Water quality improvements will be extra benefits of this project. Construction of a spring box, stock water pipeline and stock tank are necessary to provide an alternative stock water source. Little additional design work is required to advance this project.

10. Shiverdecker North Project Hosack # 3 and #4 Ditches (12-70-2.3)

    This project involves rehabilitation of two spring fed ponds, related to the Hosack Ditch No. 3, WY SEO Permit No. 8770 and the Hosack Ditch No. 4, WY SEO Permit No. 8771. This project will involve fencing of the south pond, replacement of the outlet pipes and head gates, and miscellaneous work to restore the irrigation system. Also, stock water pipelines and tanks will be constructed. Additional design work is required to advance this project.

11. Sand Creek Section 11 New Stock Reservoir (12-70-11.1)

    This project involves the construction of a stock reservoir on Sand Creek. The dam will be approximately 160’ long and a maximum of approximately 15’ tall. The capacity of the reservoir will be approximately 3.5 acre-feet. Additional design work is required to advance this project.

12. Sand Creek Ranch Stock Reservoir Rehab (12-70-14.1)

    This project involves rehabilitation of the existing Sand Creek Stock Reservoir, WY SEO Permit No. 8980 SR. This reservoir is adjudicated for 12.8 acre-feet. The main effort of this project will be directed toward the rehabilitation of the emergency spillway. This project includes work directly on the emergency spillway, as well as some improvements to the principal spillway. Additional design work is required to advance this project.

13. Sand Creek Section 14 New Stock Reservoir (12-70-14.2)

    This project will involve construction of a new stock reservoir on Sand Creek. The dam will be approximately 240' long and a maximum of 20' high. The capacity of the new reservoir will be approximately 10 acre-feet. Additional design work is required to advance this project.

14. Raisbeck Stock Reservoir (12-71-18.1)

    This project involves construction of a new small stock reservoir on an ephemeral draw, tributary to Mud Creed, which is a tributary to Dale Creek. This project will provide water storage and potential wildlife habitat, while helping to mitigate erosion and head cutting that currently occurring in the draw upstream. Additional design work is required to advance this project.

15. Raisbeck Spring Development (12-71-19.1)

    This project includes a spring development, an short pipeline, installation of a tire tank and installing a fence around the spring. This project will provide stock water and support wildlife habitat. Little additional design work is required to advance this project.

16. David Martin Stock & Wildlife Project (13-61-30.1)

    This project involves drilling a new well. An electrical submersible pump will be installed and and two tanks will be installed near the well. This project will provide stock water and support wildlife habitat. Little additional design work is required to advance this project.

17. Smith Section1 Stock Well & Tank (13-63-1.1)

    This project involves construction of new stock well, new submersible electric pump and installation of two 10' diameter tire tanks near the well. Little additional design work is required to advance this project.

18. Beaver Dam Rehabilitation (13-63-7.1)

    This project rehabilitates the existing Beaver Dam ditch diversion dam and head gate. The Beaver Dam Ditch is a territorial appropriation, Crow Creek Court Decree Priority No. 41. The exact work to be done will need additional study and design efforts.

19. Beaver Dam Ditch Pipeline (13-63-9.1)

    This project will replace the open ditch located in Section 9, Township 13 North, Range 63 West with a pipeline. This work will reduce seepage in the ditch and improve efficiency of the system. A significant amount of the water diverted at the headgate and diversion dam does not reach the irrigated land, making the pipeline necessary. Ultimately, approximately one mile of pipeline will be installed. The exact work to be done will need additional study and design efforts.

20. Evans State Section 16 Stock Water (13-63-16.1)

    This project involves installation of a new solar pump system into an existing non-permitted well in Section 16, Township 13 North, Range 63 West. This is a school section. The new solar pump will replace a windmill. Also, the project will include installation of a new bottomless tank near the well. Little additional design work is required to advance this project.

21. Smith Section 25 Stock Reservoir (13-63-25.1)

    This project involves construction of an off-channel stock reservoir on the west side of Crow Creek in Section 25, Township 13 North, Range 63 West. This project will provide storage for stock water and wildlife and could provide groundwater recharge benefits. Conceptually, the design of these reservoirs would be similar to the Emmanuel Farms Reservoir, which was designed by the NRCS, which means there would be a small diversion dam and supply ditch. A detailed survey and final design will need to be completed prior to submitting the application for this project. The State Engineer's recent decisions on Crow Creek water administration likely will impact the ability to permit this project.

22. Smith Section 34 Stock Well & Tank (13-63-34.1)

    This project involves construction of new stock well, new submersible electric pump and installation of two 10' diameter tire tanks near the well in Section 34, Township 13 North, Range 63 West. Little additional design work is required to advance this project.

23. Ullman #1 Reservoir Rehabilitation (13-64-6.1)

    This project involves repair and rehabilitation of the Ullman Reservoir, Permit No. 7286R. The outlet pipes through the dam, including the principal spillway, the low-level outlet pipe and the 24" outlet pipe through the dam, which supplies water to the Ullman ditches need repair and rehabilitation. Additional design work is required to advance this project.

24. Ullman #1 and #2 Ditch Rehabilitation (13-64-6.2)

    This project involves repair and rehabilitation of the pumps and head gates for the associated Ullman No. 1 and No. 2 Ditches, which are Territorial Appropriations (or 24/572). Also, the ditch and pipelines to the pumps need rehabilitation. Additional design work is required to advance this project.

25. Blue Ribbon Section 2 Ponds (13-65-2.1)

    This project involves construction of a small reservoir or reservoirs near Crow Creek in Section 2, Township 13 North, Range 65 West. Conceptually, the design of these reservoirs would be similar to the Emmanuel Farms Reservoir, which was designed by the NRCS, which means there would be a small diversion dam and supply ditch. The water would flow through the reservoirs and return to Crow Creek. Also, these reservoirs potentially would be filled by seepage from the creek and from groundwater.

A detailed survey and final design will need to be completed prior to submitting the application for this project. The State Engineer's recent decisions, (Burnett May 2017 and Emmanuel Farms June 2017) concerning construction of new surface water diversions from Crow Creek and water administration on Crow Creek likely will impact the ability to permit this project.

26. Blue Ribbon Section 2 Environmental (13-65-2.2)

This project involves bank stabilization and erosion control along Crow Creek and a side channel Section 2, Township 13 North, Range 65 West. The erosion in Crow Creek is located below the diversion dam and head gate for the WHR No. 2 Ditch, Permit No. 17170. The erosion in the side channel is located near where a gas line has been constructed. Also, water from the WHR No. 2 Reservoir principal spillway flows through this side channel.

The erosion control would provide environmental benefits by reducing sedimentation, potentially providing fish habitat, and would protect the gas line and the WHR No. 2 Ditch diversion dam and head gate. Final design is necessary prior to submitting an application for a Small Water Project.

27. WHR #2 Reservoir Spillway Rehabilitation (13-65-3.1)

This project involves repair and/or rehabilitation of the WHR #2 Reservoir principal spillway in Section 3, Township 13 North, Range 65 West. The WHR #2 Reservoir has two water right permits, the original permit No. 4032 Res and enlargement permit, No. 4640 RES. In total, this reservoir stores approximately 877 acre-feet. The enlarged dam and reservoir was originally constructed in 1937 with a concrete principal spillway on the north end of the dam. Repair and/or rehabilitation of the principal spillway structure would extend the life and the safety of the dam and reservoir. Additional design is necessary prior to submitting an application for a Small Water Project.

28. Sweetgrass (13-66-16.1)

This project involves construction of a pond and constructed wetlands. The project will provide wild habitat, water quality, and flood control benefits. Additional design is necessary prior to submitting an application for a Small Water Project.

29. Belvoir Ranch Section 28 Well & Stock Water (13-68-28.1)

This project involves the construction of a new stock well in NW ¼ of Section 28, Township 13 North, Range 68 West, which is a School Section. In addition to the new well, the project includes installation of a new electrical pump, and four sets of tanks, with approximately 4,800' of associated pipelines. Little additional design work is required to advance this project.

30. Soapstone Section 9 Well & Stock Water System (12-69-9.1)

This project involves the construction of a new well, solar pump, tanks and pipeline, replacing an unpermitted and unreliable windmill. The new well would be located on the

Soapstone Grazing association property in Section 9, Township 12 North, Range 69 West. One set of tanks would be installed near the well and a second set of tanks could be located in Section 16, which is a State section. Little additional design work is required to advance this project.

31. Soapstone Goose Camp Well & Stock Water (13-69-26.1)

This project involves work at the existing Goose Camp No. 1 Well, SEO permit No. UW 196466 in Section 26, Township 13 North, Range 69 West. Two options were considered for this project: at a minimum, the project will involve installing a solar pump, panels, and tanks in the existing well. The project could be expanded to include drilling a new well and the installation of the solar pump, panels and tanks. The budget for this project assumes a new well will be drilled and that the old well will be plugged and abandoned. Additional design work is required to advance this project.

32. Soapstone Flattery Windmill Replacement (13-69-34.1)

This project involves the replacement of the Flattery windmill well, WY SEO Permit No. UW 196467 in Section 34, Township 13 North, Range 69 West. The most complete option for this project is to plug and abandon the old well and drill a new well. A new solar pump and three 10' diameter tire tanks would be installed in Section 34, with pipeline approximately one-quarter mile in length installed from the well to another set of tanks located in the SW ¼ of Section 35. Little additional design work is required to advance this project.

33. Bath State Spring Development (13-72-36.1)

This project will involve a spring development, pipeline, and tank, and then installing a fence around the spring development in Section 36, Township 13 North, Range 72 West, which is a State section. Little additional design work is required to advance this project.

34. Bath State Stock Reservoir (13-72-36.2)

This project will involve construction of new small stock reservoir on an ephemeral draw, tributary to Johnson Creek in the SE NW Section 36, Township 13 North, Range 72 West, which is a State section. The dam will be approximately 12' tall and 150 feet long. Additional design work is required to advance this project.

35. Bowman Wildlife Habitat (14-61-20.1)

This project involves construction of an approximately 10 acre grassed waterway and six rock checks along Lodgepole Creek in Section 20, Township 14 North, Range 61 West to prevent erosion in the area. This project will provide wildlife habitat along the grassed water way. Additional design work is required to advance this project.

36. Mead Irrigation (14-63-14.1)

This project involves the construction of a new small irrigation reservoir and associated irrigation system. This reservoir will be located in an existing low area on the owner's property. Surface water, including possible water from the county road borrow ditches will be diverted into the reservoir. Additional design work is required to advance this project.

37. <u>McWilliams Sec 10 Pump (14-64-10.1)</u>

This project involves installation of a new solar pump system into an existing well, the McWilliams No. 6 Well, Permit No. UW 26918 in Section 10, Township 14 North, Range 64 West. The solar pumping system will replace a windmill. The tank at the site is in good condition and will not need to be replaced. Little additional design work is required to advance this project.

38. <u>McWilliams State Sec 16 Stock Water (14-64-16.1)</u>

This project involves installation of a new solar pump system into an existing well, the McWilliams No. 3 Well, Permit No. UW 11527 in Section 16, Township 14 North, Range 64 West. The solar pump will replace a windmill. Also, the project will include installation of a new bottomless tank near the well. Little additional design work is required to advance this project.

39. <u>Polo Ranch Sections 8, 9 and 10 Stock Water Project (14-68-8.1)</u>

This project involves construction of a new stock watering system, including new well; submersible electric pump, and power service from the existing powerline. The pipeline will run from the new well, located in the NE1/4 NE1/4 of Section 8, Township 14 North, Range 68 West, to a set of tanks in Section 9 and to another set of tanks in Section 10. The pipeline will be approximately 8500' long. Additional design work is required to advance this project.

40. <u>Polo Ranch Bell Ditch & Home Ditch (14-68-13.1)</u>

This project involves rehabilitation and replacement of the diversion dam(s) and head gates for the Home No. 1 Ditch (CD 01/010) and the Bell No. 2 Ditch (CD 01/010). These ditches are territorial water rights and were adjudicated under the Crow Creek Court decree. The Home Ditch No. 1 has a water right for 1.66 cfs and the Bell No. 2 Ditch has a water right for 4.5 cfs. Both ditches have a priority date of March 31, 1888. Additional survey and design is necessary before an application for this project will be complete.

41. <u>Polo Ranch Section 15 Crow Creek Bank Stabilization (14-68-15.2)</u>

This project involves rehabilitation of a ranch road crossing and bank stabilization along Crow Creek in Section 15, Township 14 North, Range 68 West, including riprap and erosion control. This area was damaged during the high flows in the spring of 2016 and has been temporarily repaired. If a more permanent repair is not completed, it is likely that additional erosion damage will occur in this area. Additional design will be necessary to prior to submitting an application for this project.

42. <u>Polo Ranch Section 15 Stock Pipelines and Tanks (14-68-15.1)</u>

This project involves construction of a new stock water pipeline and set of tanks. The water source will be the existing Polo No. 15 Well, Permit Nos. UW 178232 and UW 203580 in Section 15, Township 14 North, Range 68 West. This well has a solar pumping system and tanks. A pipeline will convey water from the existing No. 15 Well to a new set of tanks, which will be located in the SENE of Section 16 which is a State or School Section. A new solar pump will be required to move water from the No. 15 Well to the new tank(s). Additional design will be necessary to prior to submitting an application for this project.

43. Polo Ranch Section 23 Stock Water Project (14-68-23.1)

This project involves construction of a new stock water pipeline and set of tanks. The water source will be the existing Polo No. 23 Well, Permit No. UW 178227 in Section 23, Township 14 North, Range 68 West. This well has a submersible electric pump and tanks. A new pipeline will convey water from the existing No. 23 Well to a new set of tanks, which will be located in the SW NW of Section 24 Township 14 North Range 68 West. Little additional design work is required to advance this project.

44. Jawbone Gulch Ranch Bramford Ditch Rehab (14-70-22.1)

This project involves repair and rehabilitation of the diversion dam and headgate for the Bramford Ditch, Permit No. 10747 in SE ¼ of Section 22, Township 14 North, Range 70 West. The ditch diverts from South Fork Middle Crow Creek approximately one-half mile upstream of Crystal Reservoir. Additional design will be necessary to prior to submitting an application for this project.

45. Jawbone Gulch Ranch Bramford #1 & #2 Ditch Rehab (14-70-22.2)

This project involves repair and rehabilitation of the diversion dam and headgates for the Bramford No. 1 Ditch, Permit No. 20940 and the Bramford No. 2 Ditch, Permit No. 20941. These ditches share a common diversion dam that diverts water from the South Fork Middle Crow Creek. The project is located in the NW ¼ SW ¼ Section 22, Township 14 North, Range 70 West. Additional design will be necessary to prior to submitting an application for this project.

46. R&K Farms Stock Pipeline & Tank (15-60-20.1)

This project involves construction of a pipeline from an existing stock tank, supplied by the Freeburg #3 Well, Permit No. UW 198891 in Section 21, Township 15 North, Range 60 West. The pipeline will convey water to two new tanks that will be located in Section 20, Township 15 North, Range 60 West. There is no other water source for the pasture in the north ½ of Section 20. Little additional design is required to advance this project.

47. R&K Farms Stock Pipeline & Tank (15-60-20.2)

This project involves construction of new well, solar pump, and tank in the SWNW of Section 20, Township 15 North, Range 60 West. In addition to the stock water benefits, this well and tank will also provide water for wildlife. This project will provide back up or redundancy for the R&K Farms stock water pipeline, listed as project 15-60-20.1. Little additional design is required to advance this project.

48. Kathleen Lyon Stock & Wildlife Water (15-62-5.1)

This project involves construction of a new stock watering system and wildlife plot, in Section 5, Township 15 North, Range 62 West. including a new well; solar pumping system, 2 – 10' diameter galvanized tanks near the well; ½ mile of pipeline; and a second set of tanks (2-10' dia. galvanized tanks). A wildlife food plot will be constructed near the well with a drip system installed to irrigate the food plot. Little additional design is required to advance this project.

49. Gary Lyon Stock & Wildlife Water (15-62-7.1)

    This project involves construction of a new stock watering system and wildlife plot in Section 7, Township 15 North, Range 62 West, including a new well; electric pump, 2 – 10' diameter galvanized tanks near the well; ¾ mile of pipeline; and a second set of tanks (2-10' dia. galvanized tanks). The new well will be a replacement for the existing Gary #1 Stock Well, Permit No. UW 54639. A wildlife food plot will be constructed the tanks with a drip system installed to irrigate the food plot. Little additional design is required to advance this project.

50. Larry Lyon Stock Water (15-62-8.1)

    This project involves construction of a new stock watering system, including new well; solar pumping system, and 2 – 10' diameter tire tanks near the well in Section 8, Township 15 North, Range 62 West. Little additional design is required to advance this project.

51. Keenan Stock Water (15-63-20.1)

    This project involves construction of a new stock watering system, including new well; solar pump, panels and associated equipment; and a tank near the well in Section 20 Township 15 North, Range 63 West. This well will require a new well permit. Little additional design is required to advance this project.

52. Hallock Section 4 Stock Water (15-65-4.1)

    This project involves installation of a solar pump, panels and tank(s) at the Hallock #1 Well Permit No. UW 202658. This well is located in Section 4, Township 15 North, Range 65 West. The well has been drilled and cased, but no pump has been installed. Also no statement of completion has been filed. Little additional design is required to advance this project.

53. Dudash Section 18 Stock Water Pipeline (15-68-18.1)

    This project involves construction of a 5000' 2" stock water pipeline to connect the existing Goodman South Well, Permit No. UW 144810 to an existing tire tank in Section 18, Township 15 North, Range 68 West. The Goodman South Well supplies a stock tank near the well. Both are located near the south west corner of Section 18. The existing tire tank that the new pipeline would supply is located closer to the center of Section 18, and is currently supplied by well(s) that are located on the adjacent landowner's property. Little additional design is required to advance this project.

54. Lorenz Ranch North 3-4 Spring (15-70-3.1)

    This project involves the development/rehabilitation of the 3-4 Spring, Permit No. UW 173982, in Section 3 Township 15 North, Range 70 West. The project includes the spring rehabilitation, spring box, a short pipeline, and tank, and installing a fence around the spring. Little additional design is required to advance this project.

55. Lorenz Ranch Section 4 Spring Development (15-70-4.1)

This project involves the development/rehabilitation of a spring located in Section 4, Township 15 North, Range 70 West. The project includes the spring rehabilitation, spring box, a short pipeline, and tank, and installing a fence around the spring. This spring does not have a water right, so a new application will be necessary. Little additional design is required to advance this project.

56. Lorenz Ranch Section 13 Stock Water Project (15-70-13.1)

This project creates stock water in Section 13, Township 15 North, Range 70 West. Two options are available: drilling a well, with solar pump and tanks at the site or installing a pump in South Lodgepole Creek, near the ranch house, and a 2 mile long pipeline to the site. Additional designs, including costs estimates for the project will need to be completed for this project.

57. Lorenz Ranch Section 23 Stock Water Project (15-70-23.1)

This is a stock water project that will provide water to a pasture on Mesa Mountain in Section 23, Township 15 North, Range 70 West. Water is scarce on Mesa Mountain and the pasture is under-utilized. Two options are available: drill a well at the site or pump water from a spring on the west side of the mesa. Additional design will be necessary to prior to submitting an application for this project.

58. Lorenz Ranch Hill Horse Spring Pipeline (15-70-25.1)

This is a stock water project that will provide water to Mesa Mountain in Section 25 Township 15 North Range 70 West, by pumping water from the existing Hill Horse Spring, Permit No. UW 173983 using a new solar pump, and pipeline, to a new set of tanks up the hill. Fencing will be required. Additional design will be necessary to prior to submitting an application for this project.

59. North Crow Creek Wetlands (15-70-35.1)

This environmental project will repair and stabilize the wetland complex, which has developed along North Crow Creek upstream of the North Crow Diversion dam. This project is located in the Woodhouse Recreation and Wildlife Habitat Area in Section 35, T15N, R70W and public access and recreation is allowed in this area. This project is located on land owned by the City of Cheyenne. Additional design will be necessary to prior to submitting an application for this project.

60. * Albin – Bushnell Draw Stock Reservoir (16-61-1.1)
61. * Albin – Forester Mills Creek Stock Reservoir (17-60-31.1)
62. * Albin - Hanson Stock Reservoir (17-60-32.1)
63. * Albin - Bella Farms Stock Reservoir (17-60-34.1)

* These projects involve construction of four small reservoirs in the Albin, Wyoming area. Each of the reservoirs can provide stock water, wildlife habitat, flood control, and potentially groundwater recharge benefits. It is anticipated that these projects will be eligible for Small Water Project funding.

Additional design work will be required before submitting the final applications for these projects. Conceptually, each of the reservoirs will involve construction of a small dam (less than 20' tall), spillway, and low-level outlet to drain the reservoirs. The face of the dam will be vegetated, and no riprap would be installed.

64. Spatz Stock Water (16-63-29.1 and 30.1)

    This project involves construction of a new stock watering systems, including new well, submersible electric pump and power service from the existing pipeline in Sections 29 and 30, Township 16 North, Range 63 West. The well will feed four new stock tanks via four new pipelines with a total length of approximately 5000'.Little additional design is required to advance this project.

65. Berry Ranch Solar Conversion Section 1 (16-65-1.1)

    An existing stock well, Permit No. UW 11826, will be converted from wind power to solar power. The project will include installing a solar pump with solar panels and controllers. The existing well is 260 feet deep and includes a backup submersible pump run by a portable generator. The well feeds an existing bottomless tank. Little additional design is required to advance this project.

66. Berry Ranch Solar Conversion Section 2 (16-65-2.1)

    An existing stock well, Permit No. UW 11821, will be converted from wind power to solar power. The project will include installing a solar pump with solar panels and controllers. The existing well is 280 feet deep and includes a backup submersible pump run by a portable generator. The well feeds an existing bottomless tank. Little additional design is required to advance this project.

67. Berry Ranch Solar Conversion Section 22 (16-65-22.1)

    An existing stock well, Permit No. UW 11819 will be converted from wind power to solar power. The existing bottomless tank will be reused. The existing well is 280 feet deep. The project will include installing a new well, solar pump with solar panels and controllers. Little additional design is required to advance this project.

68. Berry Ranch Solar Conversion Section 23 (16-65-23.1)

    An existing stock well, Permit No. UW 14620 will be converted from wind power to solar power. The project will include installing a new well, solar pump with solar panels and controllers. The existing bottomless tank will be reused. The existing well is 240 feet deep. Little additional design is required to advance this project.

69. Berry Ranch Section 23 Pipeline & Tanks (16-65-23.2)

    This project involves the construction of a new pipeline and two new stock tanks to provide stock water to two pastures. The existing well is in the southeast quarter of the northeast quarter of Section 23, Township 16 North, Range 65 West. The pipeline will extend to northeast into the southwest quarter of the southwest quarter of Section 13, Township 16 North, Range 65 West.

The existing well, Permit No. UW 91315 is 380 feet deep and includes a submersible pump run by a portable generator. The pipeline will be 1,910 feet long, a 4,500-gallon bottomless tank will also be installed near the well and at the end of the pipeline. New power service will be run 1,910 feet from the existing well to the east to provide reliable power to the existing submersible pump. This project will allow land that was previously used for dryland farming to be converted to native pasture for livestock grazing. Additional design work will be required to advance this project.

70. Berry Ranch Solar Conversion Section 27 (16-65-27.1)

An existing stock well, Permit No. UW 67208 will be converted from wind power to solar power. The project will include installing a new well, solar pump with solar panels and controllers. The existing well is 300 feet deep. The existing bottomless tanks will be reused. Little additional design is required to advance this project.

71. Paul Kahlr #2 Well Tank (16-65-34.1)

This project involves the addition of a stock tank and appropriate fencing for the existing E. Kahler #2 Well, Permit No. UW 9772. The well currently has a solar pump. Little additional design is required to advance this project.

72. Paul Bam Bam Well Solar Pump & Tank (16-65-34.2)

This project involves the installation of a solar pump into an existing well, the #1 Bam-Bam 14-34 WSW, WY SEO Permit No. UW 92835. A stock tank will be installed next to the well. This well was drilled in 1993 and the reported yield is 25 gpm. Little additional design is required to advance this project.

73. Paul North Section 34 Stock Water Project (16-65-34.3)

This project involves drilling a new well in the NE 1/4 NE 1/4 Section 34, Township 16 North, Range 65 West. The pump will be a solar pump with panels, and a tank will be installed near the well. Minor additional design work will be required to advance this project.

74. Kleiman Section 35 Well & Stock Water (16-65-35.1)

This project involves construction of a new stock watering system, including new well; solar pump, panels and associated equipment; a tank near the well; ½ mile pipeline; and a second tank at the end of the pipeline. The project is located in Section 35, Township 16 North, Range 65 West. The new well will be a replacement for the existing Birdie #1 Well, Permit No. UW 200817. Little additional design is required to advance this project.

75. Hollingsworth South Pipelines & Tanks (15-68-1.1)

This project involves construction of 2 new pipelines and 2 stock tanks to extend an existing stock watering system to serve additional pastures. The first pipeline will be approximately 2000' long and 2" diameter and will serve one new tank located in Section 1 Township 15 North, Range 68 West. The pipeline will connect to the existing stock water pipeline system, near the SW corner of Section 31, T16N, R67W. The second pipeline also will be approximately 2000' long and 2" diameter and will serve one new tank in Section 11 Township 15 North, Range 68 West. The pipeline will connect to the existing stock water pipeline system, near the existing stock tank in Section 2, Township 15 North, Range 68 West. Minor additional design work will be required to advance this project.

76. Hollingsworth North Stock Water (16-67-5.1)

    This project involves construction of a new stock watering system, including new well; submersible electric pump, two new stock tanks and associated pipelines in Section 5, Township 16 North, Range 67 West. The well will also provide back-up water supply for an existing stock system located in Section 8, Township 16 North, Range 67 West. A little additional design work is required to advance this project.

77. Hollingsworth Section 19 Erosion Protection (16-67-19.1)

    This project involves bank stabilization, placement of riprap, and wetlands construction to control erosion below an existing road that crosses Lodgepole Creek in Section 19, Township 16 North, Range 67 West. This project will also protects a critical stock water pipeline that crosses the creek in this location. Minor additional design work will be required to advance this project.

78. Hollingsworth Middle Pipelines & Tanks (16-67-30.1)

    This project involves construction of 2 new pipelines and 3 stock tanks to extend an existing stock watering system to serve additional pastures. The first pipeline will be approximately 8000' long and will provide water to new two tanks, one located in Section 29 and one located in Section 30, Township 16 North, Range 67 West. The second pipeline will be approximately 6250' long. This pipeline will serve one tank in Section 32, Township 16 North, Range 67 West. These will connect to existing stock water pipelines and provide redundant or back up water sources for several pastures. Minor additional design work will be required to advance this project.

79. LF Enterprises Section 8 Stock Water (16-67-8.1)

    This project involves construction of a new stock watering system, including pipeline from an existing well and two sets of new tanks in Section 8, Township 16 North, Range 67 West. Water will be supplied from the existing Falen #2 Stock well, Permit No. UW 205814. Little additional design work is required to advance this project.

80. LF Enterprises Section 8 Irrigation Well (16-67-8.2)

    This project involves construction of a new irrigation project, including a new well, new irrigation pump, and sprinkler system in Section 8, Township 16 North, Range 67 West. This project will provide irrigation for approximately 40 acres. Additional design will be necessary to prior to submitting an application for this project.

81. Falen #2 Stock Reservoir (16-67-21.1)

    This project involves completion of an existing stock reservoir that has been constructed near Lodgepole Creek in the SE ¼ of Section 21, Township 16 North, Range 67 West. The permit for the Falen #2 Stock Reservoir, Permit No. 15978 SR, which appears to cover this facility, has been cancelled. A new permit will be required and additional design work completed before submitting an application for this project.

82. Baccei Section 28 Stock Water System (16-67-28.1)

This project involves construction of a new stock watering system, including a new well, solar pumping system, cistern, and three sets of stock tanks in Section 28, Township 16 North, Range 67 West. Each set of stock tanks will include 2 – 10' diameter tanks or a one 20' diameter bottomless tank. Pipelines will be installed from the new well to the new tanks. Little additional design work is required to advance this project.

83. Vercelli Section 6 Pipeline & Tank (15-68-6.1)

This project involves tapping into an existing pipeline to provide water for Section 6, Township 15 North, Range 68 West. A new pipeline will be constructed and a new 4,500-gallon bottomless stock tank, with associated valves and floats, will be constructed. Little additional design work is required to advance this project.

84. Vercelli Section 19 Stock Water Project (16-68-19.1)

This project involves the construction of a stock well, pipeline and tanks that will be used to provide stock water for two pastures. It will include the drilling a new 400' deep stock well (based on adjacent stock wells) and installing a solar pump with solar panels. 4,320 feet of pipeline and two new 4,500-gallon bottomless tanks will be installed. This project will provide reliable stock water to undeveloped pastures and alleviate stock watering in riparian areas. Minor additional design work will be required to advance this project.

85. Vercelli Section 34 Stock Water Project (16-69-34.1)

This project involves the construction of a stock well, pipeline and tanks that will be used to provide stock water in two pastures. It will include the drilling of a new 400' stock well (based on adjacent stock wells) and installing a solar pump with solar panels. Approximately 3700' of pipeline and two new 4,500-gallon bottomless tanks will be installed. Minor additional design work will be required to advance this project.

86. Y Cross Section 19 Pipelines & Tanks (16-69-19.1)

The purpose of this project is to provide additional water sources for various pastures on the Y-Cross Ranch. Currently, stock water is provided via surface water from the South Fork of Lodgepole Creek which tends to be unreliable during dry years. This project includes installing a solar pump in the existing well, construction of pipelines and stock tanks. Approximately 5050' of pipeline and two 4,500 gallon bottomless stock tanks will be constructed. Minor additional design work will be required to advance this project.

87. Y Cross Section 30 Stock Well & Tank (16-69-30.1)

This project includes a 150' deep stock well, three 4,500-gallon bottomless stock tanks, and 13,200' of pipeline. The purpose of this project is to provide additional water sources for various pastures on the Y-Cross Ranch. Additional design work will be required to advance this project.

88. Y Cross Islay Draw #1 Reservoir Rehab (16-70-24.1)

The Islay Draw #1 Stock Reservoir, Permit No. 105 SR provides water for stock and wildlife and is permitted for 19.60-acre feet of storage. The existing dam is in disrepair due to wave action. The crest of dam needs to be leveled and raised to provide adequate freeboard. Riprap should be placed on the dam. Additional design effort is required to determine the costs of this project prior to submitting an application.

89. Y Cross Tabletop Reservoir Rehab (16-70-36.1)

The Table Top Reservoir provides water for stock and wildlife and is permitted for 49.80-acre feet of storage. However, the existing water rights have expired (Permit 5879 Res). The existing dam is in disrepair due to wave action and the reservoir experiences excessive seepage. Rehabilitating this reservoir for stock water only may not prove cost effective in comparison to other alternative including a new stock well, a series of smaller reservoirs, etc. Additional design work is required to determine the work at this reservoir, to evaluate options, and to develop cost estimates.

90. Islay North Pasture Stock Well & Tank (16-69-21.1)

This project would include construction of a well with solar platform and installation of a 4,500-gallon bottomless tank to reduce or eliminate stock use of nearby riparian areas along Lodgepole Creek. The proposed well would be in the southwest quarter of the southwest quarter of Section 21, Township 16 North, Range 69 West. Existing stock wells adjacent to this section have well depths ranging 20-100 feet. Little additional design work is required to advance this project.

91. Islay Chadwick Reservoir #3 Rehab (16-69-29.1)

Rehabilitation work is recommended for the existing Chadwick Reservoir No. 3 dam, State Engineer's Office Permit No. 5289 Res. The Chadwick Reservoir No. 3 is an on-channel reservoir on Lodge Pole Creek and it is permitted for 27 acre-feet. The existing dam is approximately 1,100 feet long and 10' tall. The reservoir includes a primary concrete spillway controlled by stop-logs, an emergency spillway on the north side of the reservoir and the concrete head gate for the Chadwick No. 3 Ditch, which is a territorial water right. The Chadwich No. 3 dam acts as the diversion for the Chadwick No. 3 Ditch, and the reservoir provides irrigation water, stock water and wildlife habitat.

The recommended work includes removal of vegetation from the dam embankment, leveling and re-grading of the dam crest, repair of the spillway, repair of the head gate, and placing riprap on the face of the dam. The exact work to be done will need additional study and design efforts; therefore no detailed cost estimates were prepared for this project. The work funded through the Small Water Program will be less than the $135,000 limit.

92. Islay Chadwick #1 Ditch Rehab (16-69-29.2)

The Chadwick No. 1 Ditch, Territorial Permit OR 01/222 point of diversion is currently located on Lodge Pole Creek, approximately 1000' below the Chadwick #3 Reservoir, Permit No. 5289 Res. Moving the point of diversion upstream to the existing Chadwick

No. 3 Reservoir is recommended, because this effort would eliminate the need to repair and maintain a separate diversion structure in the creek. This project would include work on the Chadwick No. 3 Ditch, Territorial Permit OR 01/222 so that it can convey the additional water to the Chadwick No. 1 Ditch, installing a new turnout structure and approximately 300 feet of new ditch between the No. 3 and No. 1 Ditches. Additional design work is required to advance this project.

93. Islay Ranch Road Pasture Well (16-69-32.1)

This project involves replacement of an existing spring with a new well and tank. This project is located in the NE quarter of Section 32 Township 16 North, Range 69 West. The spring has been dry in recent years. Replacing the spring with a well and solar pump and 4,500-gallon bottomless stock tank is recommended. This effort will provide a more reliable water source for this pasture. Little additional design work is required to advance this project.

94. Anderson Section 27 Well & Solar Pump (17-63-27.1)

This project involves the construction of a new well and solar platform to replace the existing Anderson No. 3 Well, WY SEO Permit No. UW 9289. This project is located in Section 27, Township 17 North, Range 63 West. The current pump is a windmill and the well has a low yield. A new well will be drilled and a solar pumping system and tanks will be installed. Little additional design work is required to advance this project.

95. Anderson Section 27 Ditch Rehab (17-63-27.2)

This project involves the rehabilitation of a contour ditch system located primarily in the NE ¼ of Section 27, Township 17 North, Range 63 West. This ditch system starts at Highway 85 and flows generally east from the highway. The ditch diverts water from Bushnell Creek. This project is in the mapped FEMA 100- year flood plain. This project will involve re-construction of the ditches.

96. Anderson Section 28 Contour Ditch Rehab (17-63-28.1)

This project involves the rehabilitation of a series of contour ditches located in the NW ¼ of Section 28, Township 17 North, Range 63 West. There are two related ditch systems starting at County Road 144 and flowing east from the road – one to the north and one to the south. These ditches divert water from tributaries of Bushnell Creek. This project is just upstream of the FEMA 100-year flood plain. This project will involve re-construction of the ditches.

5.3 United States Forest Service Stock Water Projects

The US Forest Service has 11 stock water projects in the South Platte River Watershed. These projects are listed on the following Table 5.2 and are their locations are shown on Figure 5.2. Nine of the projects involve rehabilitation of existing facilities and two projects involve construction of new facilities. Water right searches and permit status need to be verified during the design of these projects. Not all of the stock water facilities were visited and the water rights permits could not be verified without more detailed information concerning the locations of these facilities.

Table 5.2: South Platte River Watershed Study USFS Stock Water Projects

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
USFS-1	Albany	14-71-24.1	USFS-1	Spring Development	USFS	Jackie Roaque	24 T14N R71W	41.1728 N	105.2987 W
USFS-2	Albany	14-71-15.1	USFS-2	Spring Rehabilitation	USFS	Jackie Roaque	15 T14N R71W	41.1900 N	105.3460 W
USFS-3	Albany	15-71-31.1	USFS-3	Spring Rehabilitation	USFS	Jackie Roaque	31 T15N R71W	41.2234 N	105.3876 W
USFS-4	Albany	15-72-24.1	USFS-4	Spring Rehabilitation	USFS	Jackie Roaque	24 T15N R72W	41.2600 N	105.4174 W
USFS-5	Albany	15-71-31.1	USFS-5	Spring Rehabilitation	USFS	Jackie Roaque	31 T15N R71W	41.2320 N	105.4013 W
USFS-6	Albany	15-71-35.1	USFS-6	Spring Rehabilitation	USFS	Jackie Roaque	35 T15N R71W	41.2219 N	105.3192 W
USFS-7	Albany	15-71-35.2	USFS-7	Spring Rehabilitation	USFS	Jackie Roaque	35 T15N R71W	41.2330 N	105.3154 W
USFS-8	Albany	15-71-13.1	USFS-8	Spring Rehabilitation	USFS	Jackie Roaque	13 T15N R71W	41.2685 N	105.3043 W
USFS-9	Albany	15-71-2.1	USFS-9	Spring Rehabilitation	USFS	Jackie Roaque	2 T15N R71W	41.2977 N	105.3107 W
USFS-10	Albany	15-72-14.1	USFS-10	Spring Rehabilitation	USFS	Jackie Roaque	14 T15N R72W	41.2645 N	105.4316 W
USFS-11	Albany	15-71-6.1	USFS-11	Spring Development	USFS	Jackie Roaque	6 T15N R71W	41.3000 N	105.3986 W

Conceptually, each of the USFS Stock water projects will involve developing a spring, a short pipeline, and installation of a tank. A fence will be installed around each of the springs. The exact details of each project will be determined during final design of the project and prior to submittal of an application for it. For cost estimating purposes, the following work was assumed for each project: A spring development with perforated pipe, gravel, and spring box; 400' of 2" pipe downhill (east) from the spring box to the tanks; A new 10' diameter tire tank with miscellaneous valves and 400' of fence with a gate around the spring would be constructed.

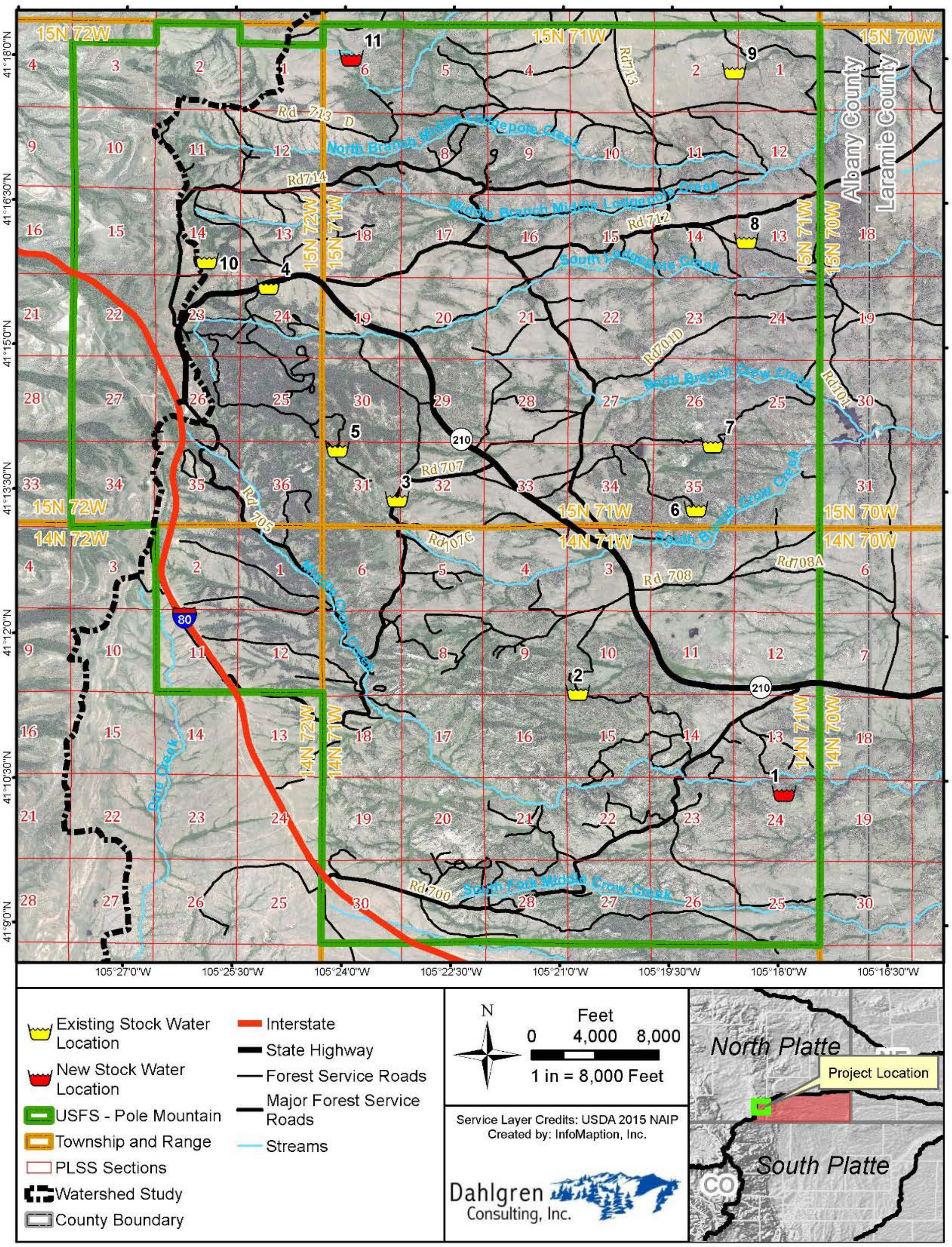

Figure 5.2 USFS Pole Mountain Stock Water Locations

Document Name: USFS_Stock Water Projects
Date Saved: 6/13/2018

5.3 Other Projects

In addition to the Small Water Projects and the Forest Service Stock water projects described in the previous sections of this report, the “Other Projects” listed in this section of the report include projects that would be beneficial to the South Platte Watershed, but likely will not qualify as a Small Water project. These projects are generally more expensive than the $135,000 limit of the Small Water Project program. Maps showing the locations of these projects are presented at the end of this chapter of the report.

Mackley Reservoir and Ditches Project (12-63-13.1 and 12-62-18.1)

This project involves repair and rehabilitation of an irrigation system including the Mackley Reservoir, Permit No. 2037Res and the associated irrigation ditches. The reservoir is permitted to store 148 acre-feet and the Wyoming rights for the ditches total approximately 3.24 cfs. The reservoir and associated ditches have priority dates from the early 1900’s.

This project is located on Crow Creek near the Colorado – Wyoming state line. The Mackley Reservoir dam has been washed out for some time, which raises concerns about the “soundness” or validity of the water rights. Abandonment of the water rights could be possible.

Repair or reconstruction of the Mackley dam back to its original configuration may not be feasible. However, the potential benefits of a project at the Mackley Reservoir site include wildlife habitat, water quality, and perhaps groundwater recharge, even if the original irrigation rights are not re-activated or used.

Crow Creek Groundwater Recharge Project (12-63-36.1)

A Crow Creek Groundwater Recharge project was described in a WWDC funded Level II Study completed by States West Water Resources in 1990.

This study is available on the WWDC project reports website at: http://library.wrds.uwyo.edu/wwdcrept/Crow_Creek/Crow_Creek-Flood_Control_and_Groundwater_Recharge_Project- Executive_Summary-1990.html.

This Level II study described the potential to use flood water in Crow Creek for artificial recharge of groundwater in the Carpenter, Wyoming area. Conceptual designs of recharge projects were developed in this study. Check dams in Crow Creek, pipelines, and ditches were some of the options considered in this study and cost estimates for these ideas were developed. These cost estimates ranged from approximately $150,000 to $986,000. Using the US Bureau of Labor Statists inflation cost index or multiplier of 1.87 (27 years at an average inflation rate of approximately 2.35%) to inflate or adjust the costs estimates from the 1990 Study to 2017 results in cost estimates that range from approximately $280,000 to $1,850,000.

Although a Crow Creek Groundwater Recharge Project was not studied extensively during this Watershed study, the projects and concepts presented in the Level II study seem valid and would be beneficial to the Watershed.

Water availability will be a key consideration to determine if a Crow Creek – Carpenter area recharge project is feasible, practical, and/or beneficial. The 1990 Level II study estimated that approximately 600 acre-feet of water would be available for groundwater recharge. Since the 1990 study was completed, the USGS stream gage, Crow Creek at 19th Street has been operating and much more date concerning flows in Crow Creek are available. Based on the 19th Street stream gage and other supplemental or miscellaneous flow measurements and monitoring of Crow Creek near Carpenter, it appears that more water is available in Crow Creek than was estimated in the 1990 Level II report.

It is recommended that the feasibility of a Crow Creek – Carpenter groundwater recharge study be re-visited and studied again. This project could be done in conjunction with some sort of a Mackley Reservoir project, as described above.

Swan Ranch – Clear Creek Reservoirs Project (13-67-15.1)

The City of Cheyenne owns two reservoirs located on Clear Creek, just south of I-80 in Section 15, T13N, R67W. The accompanying map shows the locations of these reservoirs. The larger reservoir, Swan Ranch Reservoir, Permit No. 942RES is permitted to store 247 acre-feet. The smaller reservoir, the Clear Creek Reservoir, Permit No. 1741RES is permitted to store 69 acre-feet.

The conditions of these reservoirs, their benefits, potential risks and/or hazards should be evaluated. Repair, rehabilitation or breaching and abandonment of these reservoirs may be warranted. During this Watershed study Dino-Nobel expressed interest in additional fire flow storage and water supply. These reservoirs could store water for fire-fighting, as well as wildlife habitat, recreational opportunities, and flood control benefits.

Also, Clear Creek joins Crow Creek downstream of the point of diversion for the senior City of Cheyenne – BOPU water right and may not be subject to regulation or administration for this right. Additional study of the Clear Creek Reservoirs is recommended.

Chapter 6 - Funding Sources and Descriptions

6.1 Funding Sources Introduction

Federal, State, Local and Private funding sources and assistance are available for many of the projects proposed or described in the Watershed Management Plan. Coordination with the landowner, land management agencies, funding agencies, and Conservation District(s) will be vital to determine the optimum funding and assistance package for a project. Some entities will provide technical support, while others will provide technical assistance and perhaps in-kind services. Opportunities for partnerships, incentives and cooperative projects should be thoroughly explored.

Additional evaluation of the funding sources and other assistance available for a specific project will need to be completed as the project moves through additional design and planning efforts.

Funding sources are categorized in Figure 6.1: First by the nature or type of the project and the entity that is looking for funding; and second by prerequisites for the funding source such as aquatic verses terrestrial habitat. Federal funding sources are colored green, state funding sources are yellow and private or Non-government organization funding sources is orange. More details about each of the funding sources can be found in the following pages.

Additional resources for more funding can be found at any of these links:

- Water Management & Conservation Assistance Programs 2014 Directory
  - Developed by the Wyoming State Engineer's Office but is currently maintained by the Wyoming Water Development Commission
  - http://wwdc.state.wy.us/wconsprog/2014WtrMgntConsDirectory.html
- Grants.gov
  - Federal grant website that allows users to search by location and keyword
  - https://www.grants.gov/web/grants/search-grants.html
- Catalog of Federal Funding Sources for Watershed Protection
  - Created by the Environmental Protection Agency and is organized by agency name
  - https://ofmpub.epa.gov/apex/watershedfunding/f?p=fedfund:1.

Local resources that can provide further information include but are not limited to:

- Laramie County Conversation District (307-772-2600)
- Laramie Rivers Conservation District (307-721-0072)
- Laramie County Natural Resource Conservation Service: (307-772-2314)
- Albany County Natural Resource Conservation Service: (307-223-3271)
- Wyoming Water Development Commission (307-777-7626)
- Bureau of Land Management/Rawlins District Office (307-328-4200)

- USFS Medicine Bow National Forest: Laramie Ranger District (307-326-5258)
- WGFD Laramie Regional Office (307-745-4046)
- Wyoming Wildlife and Natural Resources Trust (307-777-8024)

6.2 Funding and Assistance Sources and Descriptions

6.2.1 Federal Sources

6.2.1.1 Bureau of Land Management

6.2.1.1.1 Watershed Restoration and Fisheries Improvement
Eligibility:
Non-Profits having a 501c(3) status with the IRS, institutions of higher learning, Native American tribal governments, public and state controlled institutions of higher learning, City or Township, County and State governments
Description:
Projects aided at protection, restoration and enhancement of watersheds within Wyoming. Specifically, watersheds within the Upper Green River, Bighorn River and Platte River watersheds. The principle purpose of this agreement will be to encourage riparian and aquatic improvement projects that benefit fish, wildlife, and other biotic resources on public lands
Website Location:
https://www.grants.gov/web/grants/view-opportunity.html?oppId=294541

6.2.1.1.2 Other
Eligibility:
Varies
Description:
The BLM has some very site or habitat specific grants that can be released and can be located either through the site below or contacting a local BLM Field Office.
Website Location:
https://www.grants.gov/web/grants/search-grants.html
https://www.blm.gov/contact/wyoming

6.2.1.2 US Bureau of Reclamation

6.2.1.2.1 Cooperative Watershed Management Program
Eligibility:
Community/Watershed Group, Conservation District, Indian Tribes, Irrigation and Drainage Districts, Local Government, Nonprofit Groups, State/Territorial Agency
Description:
Through the Cooperative Watershed Management Program (CWMP), Reclamation provides financial assistance to locally led watershed groups to encourage diverse stakeholders to form local solutions to water management needs. By providing this funding, Reclamation aims to promote the sustainable use of water resources and improve the condition of rivers and streams through water conservation, improved water quality and ecological resilience, and reduced conflicts over water through

collaborative conservation efforts.
Website Location:
https://www.usbr.gov/watersmart/cwmp/index.html

6.2.1.2.2 Drought Response Program
Eligibility:
Native American Tribes, Irrigation and Drainage Districts, State/Territorial Agency
Description:
The Bureau of Reclamation's new Drought Response Program supports a proactive approach to drought. It will provide assistance to water users for drought contingency planning, including consideration of climate change information and to take actions that will build long-term resiliency to drought
Website Location:
https://www.usbr.gov/drought/

6.2.1.2.3 WaterSMART Grants
Eligibility:
Native American Tribes, Irrigation and Drainage Districts, Nonprofit Groups, State/Territorial Agency
Description:
WaterSMART Grants is administered by the Bureau of Reclamation and is designed to contribute to this goal by providing 50% cost shared funding for water and energy improvement projects that make more efficient use of existing water supplies. WaterSMART Grants provide cost-shared assistance on a competitive basis. Funding is used primarily to carry out water and energy efficiency improvements, including projects that save water; increase energy efficiency and the use of renewable energy in water management; support environmental benefits; facilitate and support water markets; mitigate the risk of future water conflict in areas of high risk; and accomplish other benefits that contribute to water supply sustainability in the western United States.
Website Location:
https://www.usbr.gov/watersmart/grants.html

6.2.1.3 Environmental Protection Agency (EPA)

6.2.1.3.1 Brownfields Assessment and Cleanup Cooperative Agreements
Eligibility:
Educational Institution, Local Government, State/Territorial Agency, Tribal Agency
Description:
Brownfield sites are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. The objectives of the brownfield assessment, revolving loan fund and cleanup cooperative agreements (project grants) are to provide funding: (1) to inventory, characterize, assess, and conduct planning and community involvement related to brownfield sites; (2) to capitalize a revolving loan fund (RLF) and provide sub-grants to carry out cleanup activities at brownfield sites; and (3) to carry out cleanup activities at brownfield sites that are owned by the grant recipient.

Website Location:
https://www.epa.gov/brownfields

6.2.1.3.2 Clean Water State Revolving Fund

Eligibility:
Business, Community/Watershed Group, Conservation District, Local Government, Nonprofit Groups, Private Landowner, State/Territorial Agency, Tribal Agency, Water and Wastewater Utilities

Description:
The EPA's Clean Water State Revolving Fund (CWSRF) program provides a permanent source of low-cost financing for a wide range of water quality infrastructure projects. These projects include municipal wastewater treatment and collection, nonpoint source pollution controls, decentralized wastewater treatment systems, green infrastructure, water efficiency, and estuary management. Funds to capitalize the program are provided annually through federal grants and state matching funds (equal to 20 percent of federal grants). Monies are loaned to assistance recipients at below-market rates. In addition, states also have the ability to customize loan terms to benefit small and disadvantaged communities. Loan repayments are recycled back into the programs to fund additional projects. Since its inception, the CWSRF has provided over $118 billion in assistance to eligible borrowers, including communities of all sizes, farmers, small businesses, and nonprofit organizations

Website Location:
https://www.epa.gov/cwsrf

6.2.1.3.3 Drinking Water State Revolving Fund

Eligibility:
Community/Watershed Group, Conservation District, Educational Institution, Nonprofit Groups, State/Territorial Agency, Tribal Agency, Water and Wastewater Utilities

Description:
EPA awards grants to states to capitalize their Drinking Water State Revolving Fund (DWSRF) programs. States use a portion of their capitalization grants to set up a revolving fund from which loans are provided to eligible public water utilities (publicly and privately owned) to finance the costs of infrastructure projects. States rank projects and offer loans to utilities based on a priority ranking system. Priority is given to eligible projects that: (1) address the most serious risk to human health; (2) are necessary to ensure compliance with the requirements of the Safe Drinking Water Act; and, (3) assist systems most in need, on a per household basis, according to state-determined affordability criteria. States may also use up to 31 percent of their capitalization grants to fund set-aside activities that help to prevent contamination problems of surface and ground water drinking water supplies, as well as enhance water system management through source water protection, capacity development, and operator certification programs.

Website Location:
https://www.epa.gov/drinkingwatersrf

6.2.1.3.4 ***Five Star Restoration Program***

Eligibility:

Business, Community/Watershed Group, Conservation District, Educational Institution, Local Government, Nonprofit Groups, Private Landowner, State/Territorial Agency, Tribal Agency, Water and Wastewater Utilities

Description:

The EPA supports the Five-Star Restoration Program by providing funds to the National Fish and Wildlife Foundation and its partners, the National Association of Counties, NOAA's Community-based Restoration Program and the Wildlife Habitat Council. These groups then make sub-grants to support community-based wetland and riparian restoration projects. Competitive projects will have a strong on-the-ground habitat restoration component that provides long-term ecological, educational, and/or socioeconomic benefits to the people and their community. Preference will be given to projects that are part of a larger watershed or community stewardship effort and include a description of long-term management activities. Projects must involve contributions from multiple and diverse partners, including citizen volunteer organizations, corporations, private landowners, local conservation organizations, youth groups, charitable foundations, and other federal, state, and tribal agencies and local governments. Each project would ideally involve at least five partners who are expected to contribute funding, land, technical assistance, workforce support, or other in-kind services that are equivalent to the federal contribution.

Website Location:

https://www.epa.gov/wetlands/5-star-wetland-and-urban-waters-restoration-grants

6.2.1.3.5 ***Urban Water Small Grants***

Eligibility:

Educational Institution, Indian Tribes, Local Government, Nonprofit Groups, Schools and Governments, State/Territorial Agency, Tribal Agency

Description:

The mission of EPA’s Urban Waters Program is to help local residents and their organizations, particularly those in underserved communities, restore their urban waters in ways that also benefit community and economic revitalization. EPA's funding priority is to achieve the goals and commitments established in the Agency's Urban Waters Strategic Framework (www2.epa.gov/urbanwaters/urban-waters-strategic-framework). One of the ways the Urban Waters Program is accomplishing this mission is through the Urban Waters Small Grants Program. This program recognizes that healthy and accessible urban waters can help grow local businesses and enhance educational, recreational, social, and employment opportunities in nearby communities.

Website Location:

https://www.epa.gov/urbanwaters/urban-waters-small-grants

6.2.1.3.6 ***Wetlands Program Development Grants***

Eligibility:

Local Government, Nonprofit Groups, State/Territorial Agency, Tribal Agency

Description:

The EPA's Wetland Program Development Grants are intended to encourage

comprehensive wetlands program development by promoting the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution. Projects build the capacity of states, tribes, and local governments to effectively protect wetland and riparian resources. Projects funded under this program support building or refining a wetlands program through four core elements of a wetlands program: regulation, monitoring/assessment, voluntary restoration/protection, and water quality standards for wetlands.
Website Location:
https://www.epa.gov/wetlands/wetland-program-development-grants

6.2.1.4 Farm Service Agency (USDA FSA)

6.2.1.4.1 CRP Grasslands
Eligibility:
Private Land Owners
Description:
The Conservation Reserve Program (CRP) Grasslands is part of the CRP program, a federally funded voluntary program that contracts with agricultural producers so that environmentally sensitive agricultural land is not farmed or ranched, but instead used for conservation benefits. The U.S. Department of Agriculture (USDA) provides participants with rental payments and cost-share assistance. Contract duration is between 14 and 15 years. CRP Grasslands helps landowners and operators protect grassland, including rangeland, and pastureland, and certain other lands, while maintaining the areas as grazing lands. The program emphasizes support for grazing operations, plant and animal biodiversity, and grassland and land containing shrubs and forbs under the greatest threat of conversion. CRP Grasslands is authorized by the 2014 Farm Bill. The USDA Farm Service Agency (FSA) administers the program on behalf of the USDA Commodity Credit Corporation (CCC).
Website Location:
https://www.fsa.usda.gov/programs-and-services/conservation-programs/crp-grasslands/index

6.2.1.4.2 Emergency Conservation Program
Eligibility:
Private Land Owners
Description:
The Emergency Conservation Program (ECP) helps farmers and ranchers to repair damage to farmlands caused by natural disasters and to help put in place methods for water conservation during severe drought. The ECP does this by giving ranchers and farmers funding and assistance to repair the damaged farmland or to install methods for water conservation.
Website Location:
https://www.fsa.usda.gov/programs-and-services/conservation-programs/emergency-conservation/index

6.2.1.4.3 Farmable Wetlands Program

Eligibility:

Private Land Owners

Description:

The Farmable Wetlands Program (FWP) is designed to restore previously farmed wetlands and wetland buffer to improve both vegetation and water flow. FWP is a voluntary program to restore up to one million acres of farmable wetlands and associated buffers. Participants must agree to restore the wetlands, establish plant cover, and to not use enrolled land for commercial purposes. Plant cover may include plants that are partially submerged or specific types of trees. The Farm Services Agency (FSA) runs the program through the Conservation Reserve Program (CRP) with assistance from other government agencies and local conservation groups

Website Location:

https://www.fsa.usda.gov/programs-and-services/conservation-programs/farmable-wetlands/index

6.2.1.5 Natural Resources Conservation Service (NRCS)

6.2.1.5.1 Agricultural Management Assistance

Eligibility:

Clubs and Organizations, Cooperative Associations or Districts, Farmers, Indian Tribes, Irrigation and Drainage Districts, Ranchers

Description:

Agricultural Management Assistance (AMA) provides cost share assistance to agricultural producers to voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation into their farming operations. Producers may construct or improve water management structures or irrigation structures; plant trees for windbreaks or to improve water quality; and mitigate risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming.

Website Location:

https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/ama/

6.2.1.5.2 Agricultural Water Enhancement Program

Eligibility:

Private Land Owners

Description:

The Agricultural Water Enhancement Program (AWEP) was a voluntary conservation initiative that provided financial and technical assistance to agricultural producers to implement agricultural water enhancement activities on agricultural land to conserve surface and ground water and improve water quality. As part of the Environmental Quality Incentives Program (EQIP), AWEP operated through program contracts with producers to plan and implement conservation practices in project areas established through partnership agreements.

Website Location:

https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/awep/

6.2.1.5.3 Conservation Stewardship Program

Eligibility:

Private Land Owners

Description:

The Conservation Stewardship Program (CSP) helps private land owners build on existing conservation efforts while strengthening operation. Private land owners looking to improve grazing conditions, increase crop yields, or develop wildlife habitat, a customized CSP plan to help land owners meet those goals. CSP can help land owners schedule timely planting of cover crops, develop a grazing plan that will improve forage base, implement no-till to reduce erosion or manage forested areas in a way that benefits wildlife habitat.

Website Location:

https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/

6.2.1.5.4 Emergency Watershed Protection

Eligibility:

Conservation District, Local Government, Private Landowner, State/Territorial Agency, Tribal Agency

Description:

The USDA Natural Resources Conservation Service's Emergency Watershed Protection (EWP) program helps protect lives and property threatened by natural disasters such as floods, hurricanes, tornadoes, droughts, and wildfires. EWP provides funding for such work as clearing debris from clogged waterways, restoring vegetation, and stabilizing river banks. The measures that are taken must be environmentally and economically sound and generally benefit more than one property owner. EWP also provides funds to purchase floodplain easements as an alternative (in lieu of recovery) to the normal emergency recovery measure. Floodplain easements restore, protect, maintain, and enhance the functions of the floodplain; conserve natural values including fish and wildlife habitat, water quality, flood water retention, ground water recharge, and open space; reduce long-term federal disaster assistance; and safeguard lives and property from floods, drought, and the products of erosion. EWP cost-share rate is paid at a 75/25 percent ratio, but can provide up to 90 percent cost share if an area qualifies as a limited resource areas, as determined by the federal, state, and local census data.

Website Location:

https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/ewp/

6.2.1.5.5 Environmental Quality Incentives Programs

Eligibility:

Farmers, Indian Tribes, Private Landowner, Ranchers, State/Territorial Agency, Tribal Agency

Description:

The USDA Natural Resources Conservation Service's Environmental Quality Incentives Program (EQIP) was established to provide a voluntary conservation program for agricultural producers to address significant natural resource needs and objectives. Through a competitive process, EQIP offers financial assistance contracts

with a maximum term of ten years, to help implement eligible conservation practices. Persons or legal entities, who are owners of land under agricultural production or who are engaged in livestock or agricultural production on eligible land, including private non-industrial forest land, or Indian Tribes may participate in EQIP. Conservation practices implemented through EQIP are subject to NRCS technical standards adapted for local conditions. NRCS or Technical Service Providers (TSPs) help applications develop a plan of operations which identifies practices needed to address natural resource concerns and support the EQIP contract. EQIP-related programs include Conservation Innovation Grants (CIG), Resource Conservation Partnership Program (RCPP), and the National Water Quality Initiative (NWQI).
Website Location:
https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/

6.2.1.5.6 Healthy Forests Reserve Program
Eligibility:
Private Landowner
Description:
The Healthy Forests Reserve Program (HFRP) is a voluntary program established for the purpose of restoring and enhancing forest ecosystems to: 1) promote the recovery of threatened and endangered species, 2) improve biodiversity; and, 3) enhance carbon sequestration. Program implementation has been delegated by the Secretary of Agriculture to the Natural Resources Conservation Service.
Website Location:
https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/forests/

6.2.1.5.7 Regional Conservation Partnership Program (RCPP)
Eligibility:
Conservation District, Educational Institution, Farmers, Irrigation and Drainage Districts, Local Government, Nonprofit Groups, Private Landowner, Ranchers, State/Territorial Agency, Tribal Agency
Description:
The Regional Conservation Partnership Program (RCPP) is a new farm bill program that gives NRCS the authority to enhance regional cooperation to implement and maintain conservation activities, thereby promoting the restoration and sustainable use of soil, water, wildlife, and related natural resources on regional or watershed scales. NRCS will co-invest in mobilizing creative and workable solutions to agricultural production and resource management challenges with eligible partners. NRCS provides assistance to producers through partnership agreements and through program contracts or easement agreements. RCPP combines the authorities of four former conservation programs – the Agricultural Water Enhancement Program, the Chesapeake Bay Watershed Program, the Cooperative Conservation Partnership Initiative and the Great Lakes Basin Program. Assistance is delivered in accordance with the rules of EQIP, CSP, ACEP and HFRP; and in designated Critical Conservation Areas the Watershed Operations and Flood Prevention Program.
Website Location:
https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmbill/rcpp/

6.2.1.5.8 Watershed Rehabilitation Program

Eligibility:

Conservation District, Local Government, State/Territorial Agency, Tribal Agency

Description:

This program provides a 65 percent Federal cost-share to rehabilitate aging dams that were originally constructed either through Public Law-566, Public Law-534, Pilot Watershed Program authorized under the Department of Agriculture Appropriation Act of 1954, or through the Resource Conservation & Development program. The purpose for rehabilitation is to extend the service life of dams and bring them into compliance with current and applicable safety and performance standards or to decommission the dams so they no longer pose a threat to life and property.

Website Location:

https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wr/

6.2.1.5.9 Wildlife Habitat Incentives Program

Eligibility:

Indian Tribes, Nonprofit Groups, Private Landowner, Tribal Agency

Description:

The Wildlife Habitat Incentives Program (WHIP) is a voluntary program for people who want to develop and improve wildlife habitat on private lands. It provides both technical assistance and cost sharing to help establish and improve fish and wildlife habitat. Participants work with USDA's Natural Resources Conservation Service to prepare a wildlife habitat development plan in consultation with a local conservation district. The plan describes the landowner's goals for improving wildlife habitat, includes a list of practices and a schedule for installing them, and details the steps necessary to maintain the habitat for the life of the agreement.

Website Location:

https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/whip/

6.2.1.6 US Army Corps of Engineers (US ACE)

6.2.1.6.1 Aquatic Ecosystem Restoration

Eligibility:

Conservation District, Local Government, Nonprofit Groups, State/Territorial Agency, Water and Wastewater Utilities

Description:

Allows for structural or operational changes to restore historic habitat conditions of aquatic ecosystems at any location to benefit fish and wildlife resources.

Website Location:

http://www.nwo.usace.army.mil/Missions/Civil-Works/Planning/Project-Authorities/Continuing-Authorities/

6.2.1.6.2 Beneficial Uses of Dredged Material

Eligibility:

Conservation District, Local Government, Nonprofit Groups, State/Territorial Agency, Water and Wastewater Utilities

Description:

Work under this authority provides for the use of dredged material from new or existing Federal projects to protect, restore, or create aquatic and ecologically related habitats, including wetlands.

Website Location:

http://www.nwo.usace.army.mil/Missions/Civil-Works/Planning/Project-Authorities/Continuing-Authorities/

6.2.1.6.3 Emergency Stream Bank and Shoreline Protection

Eligibility:

Non-profit public facilities

Description:

Allows for construction of emergency streambank and shoreline protection to prevent erosion from damaging nonprofit public facilities.

Website Location:

http://www.nwo.usace.army.mil/Missions/Civil-Works/Planning/Project-Authorities/Continuing-Authorities/

6.2.1.6.4 Project Modifications for Improvement of the Environment

Eligibility:

US Army Corps of Engineers Projects Only

Description:

Allows for structural or operational changes to existing Corps projects for restoration or enhancement of environmental values, especially fish and wildlife.

Website Location:

http://www.nwo.usace.army.mil/Missions/Civil-Works/Planning/Project-Authorities/Continuing-Authorities/

6.2.1.6.5 Small Flood Damage Reduction Programs

Eligibility:

Conservation District, Local Government, Nonprofit Groups, State/Territorial Agency, Water and Wastewater Utilities

Description:

Allows for construction of projects (structural or nonstructural) to reduce damages caused by flooding and focuses on solving local flood problems in urban areas, towns and villages

Website Location:

http://www.nwo.usace.army.mil/Missions/Civil-Works/Planning/Project-Authorities/Continuing-Authorities/

6.2.1.7 US Department of Agriculture (USDA)

6.2.1.7.1 Conservation Reserve Program

Eligibility:

Business, Local Government, Nonprofit Groups, Private Landowner, State/Territorial Agency, Tribal Agency

Description:

The Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners. Through CRP, you can receive annual rental payments and cost-share assistance to establish long-term, resource conserving covers on eligible farmland.

Website Location:

https://www.cfda.gov/index?s=program&mode=form&tab=step1&id=c8101e2120b90ff29dce2562167b049a

6.2.1.7.2 National Integrated Water Quality Program (NIWQP)

Eligibility:

Educational Institution

Description:

The National Integrated Water Quality Program (NIWQP) provides funding for research, education, and extension projects aimed at improving water quality in agricultural and rural watersheds. The NIWQP has identified eight "themes" that are being promoted in research, education and extension. The eight themes are (1) Animal manure and waste management (2) Drinking water and human health (3) Environmental restoration (4) Nutrient and pesticide management (5) Pollution assessment and prevention (6) Watershed management (7) Water conservation and agricultural water management (8) Water policy and economics. Awards are made in four program areas - National Projects, Regional Coordination Projects, Extension Education Projects, and Integrated Research, Education and Extension Projects. Please note that funding is only available to universities.

Website Location:

https://www.cfda.gov/index?s=program&mode=form&tab=step1&id=4b413c76457403b9d728ef5e94a29129

6.2.1.7.3 Sustainable Agriculture Research and Education

Eligibility:

Business, Educational Institution, Federal Agency, Nonprofit Groups, State/Territorial Agency

Description:

The Sustainable Agriculture Research and Education (SARE) program of the U.S. Department of Agriculture National Institute of Food and Agriculture (NIFA) works to advance farming systems that are productive, profitable, environmentally sound and good for communities through a regional grants program. SARE funds research and extension activities to reduce the use of chemical pesticides, fertilizers, and toxic materials in agricultural production; to improve management of on-farm resources to enhance productivity, profitability, and competitiveness; to promote crop, livestock, and enterprise diversification and to facilitate the research of agricultural production systems in areas that possess various soil, climatic, and physical characteristics; to study farms that are managed using farm practices that optimize on-farm resources

and conservation practices; and to promote partnerships among farmers, nonprofit organizations, agribusiness, and public and private research and extension institutions. Click on program name and check the link in the Primary Internet box for more information about grant opportunities and program results.
Website Location:
http://www.westernsare.org/

6.2.1.7.4 Water and Waste Disposal Systems for Rural Communities
Eligibility:
Community/Watershed Group, Conservation District, Local Government, Nonprofit Groups, Tribal Agency
Description:
This USDA Rural Utilities Service program provides monies to provide basic human amenities, alleviate health hazards, and promote the orderly growth of the rural areas of the nation by meeting the need for new and improved rural water and waste disposal facilities. Funds may be used for the installation, repair, improvement, or expansion of a rural water facility including costs of distribution lines and well pumping facilities. Funds also support the installation, repair, improvement, or expansion of a rural waste disposal facility, including the collection and treatment of sanitary waste stream, storm water, and solid wastes.
Website Location:
https://www.rd.usda.gov/programs-services/water-waste-disposal-loan-grant-program

6.2.1.8 US Department of the Interior (US DOI)

6.2.1.8.1 Land and Water Conservation Fund (Outdoor Recreation, Acquisition, Development and Planning Grants)
Eligibility:
Local Government, State/Territorial Agency, Tribal Agency
Description:
To provide financial assistance to the States and their political subdivisions for the preparation of Statewide Comprehensive Outdoor Recreation Plans (SCORPs) and acquisition and development of outdoor recreation areas and facilities for the general public, to meet current and future needs.
Website Location:
https://www.nps.gov/subjects/lwcf/index.htm

6.2.1.8.2 Not for Profit Acid Mine Drainage Reclamation
Eligibility:
Community/Watershed Group, Conservation District, Nonprofit Groups
Description:
The U.S. Department of Interior's Acid Mine Drainage (AMD) Reclamation Program is designed to support the efforts of local not-for-profit organizations, especially watershed groups, to complete construction projects designed to clean streams impacted by AMD.

Website Location:
https://www.osmre.gov/resources/grants.shtm

6.2.1.8.3 Rivers, Trails, and Conservation Assistance (NPS Water Reclamation and Reuse Program)
Eligibility:
Federal Agency, Local Government, Nonprofit Groups, State/Territorial Agency
Description:
The Department of Interior, through its Rivers, Trails and Conservation Assistance Program (Rivers & Trails) promotes sustainable community-based environmental conservation and brownfields redevelopment. The National Park Service (NPS) does not provide financial assistance, but does provide staff time for efforts such as conservation and community revitalization.
Website Location:
https://www.nps.gov/orgs/rtca/index.htm

6.2.1.8.4 Water Resources on Indian Lands
Eligibility:
Tribal Agency
Description:
This program assists Indian tribes with the management, planning, protection, and development of their water resources and related land resources. Tribes use funds for specific water resource projects, as well as to collect and analyze baseline data and to facilitate litigation and negotiation activities. Previously funded projects have included geographic and hydrologic quantitative and qualitative analysis of water, ground water and surface water quality and quantity monitoring, aquifer classification, stream gaging, ecosystem development and management, and planning for compliance with the Endangered Species Act.
Website Location:
https://www.bia.gov/WhoWeAre/BIA/OTS/NaturalResources/Water/index.htm

6.2.1.9 US Fish and Wildlife Service (USFWS)

6.2.1.9.1 Partners of Fish and Wildlife Program
Eligibility:
Business, Community/Watershed Group, Conservation District, Educational Institution, Local Government, Nonprofit Groups, Private Landowner, Tribal Agency
Description:
The Partners for Fish and Wildlife Program provides technical and financial assistance to private landowners to restore fish and wildlife habitats on their lands via cooperative agreements. Since 1987, the program has partnered with more than 37,700 landowners to restore 765,400 acres of wetlands; over 1.9 million acres of grasslands and other upland habitats; and 6,560 miles of in-stream and streamside habitat. In addition, the program restores stream habitat for fish and other aquatic species by removing barriers to passage.
Website Location:
https://www.fws.gov/partners/

6.2.1.9.2 State Wildlife Grant Program
Eligibility:
State/Territorial Agency
Description:
The U.S. Fish and Wildlife Service's (USFWS) State Wildlife Grant (SWG) program provides grants to states, territories, and the District of Columbia for wildlife conservation. The SWG program provides funds to help develop and implement programs that benefit wildlife and their habitat, including species that are not hunted or fished. Although not directly eligible for these grants, third parties such as nonprofit organizations may benefit from these funds by working directly with their states to see if either grants or partnering opportunities are available.
Website Location:
https://wsfrprograms.fws.gov/Subpages/GrantPrograms/SWG/SWG.htm

6.2.1.9.3 Wildlife Restoration Grant Program
Eligibility:
State governments
Description:
The Federal Aid in Wildlife Restoration Act of 1937, 50 Stat. 917 as amended; 16 U.S.C. 669-669b, 669-669k, now known as the Pittman-Robertson Wildlife Restoration Act, was approved by Congress on September 2, 1937, and began functioning July 1, 1938. The purpose of this Act has been to provide funding for the selection, restoration, rehabilitation, and improvement of wildlife habitat, wildlife management research, and the distribution of information produced by the projects. The Act was amended on October 23, 1970, to include funding for hunter safety programs and the development or the operation and maintenance of firearm and archery ranges.
Website Location:
https://www.grants.gov/web/grants/view-opportunity.html?oppId=290527
https://wsfrprograms.fws.gov/Subpages/GrantPrograms/WR/WR.htm

6.2.1.10 US Forest Service (USFS)

6.2.1.10.1 Community Forest and Open Space Conservation Program
Eligibility:
Native American Tribes, Local Government, Nonprofit Groups
Description:
The Community Forest Program (CFP) provides financial assistance grants to local governments, Indian Tribes, and qualified non-profits to establish community forests through fee simple acquisition that provide public benefits. The CFP: 1) Provides public access and recreational opportunities, protects vital water supplies and wildlife habitat, addresses the effects of a changing climate, provides demo sites for private forest landowners, and derives financial and community benefits from sustainable management. 2) Promotes protection and enjoyment of the Nation’s outdoor heritage by empowering people and communities to protect and restore places they cherish. 3) Targets private lands that are threatened by conversion to non-forest uses, are not held in trust by the United States, and can provide defined community benefits and allow public access.

Website Location:
https://www.fs.usda.gov/detail/r1/communityforests/?cid=stelprdb5339829

6.2.1.10.2 Forest Legacy Program
Eligibility:
Private Landowner, State/Territorial Agency
Description:
The USSFS supports state efforts to protect environmentally important forest lands from the conversion to non-forest uses through the use of conservation easements and fee-simple purchase. Designed to encourage the protection of privately owned forest lands, FLP is an entirely voluntary program. Since inception the program has conserved 2.6 million acres of forest land through support of conservation easements (84% of acres) and fee acquisition (16% of acres). Conservation easements enable landowners to retain ownership of their land and continue to earn income from it while keeping drinking water safe and clean, conserving valuable open space as well as protecting critical wildlife habitats and outdoor recreation opportunities. The program promotes professional forest management and requires forest management plans to guide management of the conserved properties. The program emphasizes strategic conservation - working in partnership with States, local communities and non-governmental organizations to make a difference on the land and for communities by conserving areas of unbroken forest, watershed or river corridor forests or by complementing existing land conservation efforts.
Website Location:
https://www.fs.fed.us/spf/coop/programs/loa/flp.shtml

6.2.2 State of Wyoming Sources

6.2.2.1 Wyoming Conservation Districts

6.2.2.1.1 General Information
Eligibility:
Not Relevant
Description:
The Wyoming Association of Conservation Districts provides leadership for the conservation of Wyoming's soil and water resources, promotes the control of soil erosion, promotes and protects the quality of Wyoming's waters, reduce siltation of stream channels and reservoirs, promote wise use of Wyoming's water, and all other natural resources, preserve and enhance wildlife habitat, protect the tax base and promote the health, safety and general welfare of the citizens of this state through a responsible conservation ethic.
Website Location:
http://www.conservewy.com/

6.2.2.1.2 Laramie Rivers Conservation District: Regular Cost Share
Eligibility:
All residents, businesses, and nonprofits in Albany County
Description:
The program's objectives are to provide incentives for residents to conserve soil and

water and to beautify the landscape along public corridors. The maximum matching amount for a regular cost share is $1000 on a $2000+ project. Examples of eligible projects: Installation of Living Snow Fence or Windbreak, drip system installation for trees and shrubs, xeriscaping to replace traditional lawn with native dry climate species of vegetation, fences erected to conceal personal junk-yards, construction of raised garden beds for vegetables, and education and outreach.
Website Location:
http://www.lrcd.net/cost-share-1/

6.2.2.1.3 Laramie Rivers Conservation District: Rural Cost Share
Eligibility:
Landowners and cooperators
Description:
This program is intended to assist landowners and cooperators who don't meet qualifying criteria for federal or state programs (not enough acreage, not a full time operation, etc.). Eligible projects may be implemented on private land as well as adjacent public lands with grazing rights. The maximum matching amount for a rural cost share is $5000 on a $10,000+ project. Examples of eligible projects: solar stock pumps to improve livestock distribution in remote areas, fencing riparian areas to reduce impacts of livestock grazing, fencing for implementing rotational grazing systems on small acreage pastures, and stream bank restoration.
Website Location:
http://www.lrcd.net/cost-share-1/

6.2.2.1.4 Laramie Rivers Conservation District: Analysis Cost Share
Eligibility:
Albany County Residents
Description:
This program provides incentive for residents to understand their natural resources by cost sharing on expenses for tests at recognized analytical labs. The maximum matching amount for an analysis cost share is up to $500. Examples of eligible projects: soil testing for gardens or crops, potable water tests, trace minerals in water, irrigation/livestock water testing, and forage testing.
Website Location:
http://www.lrcd.net/cost-share-1/

6.2.2.2 Wyoming Department of Environmental Quality (WY DEQ)

6.2.2.2.1 Section 319 Nonpoint Source Pollution Control Funds
Eligibility:
State Agencies, organizations, business
Description:
Section 319 funds are available to a wide variety of agencies, organizations, and other entities for projects that reduce nonpoint source pollution to surface and groundwater
Website Location:
http://deq.wyoming.gov/wqd/non-point-source/resources/grant-resources/

6.2.2.2.2 Section 205(j) of the Clean Water Act
Eligibility:
State Agencies, organizations, business
Description:
Under Section 205(j) of the Clean Water Act, the State of Wyoming has approximately $40,000 available to local planning agencies for the purpose of water quality management planning and assessment. These funds are not intended for construction or implementation of water quality controls, but rather, are to be targeted for water quality planning and assessment. Additionally, these funds may not be utilized to meet monitoring requirements of any enforcement action, permit, or public water supply regulation. The U. S. Environmental Protection Agency has ruled that only cities, counties and conservation districts are eligible to receive these planning funds. However, the local planning agency may subcontract work to other entities.
Website Location:
http://deq.wyoming.gov/wqd/non-point-source/resources/grant-resources/

6.2.2.3 Wyoming Game and Fish Department (WGFD)

6.2.2.3.1 Fish Passage Grants
Eligibility:
Any, Projects require a WGFD biologist representative
Description:
Any project designed to improve fish migration or reduce entrainment
Website Location:
https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Strategic%20Habitat%20Plan/SHP2015_Final.pdf
https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Aquatic%20Habitat/Funding_Sources.pdf

6.2.2.3.2 Habitat Trust Fund
Eligibility:
Any
Description:
Any project designed to improve wildlife habitat or natural resource values. Projects required a WGFD biologist representative
Website Location:
https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Strategic%20Habitat%20Plan/SHP2015_Final.pdf
https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Aquatic%20Habitat/Funding_Sources.pdf

6.2.2.4 Wyoming Office of State Lands and Investments (WY OSLI)

6.2.2.4.1 Farm Loans
Eligibility:
Private Landowners
Description:
The Farm Loan program awards loans to: Purchase lands used principally for raising agricultural products, livestock, or dairying; Purchase livestock, fertilizers, and equipment calculated to maintain or increase the earning capacity of the borrower's agricultural operation; Purchase, construct, or install improvements calculated to maintain or increase the earning capacity of the borrower's agricultural operation; or Liquidate debts of the borrower incurred in the furtherance of the borrower's agricultural operation; or Enhance or restore livestock numbers in the state pursuant to W. S. § 11 - 34 - 113 (j).
Website Location:
https://sites.google.com/a/wyo.gov/osli/grantsloans/loans/farm

6.2.2.4.2 Hydro-Power Development Project Loans
Eligibility:
Wyoming municipalities and special districts.
Description:
The Hydro-Power Development Project (Hydro) program awards loans to finance the construction of hydro-power development projects.
Website Location:
https://sites.google.com/a/wyo.gov/osli/grantsloans/loans/hydro

6.2.2.4.3 Joint Powers Act Loan
Eligibility:
Wyoming counties, municipal corporations, school districts, community college districts, University of Wyoming, special districts and Joint Powers Boards specifically involved in providing facilities or functions specified in W.S. 16-1-104(c).
Description:
The Joint Powers Act (JPA) program awards loans for capital construction projects of local governmental entities.
Website Location:
https://sites.google.com/a/wyo.gov/osli/grantsloans/loans/joint-powers-act-loan-program

6.2.2.5 Wyoming Water Development Commission (WWDC)

6.2.2.5.1 Wyoming Water Development Program
Eligibility:
Government Entity
Description:
The Wyoming Water Development Program was established in 1975 to promote the optimal development of the state's human, industrial, mineral, agricultural, water and recreational resources. The program provides, through a commission, procedures and policies for the planning, selection, financing, construction, acquisition, and operation

of projects. This can include projects 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. There are three programs underneath the Wyoming Water Development Program: the New Development Program, The Rehabilitation Program, and the Dam and Reservoir Program.
Website Location:
http://wwdc.state.wy.us/

6.2.2.5.1.1 ***New Development Program***
Eligibility:
Varies
Description:
This program provides funding and technical assistance to develop unused and/or unappropriated waters in the state of Wyoming. The project encompasses a wide variety of projects including: projects with multiple purposes (two or more of the following: agriculture, recreation, environmental, and erosion control), creation of new water storage (less than 2,000 acre feet) and water supply (wells, diversion dams, etc.), projects that lead to watershed improvement and recreation.
Website Location:
http://wwdc.state.wy.us/

6.2.2.5.1.2 ***Rehabilitation Program***
Eligibility:
Varies
Description:
The Rehabilitation Program helps fund improvements to existing water projects that have been completed and in use for the last 15 years in order to keep existing water supplies effective and viable. The program can include: agricultural storage facilities or conveyance system, multiple purpose, creation of new water storage and supply, watershed improvement, and recreational purposes.
Website Location:
http://wwdc.state.wy.us/

6.2.2.5.1.3 ***Dam and Reservoir Program***
Eligibility:
Varies
Description:
The program is specifically for 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. The funding for this program comes from three different locations: Water Development Account No. III, the interest earning of the same account, and a percentage (0.5 percent) of the revenues that accrue to the state’s severance tax distribution account. Legislative approval must be granted before allocating funds for this particular program.
Website Location:
http://wwdc.state.wy.us/

6.2.2.5.2 Small Water Project Program

Eligibility:

Private landowners through Conservation Districts

Description:

The purpose of the Wyoming Water Development Commission (WWDC) 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, wetland developments, rural fire suppressions systems and recreation. Grants for 50% of the project costs, up to a maximum of grant amount of $35,000 are available through the SWPP.

Small Water projects must demonstrate a public benefit. Public benefits may be demonstrated for projects included in a Watershed Study. Activities 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.

Projects that have completed all necessary design, permitting and funding requirements may be classified as “shovel ready” and may be considered as a funding priority.

Website Location:

http://wwdc.state.wy.us/small_water_projects/small_water_project.html

6.2.2.6 Wyoming Wildlife and Natural Resources Trust

Eligibility:

Non-profit and governmental organizations, some for-profit entities

Description:

By statute and rule, the following types of projects are allowed:

Improvement and maintenance of existing terrestrial habitat necessary to maintain optimum wildlife populations.

Preservation of open space by purchase or acquisition of development rights.

Improvement and maintenance of existing aquatic habitat necessary to maintain optimum fish populations.

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 desired wildlife or fish population levels.

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.

To address and mitigate impacts detrimental to wildlife habitat, the environment and the multiple use of renewable natural resources attributable to residential, mineral and industrial development.

To mitigate conflicts and reduce potential for disease transmission between wildlife and domestic livestock.

Website Location:
https://sites.google.com/a/wyo.gov/wwnrt/how-to-apply

6.2.2.7 Wyoming Weed and Pest

Eligibility:
Not relevant
Description:
The Wyoming Weed & Pest Council is comprised of 23 Weed & Pest districts in the State of Wyoming. One of the main goals of the Council is to provide coordination and leadership in the fight against designated and declared noxious weeds & pests and invasive species in the State of Wyoming. The Council works closely with the Wyoming Department of Agriculture and the University of Wyoming to keep current with the latest technology and research available in the ongoing management of noxious weeds and pests. The Council has many committees that have specific goals that help the Council meet their goals.
Website Location:
https://www.wyoweed.org/

6.2.3 Private Sources

6.2.3.1 Ducks Unlimited

Eligibility:
Varies
Description:
Ducks Unlimited, together with 16 other organizations, established the Pathfinder Wetlands Partnership. The partnership was awarded Wyoming's second only standard North American Wetlands Conservation Act (NAWCA) grant. The $1 million grant, plus $4.5 million in match from partners, will restore, enhance and protect 3,300 acres of wetlands in southeast Wyoming and western Nebraska.
Website Location:
http://www.ducks.org/Wyoming

6.2.3.2 Natural Fish and Wildlife Foundation (NFWF)

6.2.3.2.1 Bring Back the Natives Grant Program
Eligibility:
Local, state, federal, tribal, non-profit organizations, schools and universities
Description:
The Bring Back the Natives program invests in conservation activities that restore, protect and enhance native populations of sensitive or listed fish species across the United States, especially in areas on or adjacent to federal agency lands. The program emphasizes coordination between private landowners and federal agencies, tribes, corporations, and states to improve the ecosystem functions and health of watersheds. The end result is conservation of aquatic ecosystems, increase of in-stream flows, and partnerships that benefit native fish species throughout the United

States.
Website Location:
http://www.nfwf.org/bbn/Pages/home.aspx

6.2.3.2.2 Conservation Partners

Eligibility:
Private landowners
Description:
Private landowners are responsible for the use and management of over two-thirds of our nation's land, including some of the most important fish and wildlife habitat in the United States. Farmers, ranchers, foresters and other landowners voluntarily participated in federal Farm Bill conservation programs authorized at $6.1 billion in FY 2012. Targeting those funds toward priority conservation objectives and maximizing their benefits are the primary goals of Conservation Partners.

Grants funded through Conservation Partners provide staff and technical assistance to private landowners in regions where some of the nation's most crucial conservation issues can be addressed through Farm Bill programs. Funding priorities for this program seek to build the following capacities: expertise in comprehensive natural resource conservation planning, discipline-specific expertise: aquatics, forestry, general ecology, rangeland ecology, wetlands, and wildlife, resource-specific scientific expertise to support development of science-based tools. These might include wildlife habitat evaluation and management guidelines; best management practices to be used in association with NRCS conservation practice implementation (e.g., best management practices for the use of prescribed grazing for the management of native prairie for lesser prairie chickens), scientific expertise and experience to help facilitate integration of current scientific knowledge and technologies into NRCS/NFWF Conservation Initiatives, technical expertise in developing methodologies to monitor, assess, evaluate and report on measurable resource conservation outcomes, farm Bill program and marketing outreach to improve landowners' and customers' understanding of Farm Bill programs and NRCS practices, standards and strategic initiatives and increase landowner and partner participation.
Website Location:
http://www.nfwf.org/conservationpartners/Pages/home.aspx

6.2.3.2.3 National Wildlife Refuge Friends Group Grant Program

Eligibility:
Varies
Description:
There are now more than 200 Friends groups supporting National Wildlife Refuges, with new organizations created each year. Friends organizations are crucial to the collective mission of the Refuge System and, along with other volunteers, accomplish approximately 20 percent of all work on National Wildlife Refuges, which is the equivalent of 648 full-time employees.

The National Wildlife Refuge Friends Grant Program funds projects that assist organizations in being effective co-stewards of important natural resources within the

National Wildlife Refuge System. The program's goals are to assist refuge Friends organizations in developing projects, expanding and increasing their capacity and skills, meeting local refuge conservation challenges and gaining and building community recognition. Funding priorities for this program include: Nonprofit Capacity Building Grants – providing funds to assist starting refuge Friends organizations with formative and/or initial operational support. Funds are also provided to existing refuge Friends organizations for activities that improve and enhance an organization's ability to achieve its mission and sustain itself over time. Project Specific Grants – providing funds to refuge Friends organizations seeking support for projects initiated and managed by the Friends in support of the refuge. Peer-to-Peer Coaching (P2P) – providing funds to refuge Friends organizations who propose to coordinate and execute a Friends peer-to-peer coaching for a minimum of four other U.S. Fish and Wildlife Service (USFWS) Friends organizations.

Since 1998, the National Wildlife Refuge Friends Grant Program has provided over 470 awards totaling more than $2 million in federal and private funds. While matching contributions are not required of these grantees, over $1 million has been contributed towards these projects, which significantly leverages the limited investment of federal funding

Website Location:

http://www.nfwf.org/refugefriends/Pages/home.aspx

6.2.3.2.4 Pulling Together

Eligibility:

Non-profit 501(c) organizations, U.S. Federal government agencies, state government agencies, local governments, municipal governments, Indian tribes, and educational institutions.

Description:

Invasive weeds represent one of the most significant threats to the economy and ecology of the United States, causing billions of dollars in damage each year to farms and ranches and degrading millions of acres of critical wildlife habitat. NFWF's Pulling Together Initiative provides modest grants to help local communities effectively manage these plant invaders. The Pulling Together Initiative is one of the only public-private partnerships to address invasive weeds nationally. Pulling Together Initiative grants are intended to help support the creation of local cooperative weed management area partnerships. Such partnerships bring together local landowners, citizens groups and weed experts to develop and implement strategies for managing weed infestations on public lands, natural areas, and private working lands

Website Location:

http://www.nfwf.org/pti/Pages/home.aspx

6.2.3.3 Trout Unlimited

Eligibility:

Varies

Description:

Trout Unlimited believes that conservation should be a true partnership between landowners, agencies, municipalities, and all stakeholders. We work to protect critical

habitat, to reconnect degraded waterways, and restore populations to coldwater fisheries. The National Conservation Agenda is set by the National Leadership Council of Trout Unlimited, a body of representatives from the grassroots and volunteer leaders. Through sound science, we inform our priorities with critical data on the health of these fisheries.
Website Location:
http://www.tu.org/conservation

6.2.3.4 Water for Wildlife Foundation (WFWF)

Eligibility:
Any
Description:
Wildlife rely on their habitat for water, feed, and cover. As these resources become increasingly scarce, our projects support the continued viability of wildlife under these conditions. We work with state and federal wildlife and land management officials and other conservation organizations to identify the need for projects, located primarily on public land.
Website Location:
http://www.waterforwildlife.org/

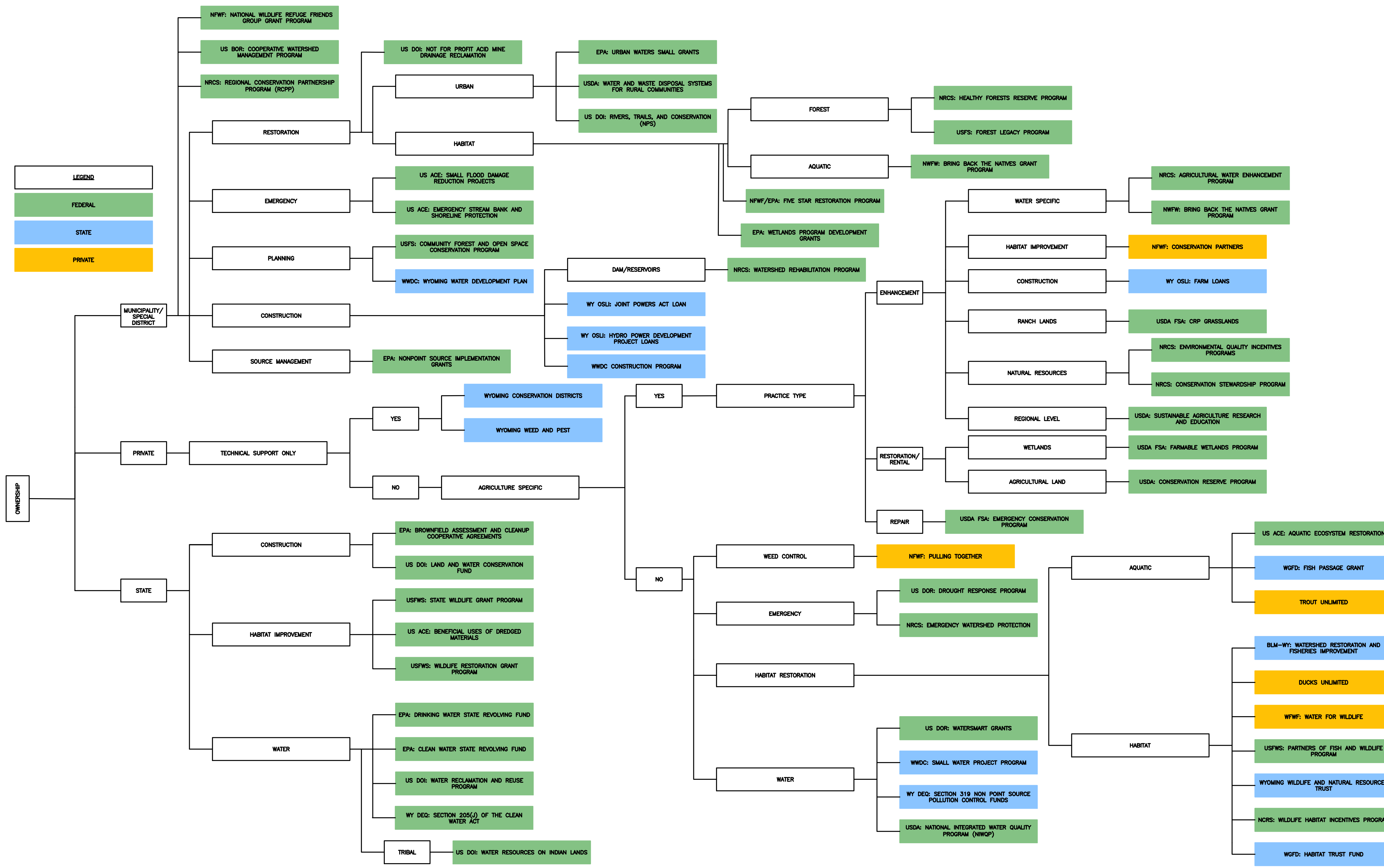

Figure 6.1
FUNDING FLOWCHART
SOUTH PLATTE WATERSHED STUDY
JUNE 2018

Chapter 7 – Permitting

7.1 Introduction

Prior to starting construction on almost any of the projects recommended in the Watershed Management Plan some level of permitting will be required. The permitting effort for a particular project can vary from relatively simple to extremely complex. The conservation districts and other funding agencies need to be aware of and consider the permitting process when deciding to implement a project. The timeline and schedule for receiving the necessary permits for a project could impact the ability to complete a project on schedule. Right-of-Way and land access agreements with land owners, which may include the Bureau of Land Management, US Forest Service, and private parties may be required for some projects. Preparation of permit applications and complying with all of the various regulations will require a serious and coordinated effort.

The most common permit(s) for the projects that have been identified during this study are water right permits. Safety of Dams review and approval could be required for larger reservoirs. County permits, such as right-of-way or flood plain development permits could be required.

Some projects will require a Federal permit, such as a Section 404 of the Clean Water Act permit, or at least, notification, consultation and review with Federal agencies. The longest time requirement would be associated with obtaining a Section 404 of the Clean Water Act Permit from the US Army Corps of Engineers and associated National Environmental Protection Act (NEPA) compliance, particularly if an Environmental Impact Statement (EIS) is required. It is not unusual for the 404 permitting and EIS process to take 1-1/2 to 2 years or longer from the time that an application is submitted.

Section 404 of the Clean Water Act (CWA) established a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports) and mining projects. https://www.epa.gov/cwa-404/section-404-permit-program

Table 7.1 shown below lists common permits that may be required for projects.

7.2 Access

Most projects identified during this Study are requested or proposed by the landowner for a project on their property. However when a project is proposed by a party on land that they do not own, permission must be obtained from the landowner or management agency before starting the project. Verbal permission from landowners may be sufficient for initial site visits; however, formal easements, rights-of-way (ROW), and property access for planning or construction activities associated with a proposed project may be necessary.

Landowner information can be obtained from the Laramie County and Albany County web based GIS maps. The web address for the Laramie County GIS map is *https://maps.laramiecounty.com/mapserver/map.*

The address for the Albany County GIS map is *http://maps.greenwoodmap.com/albany/map.*

Also the Wyoming Statewide Parcel Viewer can be accessed via the website (*http://gis.wyo.gov/parcels)* to help determine ownership information for any parcels that may be involved with a proposed project.

Table 7.1
Potential Permits Required by Federal, State, and Local Agencies

Agency	***Requirement***
Federal	
U.S. Army Corps of Engineers	• Permit for Discharge of Dredged of Fill Material (Section 404 permit) • Environmental Impact Statement or Environmental Assessment under requirements of NEPA
U.S. Fish and Wildlife Service	• Compliance with Endangered Species Act, Section 7 consultation • Platte River Recovery Implementation Program (PRRIP) • Compliance with Fish and Wildlife Coordination Act
U.S. Forest Service	• Special Use Permit • Compliance with NEPA as a cooperating agency
Bureau of Land Management	• Right-Of-Way Permit • Compliance with NEPA as a cooperating agency
Advisory Council on Historic Preservation	• Compliance with cultural resources protection regulations
State Agency	
Wyoming Department of Environmental Quality	
Air Quality Division	• Open Burning Permit • Dust control during construction
Water Quality Division	• WYPDES Permits • Water Quality Certification (401 Permits) • Permits to construct of modify Public Water and Sewer Systems
Land Quality Division	• Any landfill will need a permit
Wyoming State Engineer's Office	• Permit to Appropriate Water Surface water and well permit applications. • Stock Water Pipelines • Safety of Dams approval for large Dams and Reservoirs • Laramie County Control Area
Wyoming State Historical Preservation Office	• Cultural Resource Clearance
Wyoming State Fire Marshall	• Review and approval of electrical plans

Local	
County Permits	• Zoning and Land Use plans. • Right of Way permits to cross or use County Roads • Flood Plain Development permits • Aquifer Protection Program in Albany County

7.3 Utilities

In Wyoming, the State's "Wyoming Underground Facilities Notification Act" requires everyone who owns underground facilities in the state to be a member of One-Call of Wyoming. Before any excavation begins, the excavator is required to provide advance notice (at least 2 business days before intending to dig) to the One-Call of Wyoming Notification Center at 811. For more information about One Call of Wyoming, please visit their website: http://www.onecallofwyoming.com/

7.4 Water Rights

This section of the report describes the most common water right permits that likely will be needed to construct any of the projects described in the Management Plan. These permits will be obtained through the Wyoming State Engineer's Office. Work cannot begin until the permit is approved by the State Engineer. Further information can be obtained from the State Engineer's Office website: *https://sites.google.com/a/wyo.gov/seo/regulations-instructions#SEO*

7.4.1 Wells

In Wyoming, any person drilling a water well must obtain a well permit prior to drilling the well. The well must be drilled by a Wyoming licensed well driller and the pump must be installed by a Wyoming licensed pump installer (Wyoming Water Well Contractors Licensing Board - *http://wwcb.state.wy.us/*) Also, the drilling and/or pump contactor and the well owner must comply with the requirements of the Water Well Minimum Construction Standards, which can be obtained via the website: *https://sites.google.com/a/wyo.gov/seo/ground-water/water-well-construction.*

7.4.2 Spring Developments

Spring developments also need to be permitted by the SEO using either a ground water or surface application. If a spring yields 25 gallons per minute or less, it will be used for stock and/or domestic use, the pipeline from the spring is less than 1 mile long, and the spring has less than 4 points of use; then the spring can be permitted as a groundwater source. If a spring development doesn't meet of the described conditions, then the spring is permitted by completing a surface water application.

7.4.3 Stock Reservoirs

A stock reservoir permit is required for constructing a stock reservoir to provide water for livestock. Stock reservoirs must not exceed 20 acre-feet in capacity, cannot have a dam height greater than 20 feet, and the use of the stored water should be for stock water purposes only. The SW-4 Stock Reservoir Application form is used for these types of facilities.

7.4.4 Other Reservoirs

An application for any reservoir larger than a stock reservoir and/or that is to be used for purposes other than stock water need to be filled on the State Engineer's Office SW-3 application form. There are some special reservoir applications that are filed on the SW-3a form.

7.4.5 Safety of Dams Program

Wyoming's Safety of Dams Program is administered by the SEO, typically only applies to dams that are greater or equal to 20 feet in height and/or reservoirs that store 50 acre-feet of more. While not technically a water right program, the Safety of Dams program is administered and regulated by the Wyoming State Engineer's Office. Plans and specifications for these types of reservoirs must be prepared by a Wyoming licensed professional engineer and the plans and specifications must be submitted to the State Engineer's Office for review and approval prior to construction. Construction of Safety of Dams facilities must be supervised by a Wyoming licensed professional engineer. Reports on the construction must be submitted. When construction is complete, certification and record drawings must be submitted. Also, these facilities will be inspected once every five years by Wyoming State Engineer's Office staff.

7.4.6 Surface Water Diversions

A few projects will involve new Construction and rehabilitation of irrigation diversions, ditches, or pipelines. A SW-1 surface water permit application and map must be submitted for a new facility. For repair or rehabilitation a permit may not be required. However, before initiating any project on an irrigation facility the SEO should be notified and the water rights should be reviewed.

The water rights should be reviewed to see that the facility has a permit, that the permit is still valid or in good standing, and that the proposed work appears to be consistent with the permit.

If the proposed project does not involve a change in the point of use, point of diversion, or an enlargement, additional approval from the SEO is not likely to be required. However, a new permit, an enlargement, or other change of the structure or facility would require the submittal of an application and/or petition to the SEO and the Board of Control (BOC) for approval.

7.5 404 Permits

Any project that would involve the discharge of dredged or fill material into waters of the United States could require permitting under Section 404 of the Clean Water Act (CWA). The US Army Corps of Engineers (COE) administers the 404 permit process. Generally speaking, any blue line channel on a USGS map qualifies as "waters of the US." Wetlands are a special case of waters of the US. The 404 permitting process involves a permit application, opportunities for public notice and comment, and preparation of an alternatives analysis. The COE must also make sure that the discharge will not violate state water quality standards pursuant to Section 401 of the Clean Water Act.

It is recommended that coordination with the COE occur to determine any agricultural exemptions from Section 404 regarding the construction or maintenance of irrigation ditches or stock reservoirs. More information can be obtained by contacting the COE's Wyoming Regulatory Office by telephone (307) 772-2300 or via the website*:* *http://www.nwo.usace.army.mil/Missions/Regulatory-Program/Wyoming/*

7.6 Section 401 permits

When a 404 permit application is submitted to the USACE, information is forwarded to the Wyoming Department DEQ for review under Section 401 of the CWA to determine compliance surface water quality standards or total maximum daily loads (TMDLs). Information about the WDEQ's 401 Certification is available via the website *http://deq.wyoming.gov/wqd/401-certification/*

7.7 Platte River Recovery Implementation Program

The requirements under the Endangered Species Act for the critical habitat of whooping cranes, piping plover, and least terns along the Central Platte River in Nebraska resulted in the signing of a cooperative agreement in 1997 for the Platte River Recovery Implementation Program (PRRIP) between the United States Department of Interior (USDI), the USFWS, and the states of Wyoming, Nebraska, and Colorado. The PRRIP's purpose is to ensure agricultural, municipal, industrial, and other water uses while protecting critical habitat along the Central Platte River in compliance with the ESA. The state of Wyoming has adopted their Wyoming Depletions Plan [SEO, 2006b], which describes their current and future water use management as part of the cooperative agreement with the PRRIP. The SEO's Basin Coordinator for the North Platte River is responsible for determining depletions and approving mitigation requirements. The USFWS has provided general guidance regarding the ESA consultations for developing water-related projects in the Platte River Basin in Wyoming under the PRRIP in the ESA Consultations Involving Platte River Depletions: Information for Project Proponents in Wyoming on the Platte River Recovery Implementation Program, which can be obtained by visiting the SEO's website: *https://sites.google.com/a/wyo.gov/seo/interstate-streams/know-your-basin/platte-river-basin*

Existing Water Related Activities Baseline
Under Wyoming's Depletion Plan, the existing water related activities baseline for water leaving the South Platte River Watershed in Wyoming for most of the water use categories is zero. For several years prior to July 1, 1997, water passed the state lines only during some spring runoffs or large rainfall events. The only water use category that could impact these events would be the construction or enlargement of reservoirs to store what little natural flow is passing the state lines. Therefore, the benchmark for the SPRWS will be the existing reservoir capacity as of July 1, 1997, as evidenced by water rights and field inspections.

New Water Development Activities
If new reservoirs were proposed, they would likely fall under the federal nexus and a consultation with the FWS would be required. In the unlikely event that a reservoir is proposed that falls outside the federal nexus, Wyoming will complete a state evaluation of the depletions, in the manner consistent with the Program. Mitigation likely would be required for new development.

7.8 NEPA process

The National Environmental Policy Act (NEPA) was signed into law in 1969 and requires federal agencies to evaluate potential adverse impacts whenever they propose an action, grant a permit or agree to fund or otherwise authorize anyone else to undertake an action that might affect environmental resources. Each federal agency must assume responsibility for meeting NEPA guidelines with oversight from the USEPA.

A large project may trigger NEPA, particularly one that requires a 404 permit. As mentioned earlier, Section 404 of the Clean Water Act authorizes the COE to issue permits for discharges of dredged or fill material into the waters of the United States. Projects on Bureau of Land Management (BLM) land and/or US Forest Service (USFS) land could also trigger a NEPA process. Finally, funding a project through Federal agencies, such as the NRCS could also trigger a NEPA process. The NRCS would likely be the lead agency for any reservoir project funded by USDA on private lands.

For proposed reservoirs on private lands funded privately or by state programs, the permitting process still requires that NEPA be addressed and would be led by the appropriate local or state agency or landowner. Coordination with the COE would be required prior to initiation of any water storage project. The most important aspect regarding the permitting process for a new dam and reservoir storage project is developing a valid purpose and demonstrable need for the project.

NEPA gives federal agencies some leeway in how they administer it. The two basic approaches to NEPA compliance involve an environmental assessment (EA) or an Environmental Impact Statement (EIS). An EA is often the first phase in NEPA compliance and provides an initial analysis of the environmental resources that might be affected by the proposed action. An EA is used to present a preliminary assessment of environmental impacts and to assess the need for changes in the design, or additions, in response to assess impacts. Based on the conclusions in the EA, the lead federal agency then either prepares a Finding of No Significant Impact (FONSI), or an EIS, if the agency determines that the proposed action may significantly affect the environment. An EIS is a detailed statement to describe the impacts, any unavoidable adverse impacts, and alternatives to the proposed action.

An EA is the most common form of NEPA compliance. It is possible to skip the EA phase and move directly into the EIS when it is apparent that adverse impacts will result. Alternatively, it is possible to issue an EA with recommendations for mitigation in order to support a FONSI (often referred to as a mitigated FONSI). This practice has been criticized by some environmental groups but has been supported by an overwhelming majority of case law over the last 20 years. Typically, only several hundred EIS's are actually prepared each year throughout the federal government, usually for large, controversial projects with significant environmental impacts that are not susceptible to mitigation. Early consultation with the lead agency can better define the process to be followed (EA or EIS).

The actual preparation of an EA or EIS is by the federal lead agency, or by a third party contractor who is selected and supervised by the lead agency. The third-party relationship is the result of the EA/EIS being prepared by a contractor under the direction of a Federal Agency, but with funding provided by the project proponent. When a third party contractor is used for NEPA related work, a conflict-of-interest disclosure statement is required indicating that they have no financial or other interest in the outcome of the proposed action. Financial interests include the promise of future design or construction work. The purpose of the disclosure is to preserve the objectivity and integrity of the NEPA process.

Other major environmental permitting issues that may require agency coordination during the NEPA process include a US Fish and Wildlife Service (USFWS) Section 7 consultation, and possibly Section 106 of the National Historic Preservation Act.

7.9 Wildlife Resources

The wildlife resources in the Watershed are described in Chapter 3 of this report. Obviously, any project that would be constructed in habitat of a threatened or endangered species requires special permitting effort. Also, a project in critical habitat for species identified by the Wyoming Game and Fish Department may require special permitting effort. In these cases, it is recommended that consultations be made with the key agencies early in the process. Permitting issues could make construction or implementation of a particular project difficult and the Conservation District(s) could consider the potential permitting issues when prioritizing a project.

7.10 Online Resources and Tools

Online planning tools and publicly available maps are also available for planning efforts. A summary of these online resources is contained in Table 7.2 below. These web-based mapping applications can help local sponsors with assisting landowners who are interested in moving forward with a project proposed in the Watershed Management Plan.

7.11 Wyoming NREX and Wisdom websites

Two key websites that provide geo-spatial data online are the Natural Resource and Energy Explorer (NREX) site https://nrex.wyo.gov/ and the Wyoming Interagency Spatial Database and Online Management System (WISDOM) site *http://wisdom.wygisc.org/.*

NREX is a Web GIS-based software tool that supports pre-planning development considerations by enabling discovery, analysis and assessment of energy, environmental, cultural, socioeconomic and infrastructural assets for user-defined, project-scale areas of interest in the state. The NREX application is designed to support the Energy Atlas concept within the Governor's Energy Strategy Initiative by providing public access to credible geographic data and information maintained by state agencies. Its primary audience includes developers, conservationists, consultants, planners, policy makers, and resource managers with interests in assessing potential place-based resource allocations. A secondary audience includes educators and the general public seeking map-based sources of information for Wyoming's natural, cultural and energy resources.

The Wyoming Interagency Spatial Database and Online Management (WISDOM) System is another online planning tool that allows individuals to access data about Wyoming's wildlife resources for use in developing project plans. WISDOM is intended to provide landscape-level information during the early stages of project planning.

WISDOM provides users with information for initial project planning phases; however, site-specific analysis with applicable agencies is still warranted regarding crucial wildlife habitat requirements and conservation potential. WISDOM is an easily accessible web-based system for providing a set of natural resource data layers. This information allows a user to visually explore the distribution of important wildlife habitat, identify potential stressors to wildlife, and other data.

Table 7.2 Websites with Useful Planning Data

Agency	Web Address	Description
Enterprise Technology Services (ETS)	*http://gis.wyo.gov/parcels/*	Wyoming Statewide Parcels
	http://gis.wyo.gov/Wyofires/	Wyoming Current Fire Map
State Parks and Historic Trails	*http://gis.wyo.gov/sphsadmin/ParksLogin.aspx*	State Parks Events Info
Office of State Lands and Investment (OSLI)	*http://www.onanypc.com/statelandaccess/*	Public Access to State Lands
	http://www.onanypc.com/osligis/oilandgas/	State Oil and Gas Information
Wyoming Pipeline Authority (WPA)	*https://www.wyopipeline.com/*	Pipeline Data
Public Service Commission (PSC)	*http://psc.state.wy.us/htdocs/Dwnload/CertMaps/ electric.pdf*	Electric Utilities Areas Map
Public Service Commission (PSC)	*http://psc.state.wy.us/htdocs/Dwnload/CertMaps/ Gas.pdf*	Gas Utilities Certificate Area Map
State Engineer's Office	*http://seo.maps.arcgis.com/home/index.html* *e-permit data base*	State Engineer's Office Information
University of Wyoming – Water Resources Data System (WRDS) and Wyoming State Climate Office (SCO)	*http://www.wrds.uwyo.edu/*	WRDS is a clearing house of hydrological and climatological data. It serves as the Wyoming SCO.

Agency	Web Address	Description
USGS – National Water Information System: Web Interface	*https://waterdata.usgs.gov/wy/nwis/current/?type=flow*	Monitors water Resources in Wyoming in cooperation with State, County, local and other Federal agencies
Wyoming Department of Environmental Quality (WDEQ)	*http://deq.wyoming.gov/*	Viewer of Active Mining Permits
Wyoming State Geological Survey (WSGS)	*http://www.wsgs.wyo.gov/wyoming-geology/mapping*	Geologic Maps
	http://www.wsgs.wyo.gov/wyoming-geology/mapping	Various geologic mapping projects
	http://www.wsgs.wyo.gov/wyoming-geology/mapping	Digital data by theme
Wyoming Geographic Information Science Center (WyGISC)	*http://www.uwyo.edu/wygisc/*	Home page for WyGISC
Wyoming Climate Office	*http://www.wrds.uwyo.edu/sco/data/PRISM/PRISM.html*	PRISM Climate Data Server
	http://ims2.wrds.uwyo.edu/Website/Statewide/	Water/Climate Map Server

Chapter 8 – Project Cost Estimates

8.1 Project Cost Estimates Introduction

The estimated costs, representing 2017 dollars, are provided for the projects described in Chapter 5. The costs for many of the project components and bid items were estimated by using current unit costs for similar projects based United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) data for various practices and improvements. Conservations with landowners, with the Conservation District staff, and NRCS staff also helped to refine these cost estimates.

Detailed cost estimates, in a spreadsheet format are provided with many of the specific project write-ups, which are contained in Appendix D of this report. The costs estimates shown in Appendix D generally depict a project construction cost, often with 15% contingency for the construction costs.

Table 8.1, which is presented at the end of this chapter, summarizes the project costs for the projects included in the Watershed Study. The project cost estimates shown in Tables 8.1 are presented in the typical WWDC format and include a pre-construction costs sub-total and a construction costs sub-total. The estimated total project costs presented in this chapter is the sum of the pre-construction and construction costs estimates.

Preparation of final designs and specifications; permitting and mitigation; legal fees; acquisition of access and rights of way are included in the pre-construction costs sub-total. Total construction costs; engineering costs (assumed to be 10% of construction costs); and a 15 % contingency are included in the construction costs sub-total.

8.2 Irrigation Systems Components

Only a few irrigation systems are included in the SPRWS project lists and most of the irrigation projects that are included in this study involve rehabilitation of existing facilities. Additional engineering and design efforts will be required to determine the components of these projects and develop detailed cost estimates. Typical costs for irrigation projects based on NRCS data are summarized below:

- Irrigation pipeline costs range from $20 to $50 per linear-foot of pipe installed. The size and pressure class of the pipe, site conditions, difficulty of excavation, and appurtenances will greatly impact these costs.
- The costs for larger concrete headgates and diversion dams can often exceed $100,000 depending on the size of the structure, the nature of the structure and the site conditions. Repair and rehabilitation of smaller head gates, consisting of a new pipe and gate, can be completed for $5,000 - $7,000

8.3 Livestock / Wildlife Water Components

The most projects included in the South Platte River Watershed study were, by far, livestock and/or wildlife watering projects. New wells, new pumps, pipelines and tanks are the typical components of these projects. Solar pumps often were the preferred choice, particularly when power was not available.

The costs of these projects were estimated using NRCS information, and using cost from similar projects. Well drillers, pump installers, and other contractors and vendors were contacted to provide a “real world” check on the cost estimates provided in this report. The NRCS and Conservation District staffs also have recent experience constructing similar projects. An itemized list or spreadsheet showing the project costs for most stock watering projects are contained in Appendix D.

Typical stock water projects included the following components:

- The costs for a new stock well was estimated at $40 per foot of completed well, including drilling, casing, gravel pack, sealing, and development.
- The cost for a new one horse-power submersible electric pump was estimated to be $2,500. Additional costs for electrical service for the pump and for powerline extensions were estimated at $3,500 and $20,000 per mile.
- The costs for a solar pump varied from approximately $9,650 to $14,500 depending on the depth to water, total dynamic head, and number of solar panels required.
- The estimated costs for water tanks varied from approximately $1,200 for a small galvanized steel tank to $20,000 for a bottomless tank.
- Costs for installed pipelines range from $2.00 to $3.00 per lineal foot.
- Costs for spring developments were estimated at $3,800 including the collection pipe and spring box. The costs of the tank, pipeline and fencing was extra.

8.4 Stock Reservoir Costs

Conceptual level cost estimates for the stock reservoirs and other small reservoirs included in this Study were developed. These estimates are included with the project discussions contained in Appendix D of this report. Additional surveying and design effort should be conducted to finalize the design for these facilities. The estimated construction costs range from approximately $40,000 to over $100,000 depending the size of the dam and if the reservoir is constructed on a live stream. Riprap costs are a major component of the small reservoirs.

Table 8.1: South Platte River Watershed Study
Project Cost Estimates

Report Number	County	Project Number	Project Name	Project Type	Legal Description	Construction Cost Estimate ($)	Engineering Costs (10%) ($)	Construction and Engineering Cost Subtotal ($)	Contingency (15%) ($)	Total Construction Costs ($)	Final Plans and Specifications ($)	Permits, Fees, Access ($)	Total Project Costs ($)
1	Laramie	12-63-3.1	Grace Valley Stock & Wildlife Project	Well New	SESW 3 T12N R63W	51,975	5,198	57,173	8,576	65,748	2,500	750	$ 68,998
2	Laramie	12-67-5.1	Duck Creek Section 5 New Stock Reservoir	SR New	SWSE 5 T12N R67W	70,000	7,000	77,000	11,550	88,550	2,500	750	$ 91,800
3	Laramie	12-67-7.1	Duck Creek Section 7 New Stock Reservior	SR New	SENE 14 T12N R67W	44,263	4,426	48,689	7,303	55,992	2,500	750	$ 59,242
4	Laramie	12-68-4.1	Duck Creek Section 4 Well & Stock Water System	Well New	SENE 4 T12N R68W	94,325	9,433	103,758	15,564	119,321	2,500	750	$ 122,571
5	Laramie	12-68-11.1	Duck Creek Section 11 Spring Development	Spring Rehab	SESE 11 T12N R67W	23,458	2,346	25,803	3,870	29,674	2,500	750	$ 32,924
6	Laramie	12-68-13.1	Duck Creek Brush Creek Well Solar	Solar New	NENE 13 T12N R68W	13,943	1,394	15,337	2,301	17,637	2,500	750	$ 20,887
7	Laramie	13-67-33.1	Duck Creek Section 33 Well	Well New	NWSW 33 T13N R67W	45,086	4,509	49,595	7,439	57,034	2,500	750	$ 60,284
8	Laramie	12-70-2.1	Shiverdecker Section 2.1 Stock Reservoir	SR New	SWSW 2 T12N R70W	65,725	6,573	72,298	10,845	83,142	2,500	750	$ 86,392
9	Laramie	12-70-2.2	Shiverdecker House Spring	Spring Rehab	NESW 2 T12N R70W	18,880	1,888	20,768	3,115	23,883	2,500	750	$ 27,133
10	Laramie	12-70-2.3	Shiverdecker North Project Hosack # 3 and #4 Ditches	Spring Rehab	SWNE 2 T12N R70W	50,221	5,022	55,243	8,286	63,529	2,500	750	$ 66,779
11	Laramie	12-70-11.1	Sand Creek Section 11 New Stock Reservoir	SR New	SESW 11 T12N R70W	72,163	7,216	79,379	11,907	91,286	2,500	750	$ 94,536
12	Laramie	12-70-14.1	Sand Creek Ranch Stock Reservoir Rehab	SR Rehab	SENW 14 T12N R70W	45,000	4,500	49,500	7,425	56,925	2,500	750	$ 60,175
13	Laramie	12-70-14.2	Sand Creek Section 14 New Stock Reservoir	SR New	SWSW 14 T12N R70W	101,100	10,110	111,210	16,682	127,892	2,500	750	$ 131,142
14	Albany	12-71-18.1	Raisbeck Stock Reservoir	SR New	SESW 18 T12N R71W	53,000	5,300	58,300	8,745	67,045	2,500	750	$ 70,295
15	Albany	12-71-19.1	Raisbeck Spring Development	New Spring Development	NENW 19 T12N, R71W	13,998	1,400	15,397	2,310	17,707	2,500	750	$ 20,957
16	Laramie	13-61-30.1	Martin Stock & Wildlife Project	Stock Well, Tanks & Pipeline	NWSE 30 T13N, R61W	32,010	3,201	35,211	5,282	40,493	2,500	750	$ 43,743
17	Laramie	13-63-1.1	Smith Section1 Stock Well & Tank	Well New, Pipeline & Tank	NWSW 1 T13N R63W	29,563	2,956	32,519	4,878	37,397	2,500	750	$ 40,647
18	Laramie	13-63-7.1	Beaver Dam Rehabilitation	Irrigation Rehab	SESE 7 T13N, R63W	100,000	10,000	110,000	16,500	126,500	2,500	750	$ 129,750

Report Number	County	Project Number	Project Name	Project Type	Legal Description	Construction Cost Estimate ($)	Engineering Costs (10%) ($)	Construction and Engineering Cost Subtotal ($)	Contingency (15%) ($)	Total Construction Costs ($)	Final Plans and Specifications ($)	Permits, Fees, Access ($)	Total Project Costs ($)
19	Laramie	13-63-9.1	Beaver Dam Ditch Pipeline	Beaver Dam Ditch Pipeline	S 1/2 Sec 9 T13N R63W	300,000	30,000	330,000	49,500	379,500	2,500	750	$ 382,750
20	Laramie	13-63-16.1	Evans State Section 16 Stock Water	Stock Water	SESW 16 T13N R63W	26,276	2,628	28,904	4,336	33,239	2,500	750	$ 36,489
21	Laramie	13-63-25.1	Smith Section 25 Stock Reservoir	Stock Reservoir	SESW 25 T13N R63W	100,000	10,000	110,000	16,500	126,500	2,500	750	$ 129,750
22	Laramie	13-63-34.1	Smith Section 34 Stock Well & Tank	Well New, Pipeline & Tank	NWNW 34 T13N R63W	24,915	2,492	27,407	4,111	31,517	2,500	750	$ 34,767
23	Laramie	13-64-6.1	Ullman #1 Reservoir Rehabilitation	Irrigation Reservoir Rehabilitation	SE NE 6 T13N R64W	100,000	10,000	110,000	16,500	126,500	2,500	750	$ 129,750
24	Laramie	13-64-6.2	Ullman #1 and #2 Ditch Rehabilitation	Rehabilitate Irrigation	SE NE 6 T13N R64W	75,000	7,500	82,500	12,375	94,875	2,500	750	$ 98,125
25	Laramie	13-65-2.1	Blue Ribbon Section 2 Ponds	New Reservoir	Sec 2 T13N R65W	25,000	2,500	27,500	4,125	31,625	2,500	750	$ 34,875
26	Laramie	13-65-2.2	Blue Ribbon Section 2 Environmental	Environmental	Sec 2 T13N R65W	25,000	2,500	27,500	4,125	31,625	2,500	750	$ 34,875
27	Laramie	13-65-3.1	WHR No. 2 Reservoir Spillway Rehab	Irrigation Reservoir Rehabilitation	NENE 3 T13N R65W	15,000	1,500	16,500	2,475	18,975	2,500	750	$ 22,225
28	Laramie	13-66-16.1	Sweetgrass	Environmental	NWNW 16 T13N R66W	100,000	10,000	110,000	16,500	126,500	2,500	750	$ 129,750
29	Laramie	13-68-28.1	Belvoir Ranch Section 28 Well & Tanks	Well, New	SWNE 28 T13N, R68W	77,908	7,791	85,698	12,855	98,553	2,500	750	$ 101,803
30	Laramie	12-69-9.1	Soapstone Section 9 Well & Stock Water	Well New, Tanks	SESW 9 T12N 69W	53,240	5,324	58,564	8,785	67,349	2,500	750	$ 70,599
31	Laramie	13-69-26.1	Soapstone Goose Camp Well & Stock Water	Well, Solar Pump, Tanks	SWSE 26 T13N R69W	47,795	4,780	52,575	7,886	60,461	2,500	750	$ 63,711
32	Laramie	13-69-34.1	Soapstone Flattery Windmill Replacement	Well New	SESE 34 T13N R69W	54,450	5,445	59,895	8,984	68,879	2,500	750	$ 72,129
33	Albany	13-72-36.1	Bath State Spring Development	Spring Development	SENW 36 T13N R72W	17,188	1,719	18,906	2,836	21,742	2,500	750	$ 24,992
34	Albany	13-72-36.2	Bath State Stock Reservoir	SR New	SENW 36 T13N R72W	27,409	2,741	30,150	4,522	34,672	2,500	750	$ 37,922
35	Laramie	14-61-20.1	Bowman Wildlife Habitat	Environmental	SENW 20 T14N R61W	35,000	3,500	38,500	5,775	44,275	2,500	750	$ 47,525
36	Laramie	14-63-14.1	Mead Irrigation	Irrigation Storage	SWSW 14 T15N R63W	50,000	5,000	55,000	8,250	63,250	2,500	750	$ 66,500

Report Number	County	Project Number	Project Name	Project Type	Legal Description	Construction Cost Estimate ($)	Engineering Costs (10%) ($)	Construction and Engineering Cost Subtotal ($)	Contingency (15%) ($)	Total Construction Costs ($)	Final Plans and Specifications ($)	Permits, Fees, Access ($)	Total Project Costs ($)
37	Laramie	14-64-10.1	McWilliams Sec 10 Pump	New Solar Pump	SESW 10 T14N R64W	13,076	1,308	14,384	2,158	16,541	2,500	750	$ 19,791
38	Laramie	14-64-16.1	McWilliams State Sec 16 Stockwater	New Solar Pump and Tank	NWSE 16 T16N R64W	26,276	2,628	28,904	4,336	33,239	2,500	750	$ 36,489
39	Laramie	14-68-8.1	Polo Ranch Sections 8, 9, and 10 Stock Water	New stock well, pipeline and tanks	NENE 8 T14 N R68W	85,883	8,588	94,471	14,171	108,641	2,500	750	$ 111,891
40	Laramie	14-68-13.1	Polo Ranch Bell Ditch and Home Ditch Head Gates	Irrigation headgates rehabilitation	SWNW 13 T14N R68W	175,000	17,500	192,500	28,875	221,375	2,500	750	$ 224,625
41	Laramie	14-68-15.1	Polo Ranch Section 15 Stock Pipelines and Tanks	New pipeline and stock tanks	SENW 15 T14N R68W	36,740	3,674	40,414	6,062	46,476	2,500	750	$ 49,726
42	Laramie	14-68-15.2	Polo Ranch Section 15 Road Crossing and Erosion Control	Erosion Control	SESE 15 T14N R68W	33,459	3,346	36,805	5,521	42,326	2,500	750	$ 45,576
43	Laramie	14-68-23.1	Polo Ranch Section 23 Stock Water Project	New pipeline and stock tanks	SESE 23 T14N R68W	29,095	2,910	32,005	4,801	36,805	2,500	750	$ 40,055
44	Laramie	14-70-22.1	Jawbone Gulch Bramford Ditch Rehab	Irrigation Rehab	NWSE 22 T14N R70W	125,000	12,500	137,500	20,625	158,125	2,500	750	$ 161,375
45	Laramie	14-70-22.2	Jawbone Gulch Bramford #1 & #2 Ditch Rehab	Irrigation Rehab	NWSW 22 T14N R70W	125,000	12,500	137,500	20,625	158,125	2,500	750	$ 161,375
46	Laramie	15-60-20.1	R&K Farms Stock Pipeline & Tank	Stockwater	SWNE 20 T15N R60W	46,778	4,678	51,455	7,718	59,174	2,500	750	$ 62,424
47	Laramie	15-60-20.2	R&K Farms Stock Well & Tank	Well, New	SWNW 20 T15N R60W	47,988	4,799	52,786	7,918	60,704	2,500	750	$ 63,954
48	Laramie	15-62-5.1	Kathleen Lyon Stock & Wildlife Water	Stock & Wildlife	SENW 5 T15N R62W	56,224	5,622	61,846	9,277	71,123	2,500	750	$ 74,373
49	Laramie	15-62-7.1	Gary Lyon Stock & Wildlife Water	Stock & Wildlife	NWSW 7 T15N R62W	52,786	5,279	58,065	8,710	66,775	2,500	750	$ 70,025
50	Laramie	15-62-8.1	Larry Lyon Stock Water	Stockwater	NWSE 8 T15N R62W	40,994	4,099	45,093	6,764	51,857	2,500	750	$ 55,107
51	Laramie	15-63-20.1	Keenan Stock Water	Stockwater	SESE 20 T15N R63W	44,935	4,494	49,429	7,414	56,843	2,500	750	$ 60,093
52	Laramie	15-65-4.1	Hallock Section 4 Stock Water	Pump, Tank	NESW 4 T15N R65W	20,735	2,074	22,809	3,421	26,230	2,500	750	$ 29,480
53	Laramie	15-68-18.1	Dudash Section 18 Stock Water Pipeline	Pipelines and Tanks	SWSW 18 T15N R68W	14,988	1,499	16,486	2,473	18,959	2,500	750	$ 22,209
54	Laramie	15-70-3.1	Lorenz Ranch North 3/4 Spring	Spring Development and Tank	SWNW 3 T15N R70W	12,609	1,261	13,870	2,080	15,950	2,500	750	$ 19,200

Report Number	County	Project Number	Project Name	Project Type	Legal Description	Construction Cost Estimate ($)	Engineering Costs (10%) ($)	Construction and Engineering Cost Subtotal ($)	Contingency (15%) ($)	Total Construction Costs ($)	Final Plans and Specifications ($)	Permits, Fees, Access ($)	Total Project Costs ($)
55	Laramie	15-70-4.1	Lorenz Section 4 Spring Development	Spring Development and Tank	SWSE 4 T15N R70W	12,609	1,261	13,870	2,080	15,950	2,500	750	$ 19,200
56	Laramie	15-70-13.1	Lorenz Section 13 Well & Tank	Well, Solar Pump, Tanks	NESW 13 T15N R70W	57,668	5,767	63,434	9,515	72,949	2,500	750	$ 76,199
57	Laramie	15-70-23.1	Lorenz Sect 23 Spring Development, Pipeline and Tank	Spring Development, Pipeline and	SESW 23 T15N R70W	52,869	5,287	58,156	8,723	66,879	2,500	750	$ 70,129
58	Laramie	15-70-25.1	Lorenz Ranch Hill Horse Spring Pipeline	Spring Development, Pipeline and	NENE 25 T15N R70W	36,245	3,625	39,870	5,980	45,850	2,500	750	$ 49,100
59	Laramie	15-70-35.1	North Crow Creek Wetlands	Environmental	E 1/2 35 T15N R70W	75,000	7,500	82,500	12,375	94,875	2,500	750	$ 98,125
60	Laramie	16-61-1.1	Albin - Bushnell Draw Stock Reservoir	Stock Reservoir	SW SE 1 T16N R61W	56,750	5,675	62,425	9,364	71,789	2,500	750	$ 75,039
61	Laramie	17-60-31.1	Albin - Forester Mills Creek Stock Reservoir	Stock Reservoir	NW NE 31 T17N R60W	56,750	5,675	62,425	9,364	71,789	2,500	750	$ 75,039
62	Laramie	17-60-32.1	Albin - Hanson Mills Stock Reservoir	Stock Reservoir	SE NE 32 T17N R60W	56,750	5,675	62,425	9,364	71,789	2,500	750	$ 75,039
63	Laramie	17-60-34.1	Albin - Bella Farms Stock Reservoir	Stock Reservoir	SE NE 34 T17N R60W	56,750	5,675	62,425	9,364	71,789	2,500	750	$ 75,039
64	Laramie	16-63-29.1	Spatz Stockwater	New Well, Solar Pumps and Tanks	SW NE 29 T16N R63W	57,723	5,772	63,495	9,524	73,019	2,500	750	$ 76,269
65	Laramie	16-65-1.1	Berry Ranch Windmill Section 1	Convert Windmill to Solar Pump	SESW 1, T16N, R65W	24,824	2,482	27,307	4,096	31,403	2,500	750	$ 34,653
66	Laramie	16-65-2.1	Berry Ranch Windmill Section 2	Convert Windmill to Solar Pump	SWSE 2 T16N, R65W	25,770	2,577	28,347	4,252	32,599	2,500	750	$ 35,849
67	Laramie	16-65-22.1	Berry Ranch Windmill Section 22	Convert Windmill to Solar Pump	NWSW 22, T16N, R65W	25,770	2,577	28,347	4,252	32,599	2,500	750	$ 35,849
68	Laramie	16-65-23.1	Berry Ranch Windmill Section 23	Convert Windmill to Solar Pump	NWSW 23, T16N, R65W	23,631	2,363	25,994	3,899	29,893	2,500	750	$ 33,143
69	Laramie	16-65-23.2	Berry Ranch Section 23 Pipeline & Tanks	Pipelines and Tanks	NENE 23, T16N, R65W	45,378	4,538	49,916	7,487	57,404	2,500	750	$ 60,654
70	Laramie	16-65-27.1	Berry Ranch Solar Conversion Section 27	Convert Windmill to Solar Pump	SWNE 27, T16N, R65W	40,466	4,047	44,513	6,677	51,190	2,500	750	$ 54,440
71	Laramie	16-65-34.1	Kahler #2 Well Tank	Stock Tank, New	SESE 34 T16N R65W	16,143	1,614	17,757	2,664	20,420	2,500	750	$ 23,670
72	Laramie	16-65-34.2	Paul Ranch The Bam Bam Well Solar Pump & Tank	Solar New, Tank	SWSW 34 T16N R65W	27,005	2,701	29,706	4,456	34,161	2,500	750	$ 37,411

Table 8.1: South Platte River Watershed Study
Project Cost Estimates

Report Number	County	Project Number	Project Name	Project Type	Legal Description	Construction Cost Estimate ($)	Engineering Costs (10%) ($)	Construction and Engineering Cost Subtotal ($)	Contingency (15%) ($)	Total Construction Costs ($)	Final Plans and Specifications ($)	Permits, Fees, Access ($)	Total Project Costs ($)
73	Laramie	16-65-34.3	Paul Ranch North Section 34 Stock Water	Well New	NENE 34 T16N R65W	38,431	3,843	42,274	6,341	48,616	2,500	750	$ 51,866
74	Laramie	16-65-35.1	Kleiman Section 35 Well & Stock Water	Well New & Stockwater Project	NWSE 35 T16N, R65W	43,450	4,345	47,795	7,169	54,964	2,500	750	$ 58,214
75	Laramie	15-68-1.1	Hollingsworth South Pipelines & Tanks	Stock pipelines and tanks	SENE 1 T15N, R68W	21,368	2,137	23,504	3,526	27,030	2,500	750	$ 30,280
76	Laramie	16-67-5.1	Hollingsworth North Stock Water	New Stock Well, pipelines and tanks	SESE 5 T16N R67W	79,750	7,975	87,725	13,159	100,884	2,500	750	$ 104,134
77	Laramie	16-67-19.1	Hollingsworth Erosion Protection	Environmental	SENE 19 T16N R67W	25,000	2,500	27,500	4,125	31,625	2,500	750	$ 34,875
78	Laramie	16-67-30.1	Hollingsworth Middle Pipelines & Tanks	Stock pipelines and tanks	SENW 30 T16N R67W	59,620	5,962	65,582	9,837	75,419	2,500	750	$ 78,669
79	Laramie	16-67-8.1	LF Enterprises Section 8 Stock Water	Stockwater	SWSE 8, T16N, R67W	24,448	2,445	26,892	4,034	30,926	2,500	750	$ 34,176
80	Laramie	16-67-8.2	LF Enterprises Section 8 Irrigation Well	Irrigation Well, New	SESE 8, T16N, R67W	160,000	16,000	176,000	26,400	202,400	2,500	750	$ 205,650
81	Laramie	16-67-21.1	Falen #2 Stock Reservoir	Stock Reservoir	SWSE 21, T16N, R67W	25,000	2,500	27,500	4,125	31,625	2,500	750	$ 34,875
82	Laramie	16-67-28.1	Baccei Section 28 Stockwater System	Stock Well and Pipeline	NWSW 28, T16N, R67W	81,993	8,199	90,192	13,529	103,721	2,500	750	$ 106,971
83	Laramie	15-68-6.1	Vercelli Section 6 Pipeline & Tank	Tank, Pipeline	NWNE 6 T15N R68W	15,414	1,541	16,955	2,543	19,498	2,500	750	$ 22,748
84	Laramie	16-68-19.1	Vercelli Section 19 Stock Water	New Stock Well, Pipeline and Tank	NENE 19 T16N R68W	75,732	7,573	83,305	12,496	95,801	2,500	750	$ 99,051
85	Laramie	16-69-34.1	Vercelli Section 34 Well & Stock Water	New Stock Well, Pipeline and Tanks	NESW 34 T16N R69W	73,686	7,369	81,055	12,158	93,213	2,500	750	$ 96,463
86	Laramie	16-69-19.1	Y Cross Section 19 Pipelines & Tanks	Pipelines and Tanks	SENE 19, T16N, R69W	68,929	6,893	75,822	11,373	87,195	2,500	750	$ 90,445
87	Laramie	16-69-30.1	Y Cross Section 30 Stock Well & Tank	Stock Well, Tank, Pipeline and Tanks.	NWSW 30 T16N, R69W	101,269	10,127	111,396	16,709	128,105	2,500	750	$ 131,355
88	Laramie	16-70-24.1	Y Cross Islay Draw #1 Reservoir Rehab	Stock Reservoir Rehab	SENE 24, T16N, R70W	40,000	4,000	44,000	6,600	50,600	2,500	750	$ 53,850
89	Laramie	16-70-36.1	Y Cross Tabletop Reservoir Rehab	Reservoir and Irrigation System Rehab	SWSE 36 T16N, R70W	75,000	7,500	82,500	12,375	94,875	2,500	750	$ 98,125
90	Laramie	16-69-21.1	Islay North Pasture Stock Well & Tank	Stock Well and Tank	NWSE 21, T16N, R69W	34,279	3,428	37,707	5,656	43,363	2,500	750	$ 46,613

Table 8.1: South Platte River Watershed Study
Project Cost Estimates

Report Number	County	Project Number	Project Name	Project Type	Legal Description	Construction Cost Estimate ($)	Engineering Costs (10%) ($)	Construction and Engineering Cost Subtotal ($)	Contingency (15%) ($)	Total Construction Costs ($)	Final Plans and Specifications ($)	Permits, Fees, Access ($)	Total Project Costs ($)
91	Laramie	16-69-29.1	Islay Chadwick Reservoir #3 Rehab	Reservoir Rehab	NENE 29, T16N, R69W	50,000	5,000	55,000	8,250	63,250	2,500	750	$ 66,500
92	Laramie	16-69-29.2	Islay Chadwick #1 Ditch Rehab	Irrigation Rehab	SENE 29 T16N R69W	75,000	7,500	82,500	12,375	94,875	2,500	750	$ 98,125
93	Laramie	16-69-32.1	Islay Ranch Road Pasture Spring	Spring Development and Tank - Road	NENE 32 T16N R69W	30,429	3,043	33,472	5,021	38,492	2,500	750	$ 41,742
94	Laramie	17-63-27.1	Anderson Section 27 Well & Solar	Well Rehab	NESW 27 T17N R63W	41,071	4,107	45,178	6,777	51,955	2,500	750	$ 55,205
95	Laramie	17-63-27.2	Anderson Section 27 Ditch Rehab	Irrigation Rehab	NWNE 27 T17N R63W	3,000	300	3,300	495	3,795	2,500	750	$ 7,045
96	Laramie	17-63-28.1	Anderson Section 28 Contour Ditch Rehab	Irrigation	NWNW 28 T17N R63W	12,000	1,200	13,200	1,980	15,180	2,500	750	$ 18,430

Report Number	County	Project Number	Project Name	Project Type	Legal Description	Construction Cost Estimate ($)	Engineering Costs (10%) ($)	Construction and Engineering Cost Subtotal ($)	Contingency (15%) ($)	Total Construction Costs ($)	Final Plans and Specifications ($)	Permits, Fees, Access ($)	Total Project Costs ($)
USFS-1	Albany	14-71-24.1	USFS-1	Spring Development	24 T14N R71W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858
USFS-2	Albany	14-71-15.1	USFS-2	Spring Rehabilitation	15 T14N R71W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858
USFS-3	Albany	15-71-31.1	USFS-3	Spring Rehabilitation	31 T15N R71W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858
USFS-4	Albany	15-72-24.1	USFS-4	Spring Rehabilitation	24 T15N R72W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858
USFS-5	Albany	15-71-31.1	USFS-5	Spring Rehabilitation	31 T15N R71W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858
USFS-6	Albany	15-71-35.1	USFS-6	Spring Rehabilitation	35 T15N R71W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858
USFS-7	Albany	15-71-35.2	USFS-7	Spring Rehabilitation	35 T15N R71W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858
USFS-8	Albany	15-71-13.1	USFS-8	Spring Rehabilitation	13 T15N R71W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858
USFS-9	Albany	15-71-2.1	USFS-9	Spring Rehabilitation	2 T15N R71W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858
USFS-10	Albany	15-72-14.1	USFS-10	Spring Rehabilitation	14 T15N R72W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858
USFS-11	Albany	15-71-6.1	USFS-11	Spring Development	6 T15N R71W	$ 15,500	1,550	17,050	2,558	19,608	2,500	750	$ 22,858

Other Projects

1	Laramie	12.63.13.1	Mackley Reservoir	Reservoir Rehabilitation & Environmental	NENE 13 T12N R63W		-	-	-	-	2,500	750	$ 3,250
2	Laramie	13-63-36.1	Carpenter Area Groundwater Recharge Project	Gary Smith	SE 1/4 36 T13N R63W		-	-	-	-	2,500	750	$ 3,250
3	Laramie	13-67-15-1	Swan Ranch Reservoir	Reservoir Rehabilitation	N 1/2 15 T13N R67W		-	-	-	-	2,500	750	$ 3,250

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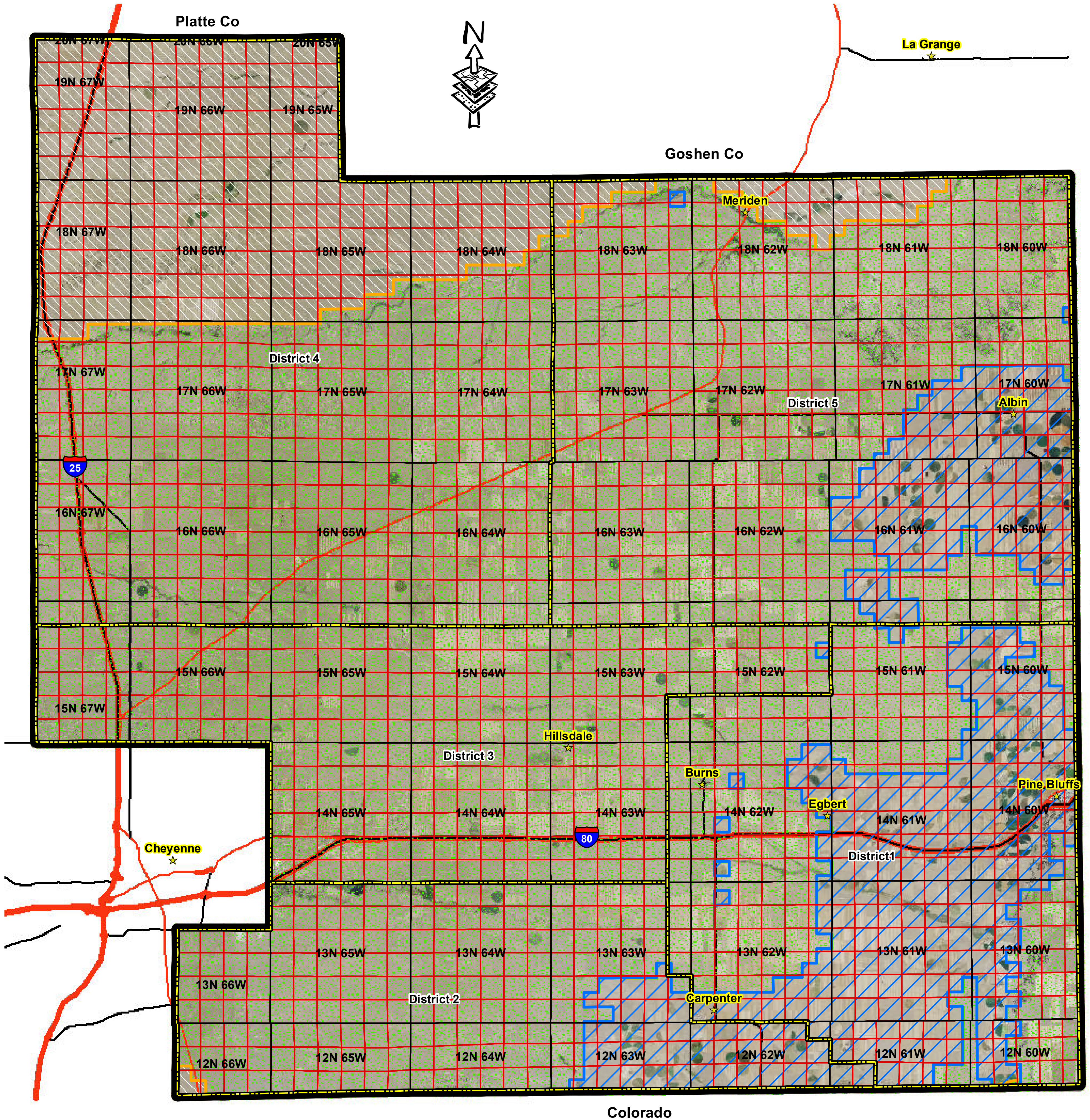
Appendix A

South Platte River Watershed
Level I Study

- Summary Information about the Wyoming State Engineer’s April 2015 Order concerning the Laramie County Control Area



Legend

- Laramie County Control Area Boundary
- Laramie County Control Area District Boundaries
- Groundwater Model Boundary
- Drawdown Area
- Conservation Area
- Unaffected Area
- Townships
- Sections
- City \ Town

Order of the State Engineer
Laramie County Control Area
April 1, 2015

Figure 1

0 3 6 12 Miles

This GIS map was created using information and records from the Wyoming State Engineer's Office, and was designed solely for informational purposes to be used in conjunction with the Order of the State Engineer, Laramie County Control Area: April 1, 2015. This map was not designed for any other purpose and the State does not warrant the accuracy of this map for any other use, and no decision involving a risk of loss or injury should be made in reliance thereon. The Wyoming State Engineer's Office will determine whether a groundwater appropriation falls within any defined area based on its records and information.

FACT SHEET
STATE ENGINEER'S ORDER
LARAMIE COUNTY CONTROL AREA, LARAMIE COUNTY, WYOMING
APRIL 1, 2015

- The effective date of the Order is April 1, 2015.
- The Order applies to the Laramie County Control Area (LCCA), within Laramie County, Wyoming.
- All existing High Plains Aquifer, non time-limited, irrigation, municipal, industrial and miscellaneous use appropriations (including enlargements) must be adjudicated by November 30, 2017. Wells that are not adjudicated by that date will be tagged, locked, and foreclosed from use until adjudication is complete.
- New groundwater rights other than stock and domestic uses will specify a deadline to complete adjudication.
- Meters must be installed on all High Plains Aquifer irrigation, municipal, industrial and miscellaneous use wells before use in water year 2017. Monthly and annual total water production must be reported to the State Engineer's Office - Ground Water Division (GW).
- New appropriations other than stock and domestic use wells, and miscellaneous use wells appropriating ≤ 5 acre-feet of annual production are prohibited in the Drawdown Area.
- All new miscellaneous use appropriations (including enlargements) in the Drawdown Area must collect and report static water levels annually to GW. All new appropriations >5 acre-feet of annual production, where allowed in the LCCA, must collect and report static water levels annually to GW.
- For appropriations >5 acre-feet of annual production in the Conservation Area and Underlying Units, a reduction of the water column in excess of 20 percent of that available to the well at the time of original development is prohibited.
- Well spacing requirements will apply to all new appropriations in the Drawdown Area, Conservation Area, and Underlying Units. Well spacing requirements are variable and will depend on geographic location within the LCCA.
- Approval of appropriations in the High Plains Aquifer and in Underlying Units is dependent upon the proposed use and annual production.
- Monitor well(s) will be required for wells >40 acre-feet of annual production in the Conservation Area and Underlying Units.
- Monitor well(s) may be required for wells >5 acre-feet and $\leq$40 acre-feet in the Conservation Area and Underlying Units.
- All new irrigation, municipal, industrial, miscellaneous use applications >25 gallons per minute, and petitions to amend an existing water right, must be public noticed, subject to public comment, and obtain a recommendation from the LCCA Advisory Board.
- The State Engineer can issue any permit subject to such conditions as he may find to be in the public interest.
- Beginning November 16, 2019, the State Engineer will review the effects of the first three years of operation under the Order.
- If no order is issued by April 1, 2020, the Order will continue in force for consecutive three-year periods until a new order is issued.
- The Order remains effective until rescinded, superseded, or modified by another order of the State Engineer or replaced by an appropriator agreement.

WELL SPACING REQUIREMENTS FOR NEW PERMITS, EFFECTIVE APRIL 1, 2015

HIGH PLAINS AQUIFER	Stock/Dom	Miscellaneous ≤5 acre-feet	>5 and ≤40 acre-feet	>40 acre-feet
Drawdown area	1 per lot or 1 per 10 acres.	0.5 mile from non DOM and STO wells. Annual static water level measurement.	No new permits.	
Conservation area	1 per lot or 1 per 10 acres.		1 per 1/4 1/4 or 40 acres. Annual static water level measurements. Possible monitor well. Reduction >20% of original water column prohibited.	1.5 mile spacing from other large cap wells. Monitor well in same interval within 500'. Annual static water level measurement. Reduction >20% of original water column prohibited.
Unaffected area	No restrictions.		Annual static water level measurement.	
UNDERLYING UNITS	Stock/Dom	Miscellaneous ≤5 acre-feet	>5 and ≤40 acre-feet	>40 acre-feet
Underlying Units	1 per lot or 1 per 10 acres.		1 per 1/4 1/4 or 40 acres. Annual static water level measurements. Possible monitor well. Reduction >20% of original water column prohibited.	1.5 mile spacing from other large cap wells. Monitor well in same interval within 500'. Possible shallow monitor well. Annual static water level measurement. Reduction >20% of original water column prohibited.

Appendix B

South Platte River Watershed
Level I Study

Appendix B.1 Gap Vegetation Class Descriptions and Ecological Site Descriptions

Brief descriptions of each dominant vegetation class are presented below, adapted from the NatureServe descriptions of GAP Ecological Systems Classifications (NatureServe 2009).

Western Great Plains Shortgrass Prairie

This system is found primarily in the western half of the Western Great Plains Division. It ranges from the Nebraska Panhandle south into Texas and New Mexico. It is the most common system in this range. This system occurs primarily on flat to rolling uplands with loamy soils and is characterized by blue grama. Climate, fire and grazing influence this system. The short grasses that dominate this system are extremely drought and grazing tolerant. In contrast to other prairie systems, fire is less important. However, historically, fires that did occur were often very expansive. Currently, fire suppression and more extensive grazing in the region have likely decreased the fire frequency even more. A large part of the range for this system has been converted to agriculture. Other areas have been impacted by the unsuccessful attempts to develop dryland cultivation during the Dust Bowl of the 1930s. This system in combination with the associated wetland systems represents one of the richest areas for mammals and birds. Endemic bird species to the shortgrass system may constitute one of the fastest declining bird populations.

Northwestern Great Plains Mixedgrass Prairie

The northern mixedgrass system extends from northern Nebraska into southern Canada and westward through the Dakotas to the Rocky Mountain Front in Montana. The growing season and rainfall are intermediate to drier units to the southwest and mesic tallgrass regions to the east. Grasses typically comprising the greatest canopy cover include western wheatgrass, green needlegrass, and fescue. Fire and grazing constitute the primary dynamics affecting this system. Drought can also impact this system, in general favoring the shortgrass component at the expense of the mid-grasses. With intensive grazing, cool-season exotics, such as Kentucky bluegrass and brome species, can increase in dominance. Shrub species can also increase in dominance with fire suppression. This system is one of the most disturbed grassland systems in Nebraska, North and South Dakota, and Canada. Historically, this system covered approximately 94 million acres in Nebraska, North and South Dakota, and Canada.

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 percent of total vegetation.

Western Great Plains Foothill and Piedmont Grassland

This mixed grassland occurs on foothill and mesa slopes along a relatively narrow elevational band near the base of the southern Rocky Mountain Front and extends east on to the plains in higher elevation piedmont areas from northeastern New Mexico to southeastern Wyoming. This area receives more abundant precipitation than the surrounding shortgrass prairie and can support mid and tall grasslands. Common plants include a mixture of grasses such as big bluestem, little bluestem, mountain muhly, green needlegrass, western wheatgrass, needle-and-thread, New Mexico needlegrass, blue grama (degraded sites), or bluebunch wheatgrass (northern sites). This grassland is maintained by frequent fire. Without fire shrubs may invade and convert to shrubland.

Inter-Mountain Basins Big Sagebrush Steppe

Open sagebrush steppe – habitats of mixed grassland with scattered shrubs – contain Wyoming or basin big sagebrush, bitterbrush or other western sage-like shrubs with usually between 10 and 25 percent cover. Native 'bunchgrasses' that form dense clumps at their base, along with other native grasses, tend to cover well over 25 percent of the ground, distinguishing this from Big Sagebrush Shrublands, which feature more shrubs and less grass. With overgrazing and/or suppression of natural wildfire, some sagebrush steppe can be converted to sagebrush shrublands. This is a very widespread type occurring on rolling and flat plains, with a variety of soil conditions. This type occurs throughout the western U.S., and is dominant in the Columbia Plateau and the northwestern Great Plains of Wyoming and Montana. Pronghorn antelope, sage grouse, pygmy rabbit, sage sparrow, and many plant and animal species utilize sagebrush steppe as their primary habitat.

Inter-Mountain Basins Big Sagebrush Shrubland

Big sagebrush shrublands are one of the most widespread ecological systems in the western U.S., found in basins, on plains and in foothills between 1500 and 2300 meters in elevation. The soils are deep, well-drained and non-saline. The most important sage species are Wyoming or basin big sagebrush; other common shrubs include bitterbrush, rabbitbrush, or mountain snowberry. Shrubs are the dominant vegetation, with grasses making up less than 25 percent of the cover, distinguishing this from the Intermountain Basins Big Sagebrush Steppe system, which has higher grass cover. In recent years this system has been widely invaded by non-native annual grasses or weeds, in particular cheatgrass, which changes the fire dynamics within the system.

Ecological Site Descriptions

Descriptions of the Historic Climax Plant Community (HCPC) of the five dominant Ecological Site Descriptions in the study area are presented below, adapted from NRCS soil survey data reports (NRCS 2016b).

The HCPC describes the final-stage successional plant community of the site under historical conditions, and typically exhibits the greatest productivity of any successional community supported by the site (Caudle et al. 2013). The HCPC can be used as an indicator of potential site productivity, by comparing the HCPC to the site's current plant community.

***Loamy (15-17 SP)*: Loamy (Ly) 15-17" Precipitation Zone Southern Plains**

The Needle-and-Thread, Rhizomatous Wheatgrass, Blue Grama Plant Community is the interpretive plant community for this site and is considered to be the HCPC. This plant community evolved with grazing by large herbivores, and is well suited for grazing by domestic livestock. The HCPC can be found on grazed areas that receive adequate periods of rest during the growing season in order for grazed plants to recover. Historically, fires likely occurred infrequently. The potential vegetation is about 75-90 percent grasses, 5-15 percent forbs, and 5-10 percent woody plants. This community is dominated by cool season mid-grasses. The major grasses include rhizomatous wheatgrasses (predominantly western with some thickspike), needle-and-thread, and blue grama. Other grasses include green needlegrass, little bluestem, prairie junegrass, and Sandberg bluegrass. Green needlegrass is found in greater abundance in the 15-17" precipitation zone than in other loamy areas with lower annual precipitation, and is also more abundant in areas of finer textured soils. A variety of forbs and half-shrubs also occur. Shrubs are not abundant. Plant diversity is high.

Total annual production (air-dry weight) is about 1500 pounds per acre during an average year, but it can range from about 1000 pounds per acre in unfavorable years to about 2000 pounds per acre in above average years.

This plant community is stable and well adapted to the Northern Great Plains climatic conditions. Litter is properly distributed with very little movement off-site and natural plant mortality is very low. The diversity in plant species allows for high dry tolerance. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity.

Under a combination of frequent and severe grazing, grasses such as green needlegrass, needle-and-thread, and eventually western wheatgrass will decrease in frequency and production. Grasses such as blue grama and threadleaf sedge increase. Under continued frequent and severe grazing, the plant community will eventually become sod-bound. Over the long-term, in combination with trampling, this sod will ultimately become broken with areas of bare ground developing and species such as cheatgrass and broom snakeweed invading. Transitions or pathways leading to other plant communities are as follows:

- Frequent and severe grazing, during the growing season of the cool-season mid-grasses, will move this plant community initially towards the Blue Grama Sod with Cool-Season Mid-Grasses Plant Community. Over a period of years, plant species less tolerant to frequent and severe defoliation will begin to decrease, and those more tolerant will begin to increase.

- No use and no fire will move this plant community towards the Low Plant Density, Excess Litter Plant Community. Initially, excess litter begins to build-up. Eventually native plant density begins to decrease and weeds and introduced species may begin to invade.

***Shallow Igneous (15-19SE)*: Shallow Igneous (SwIg) 15-19" Precipitation Zone Foothills and Mountains Southeast**

The Bluebunch Wheatgrass, Idaho Fescue, and Three-tip Sagebrush Community is the interpretive plant community for this site and is considered to be the HCPC. This plant community evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. This plant community can be found on areas that are properly managed with grazing, and sometimes on areas receiving occasional short periods of rest. The potential vegetation is about 65 percent grasses or grass-like plants, 15 percent forbs, and 25 percent woody plants.

The major grasses include bluebunch wheatgrass and Idaho fescue. Other grasses occurring on the state include slimstem muhly, threadleaf sedge, Sandberg bluegrass, Canby bluegrass and Parry's oatgrass. A variety of forbs also occur. Three-tip sagebrush can be a conspicuous element of this state. Plant diversity is high.

The total annual production (air-dry weight) of this state is about 900 pounds per acre, but it can range from about 600 pounds per acre in unfavorable years to about 1,200 pounds per acre in above average years.

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

Under a combination of frequent and severe grazing, species such as Sandberg bluegrass, threadleaf sedge, prairie junegrass, unpalatable forbs, and threetip sagebrush will increase. Grasses such as bluebunch wheatgrass, Montana wheatgrass, and Parry's oatgrass will decrease in frequency and production. Transitions or pathways leading to other plant communities are as follows:

- No use and no fire for 20 years or more will convert this plant community to the Low Plant Density, Decadent Plants Community.

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

<u>Sandy (15-17 SP)</u>: Sandy (Sy) 15-17" Precipitation Zone Southern Plains

The Little Bluestem, Prairie Sandreed, and Needle-and-Thread Grass Community is the interpretive plant community for this site and is considered to be the HCPC. This site evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. Historically, fires likely occurred infrequently. This plant community can be found on grazed areas that receive adequate periods of rest during the growing season in order for grazed plant to recover. The potential vegetation is about 70-95 percent grasses, 5-15 percent forbs, and 0-15 percent woody plants. The site is dominated by tall and mid-grasses. The major grasses include needle-and-thread, prairie sandreed, and little bluestem. Other grasses occurring on the site include sand bluestem, blue grama, Indian ricegrass, rhizomatous wheatgrasses, and threadleaf sedge. A variety of forbs, half-shrubs, and shrubs also occur. Plant diversity is high.

Total annual production (air-dry weight) is about 1500 pounds per acre during an average year, but it can range from about 1000 pounds per acre in unfavorable years to about 2000 pounds per acre in above average years.

The diversity in plant species allows for high drought tolerance. This is a sustainable plant community. Soil erosion is low. The water cycle is functioning. Infiltration is high because of litter accumulation and soil texture. Runoff is low. Areas that are compacted and have lost all vegetation such as livestock and vehicle trails are subject to runoff and soil erosion.

Under a combination of frequent and severe grazing, grasses such as little bluestem, needle-and-thread, and rhizomatous wheatgrasses will decrease in frequency and production. Grasses such as threadleaf sedge and blue grama increase. Under continued frequent and severe defoliation, the plant community will eventually become sod-bound. Over the long-term, in combination with trampling, this sod will ultimately become broken with areas of bare ground developing and species such as cheatgrass, pricklypear cactus, spreading buckwheat, and broom snakeweed invading. Transitions or pathways leading to other plant communities are as follows:

- Frequent and severe defoliation, during the growing season will move this plant community initially towards the Prairie Sandreed, Needle-and-Thread, Rhizomatous Wheatgrass, Blue Grama Plant Community. Over a period of years, plant species less tolerant to frequent and severe defoliation will begin to decrease, and those more tolerant will begin to increase.

- No use and no fire will move this plant community towards the Low Plant Density, Excess Litter Plant Community. Initially, excess litter begins to build-up. Eventually native plant density begins to decrease and weeds and introduced species may begin to invade the site.

***Loamy (12-14 SP)*: Loamy (Ly) 12-14" Precipitation Zone Southern Plains**

The Needle-and-Thread, Rhizomatous Wheatgrass, Blue Grama Plant Community is the interpretive plant community for this site and is considered to be the HCPC. This plant community evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. Historically, fires likely occurred infrequently. This plant community can be found on grazed areas that receive adequate periods of rest during the growing season in order for grazed plant to recover. The potential vegetation is about 75-90 percent grasses, 5-15 percent forbs, and 5-10 percent woody plants. This community is dominated by cool season mid-grasses. The major grasses include rhizomatous wheatgrasses (predominantly western with some thickspike), needle-and-thread, and blue grama. Other grasses include green needlegrass, little bluestem, prairie junegrass, and Sandberg bluegrass. A variety of forbs and half-shrubs occur but are not abundant. Plant diversity is high.

Total annual production (air-dry weight) is about 1300 pounds per acre during an average year, but it can range from about 750 pounds per acre in unfavorable years to about 1750 pounds per acre in above average years.

This plant community is stable and well adapted to the Northern Great Plains climatic conditions. Litter is properly distributed with very little movement off-site and natural plant mortality is very low. The diversity in plant species allows for high dry tolerance. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity.

Under a combination of frequent and severe grazing, species such as Sandberg bluegrass, threadleaf sedge, prairie junegrass, unpalatable forbs, and threetip sagebrush will increase. Grasses such as bluebunch wheatgrass, Montana wheatgrass, and Parry's oatgrass will decrease in frequency and production. Transitions or pathways leading to other plant communities are as follows:

- Frequent and severe defoliation, during the growing season of the cool-season mid-grasses, will move this plant community initially towards the Blue Grama Sod with Cool-Season Mid-Grasses Plant Community. Over a period of years, plant species less tolerant to frequent and severe defoliation will begin to decrease, and those more tolerant will begin to increase.

- No use and no fire will move this plant community towards the Low Plant Density, Excess Litter Plant Community. Initially, excess litter begins to build-up. Eventually native plant density begins to decrease and weeds and introduced species may begin to invade.

***Shallow Sandy (15-17 SP)*: Shallow Sandy (SwSy) 15-17" Precipitation Zone Southern Plains**

The Needle-and-Thread, Little Bluestem / Bluebunch Wheatgrass, Rhizomatous Wheatgrass Plant Community is the interpretive plant community for this site and is considered to be the HCPC. This plant community evolved with grazing by large herbivores and is well suited for grazing by domestic livestock; the HCPC can be found on areas that are grazed but receive adequate periods of rest during the growing season for grazed plants to recover. Historically, fires likely occurred infrequently.

The potential vegetation is about 80-95 percent grasses or grass-like plants, 5-15 percent forbs, and 0-5 percent woody plants. Combinations of warm and cool-season mid-grasses dominate the plant community. The major grasses and grass-likes include needle-and-thread, little bluestem, rhizomatous wheatgrasses, threadleaf sedge, and blue grama. Other grasses include prairie sandreed, sideoats grama, and bluebunch wheatgrass. Dominant forbs are prairie clovers, dotted gayfeather, hairy goldaster, fringed sagewort, buckwheats, and lemon scurfpea. Commonly found shrubs include yucca, winterfat, and pricklypear cactus. Skunkbush sumac and true mountain mahogany can also be found primarily on rock outcrops.

Total annual production (air-dry weight) is about 1100 pounds per acre during an average year, but it can range from about 750 pounds per acre in unfavorable years to about 1500 pounds per acre in above average years.

This plant community is well adapted to the Northern Great Plains climate. This is a sustainable plant community (soil stability, watershed function, and biologic integrity). Infiltration rates are moderate due to the rapid intake rate of the soils and the relatively steep topography. Soil erosion is low.

Under a combination of frequent and severe grazing during the growing season, grasses such as little bluestem and sideoats grama will decrease in both frequency and production. Blue grama and threadleaf sedge will increase. Under continued frequent and severe defoliation, with no rest periods for the plants to recover, blue grama and threadleaf sedge will increase while needle-and-thread, rhizomatous wheatgrass, and prairie sandreed will begin to decrease. If continued, the plant community will become sod-bound, and all mid to tall grasses can eventually be removed from the plant community. Over the long-term, this continuous use in combination with high stock densities will result in a broken sod, with areas of bare ground developing, and species such as annual bromes and broom snakeweed invading. Transitions or pathways leading to other plant communities are as follows:

- Frequent and severe defoliation will move this plant community plant community towards the Threadleaf Sedge, Blue Grama with Remnant Mid-grasses Plant Community. Over a period of years, plant species less tolerant to frequent or severe defoliation will begin to decrease, and those more tolerant will begin to increase.

- No use and no fire will move this plant community towards the Low Plant Density, Excess Litter Plant Community. Initially, excess litter begins to build-up. Eventually native plant density begins to decrease and weeds and introduced species may begin to invade.

Appendix B.2 US Army Corp of Engineers Wetland Type Descriptions

Descriptions of these USACE wetland categories are below (excerpted from Smith et al. 1995):

Depressional Wetlands

Depressional wetlands occur in topographic depressions with a closed elevation contour that allows accumulation of surface water. Dominant sources of water are precipitation, groundwater discharge, and interflow from adjacent uplands. The direction of water movement is normally from the surrounding uplands toward the center of the depression. Depressional wetlands may have any combination of inlets and outlets or lack them completely. Depressional wetlands may lose water through intermittent or perennial drainage from an outlet, by evapotranspiration, and, if they are not receiving groundwater discharge, may slowly contribute to groundwater. Dominant hydrodynamics are vertical fluctuations, primarily seasonal. Peat deposits may develop in depressional wetlands. Prairie potholes area common example of depressional wetlands.

Lacustrine Fringe Wetlands

Lacustrine fringe wetlands are adjacent to lakes where the water elevation of the lake maintains the water table in the wetland. In some cases, they consist of a floating mat attached to land. Additional sources of water are precipitation and groundwater discharge, the latter dominating where lacustrine fringe wetlands intergrade with uplands or slope wetlands. Surface water flow is bidirectional, usually controlled by water level fluctuations such as seiches in the adjoining lake. Lacustrine fringe wetlands are indistinguishable from depressional wetlands where the size of the lake becomes so small relative to fringe wetlands that the lake is incapable of stabilizing water tables. Lacustrine wetlands lose water by flow returning to the lake after flooding, by saturation surface flow, and by evapotranspiration. Organic matter normally accumulates in areas sufficiently protected from shoreline wave erosion. Un-impounded marshes bordering the Great Lakes are a common example of lacustrine fringe wetlands.

Slope Wetlands

Slope wetlands normally are found where there is a discharge of groundwater to the land surface. They normally occur on sloping land; elevation gradients may range from steep hillsides to slight slopes. Slope wetlands are usually incapable of depressional storage because they lack the necessary closed contours. Principal water sources are usually groundwater return flow and interflow from surrounding uplands as well as precipitation. 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 saturation subsurface and surface flows and by evapotranspiration. Slope wetlands may develop channels, but the channels serve only to convey water away from the slope wetland. Fens are a common example of slope wetlands.

Riverine Wetlands

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 water sources may be interflow and return flow from adjacent uplands, occasional overland flow from adjacent uplands, tributary inflow, and precipitation. When overbank flow occurs, surface flows down the floodplain may dominate hydrodynamics. At their headwater most extension, riverine wetlands often intergrade with slope or depressional wetlands as the channel (bed) and bank disappear, or they may intergrade with poorly drained flats or uplands. Perennial flow is not required.

Riverine wetlands lose surface water via the return of floodwater to the channel after flooding and through saturation surface flow to the channel during rainfall. They lose subsurface water by discharge to the channel, movement to deeper groundwater (for losing streams), and evapotranspiration. 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 hardwood floodplains are a common example of riverine wetlands.

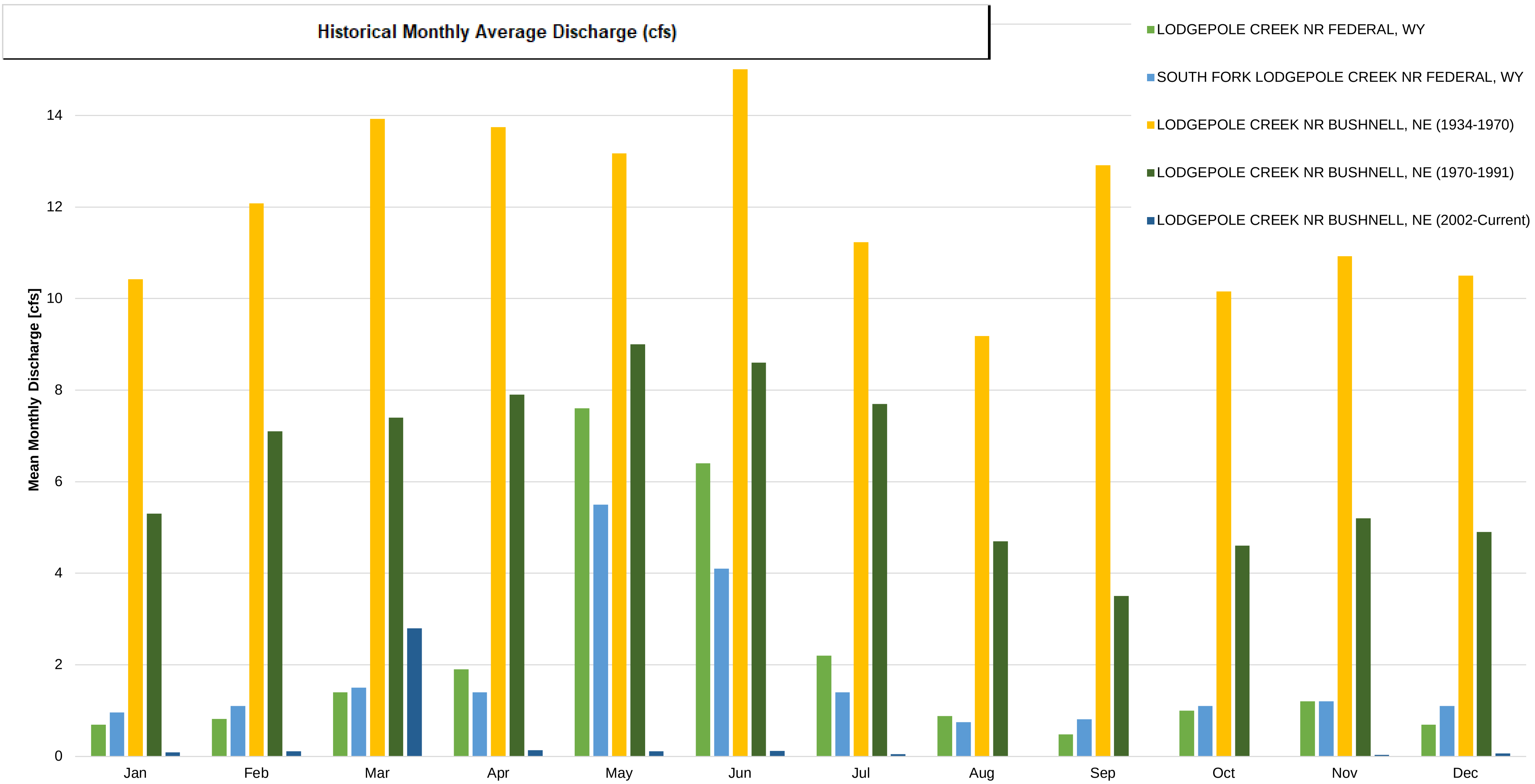


Figure B-3.1 – Historical Monthly Average Discharge

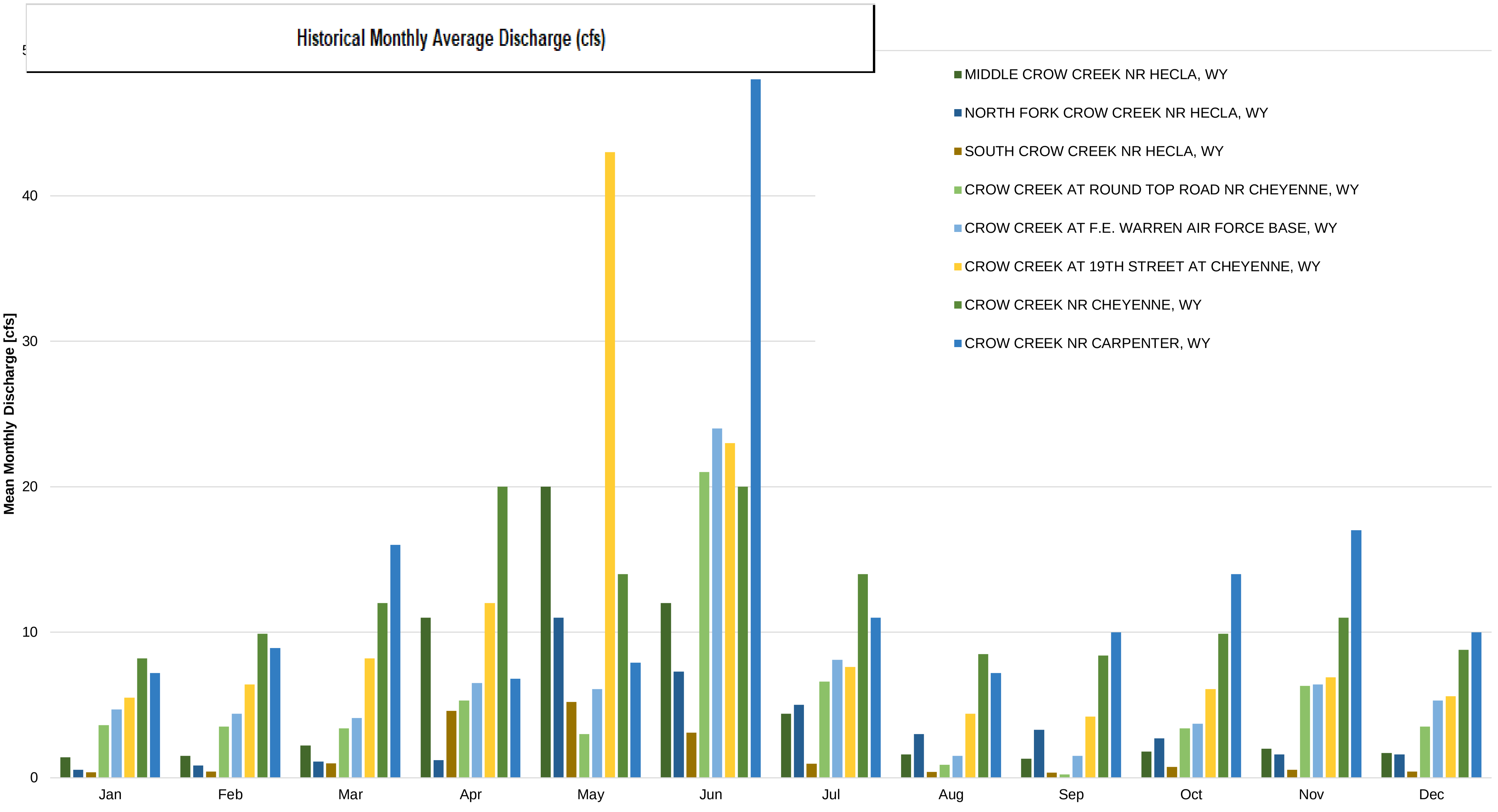


Figure B-3.2 – Historical Monthly Average Discharge

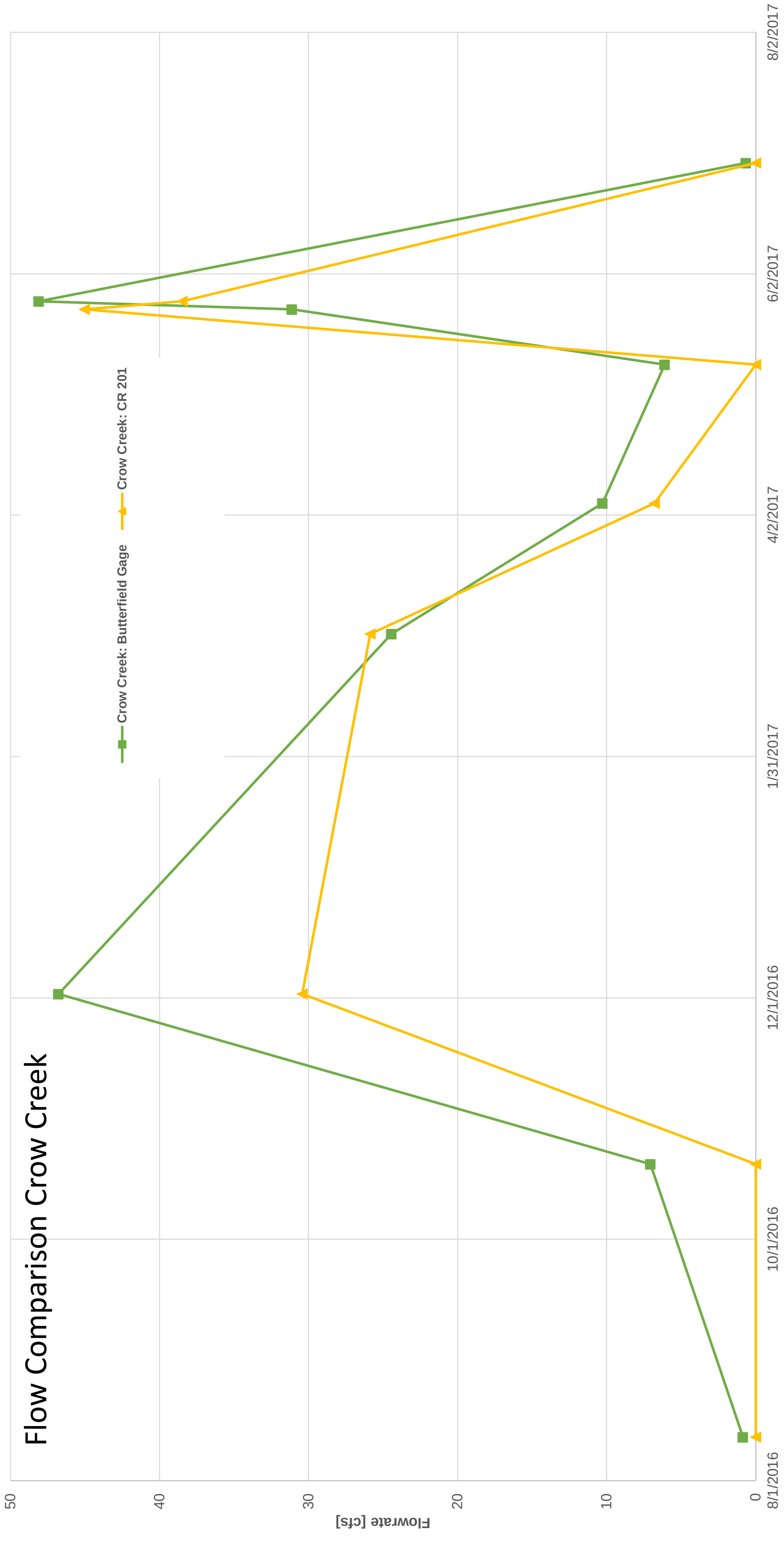


Figure B-3.3 – Flow Comparisons

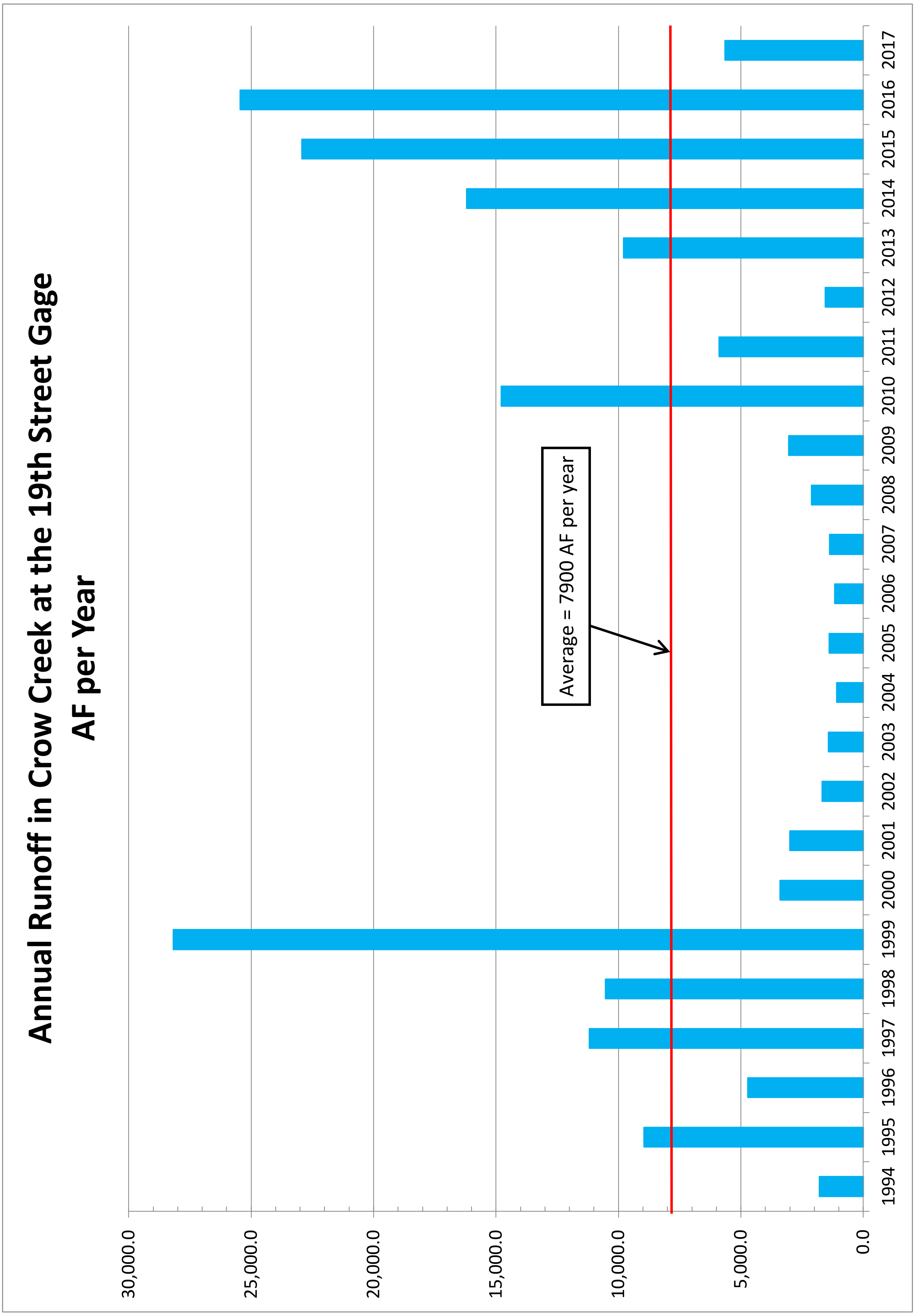


Figure B-3.4 – Annual Runoff in Crow Creek

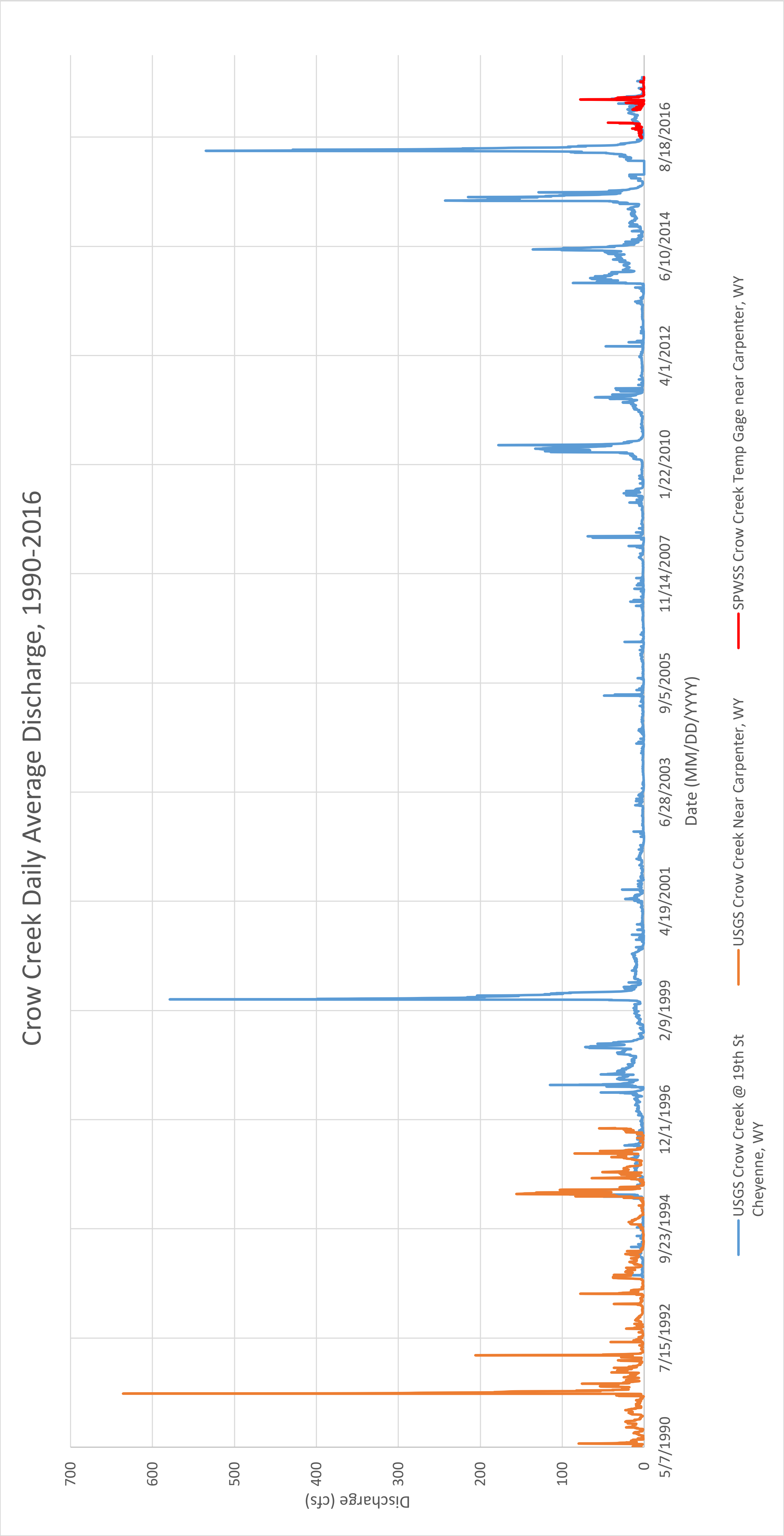


Figure B-3.5 – Crow Creek Daily Average Discharge

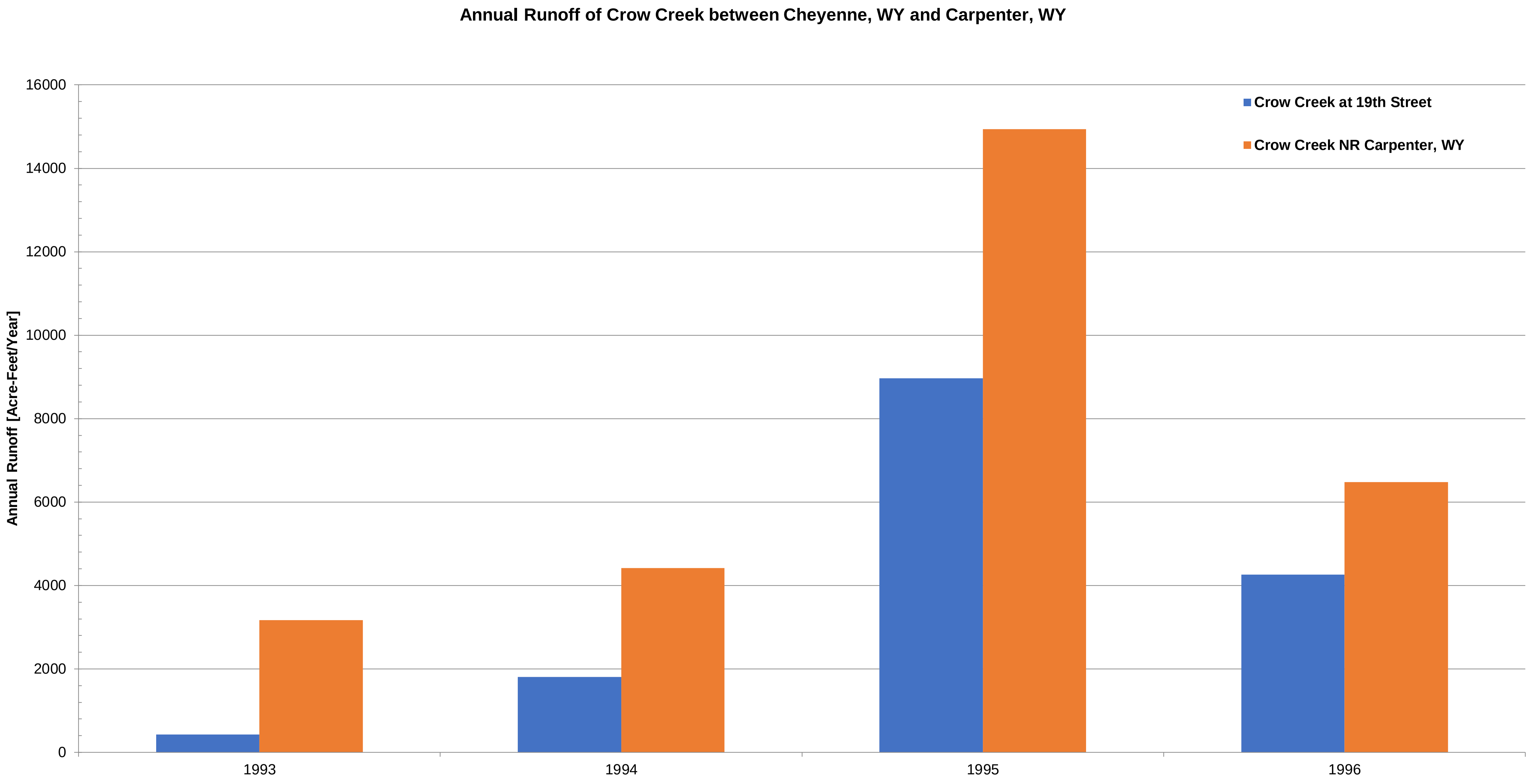


Figure B-3.6 – Annual Runoff of Crow Creek Between Cheyenne and Carpenter

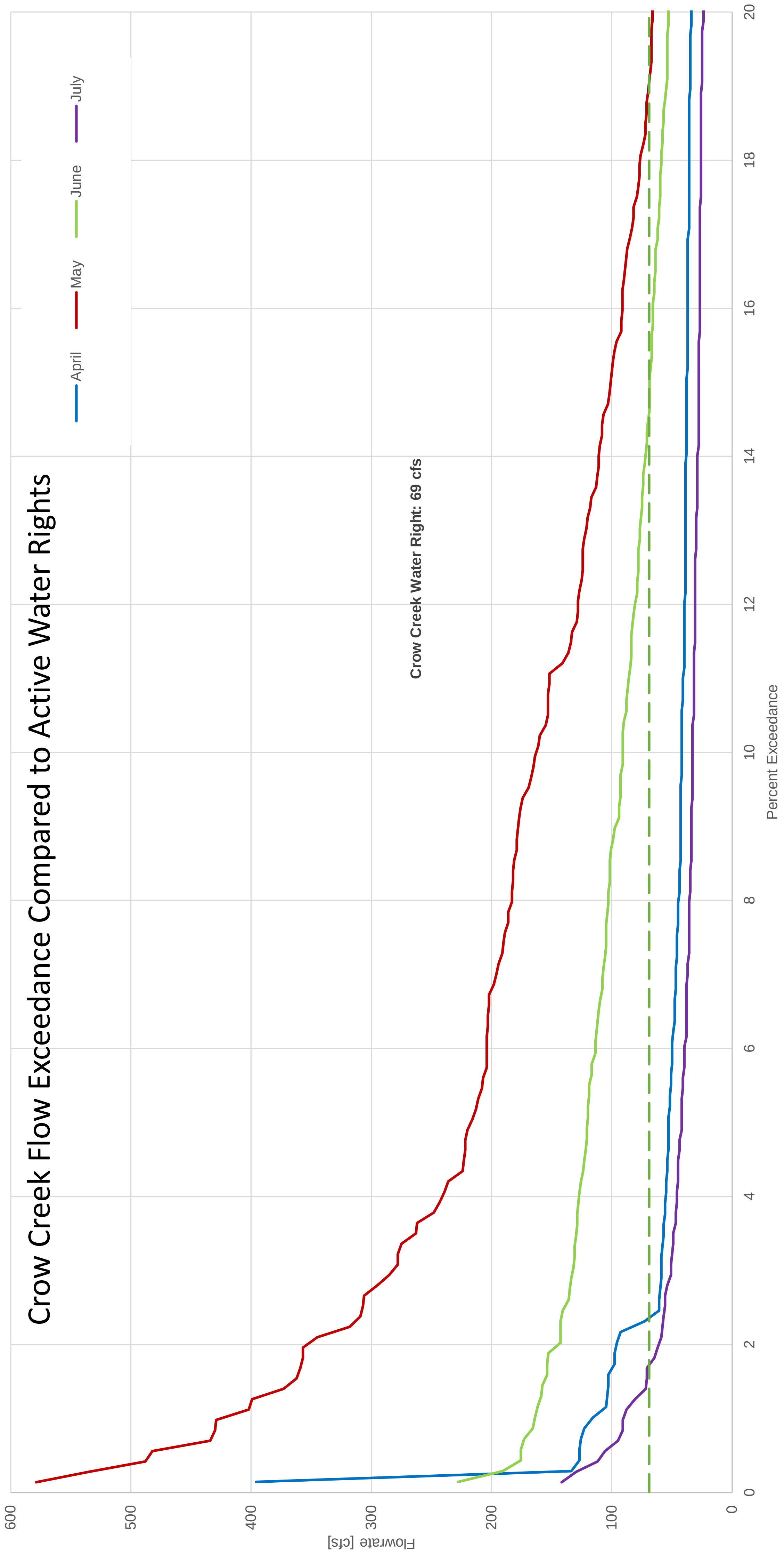


Figure B-3.7– Crow Creek Flow Exceedance

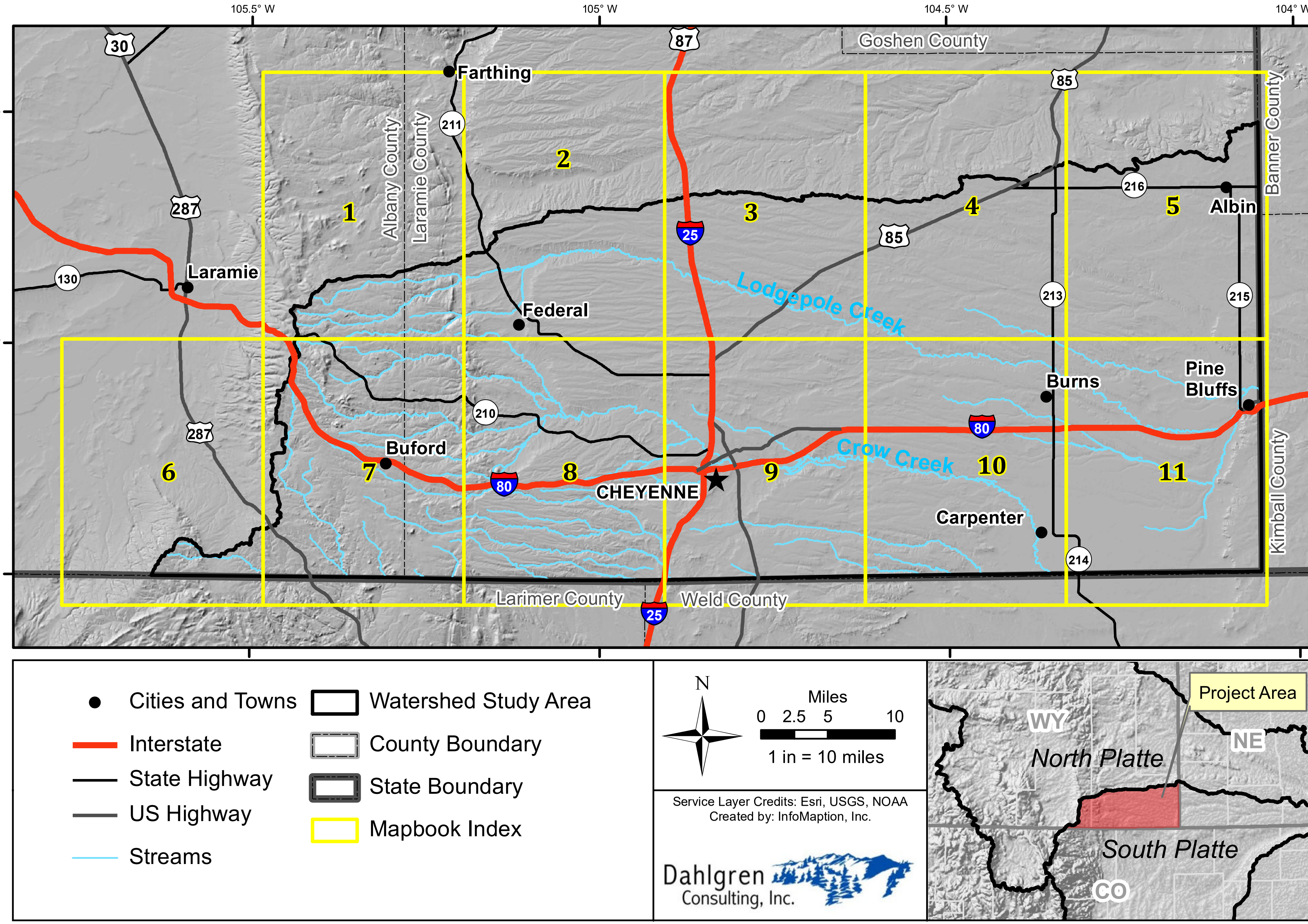


Figure B4-1 Surface and Groundwater Irrigation Lands - Mapbook Index Page 1 of 12

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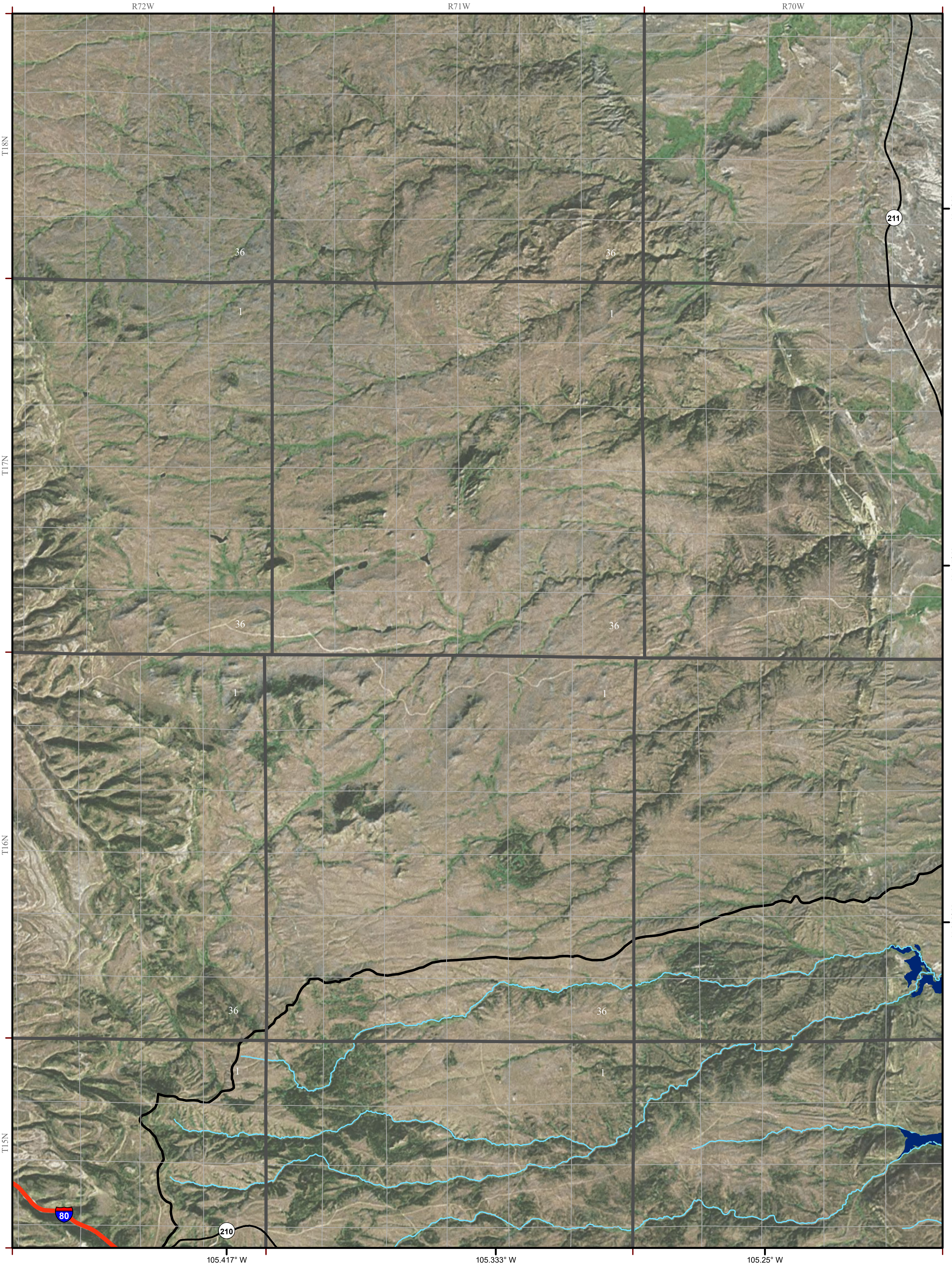

Cities and Towns
Streams
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PLSS Section
State Boundary
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1 in = 1.5 miles

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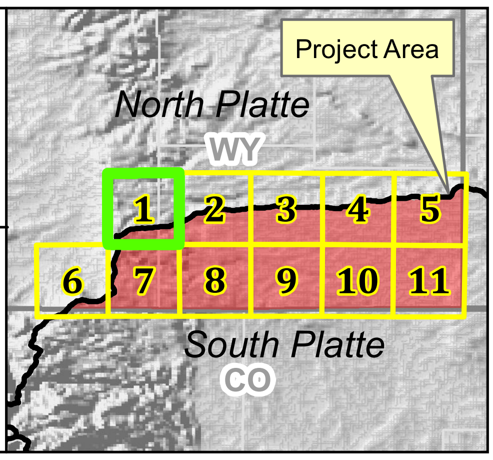

Figure B4-2. Surface and Groundwater Irrigation Lands - Page 2 of 12

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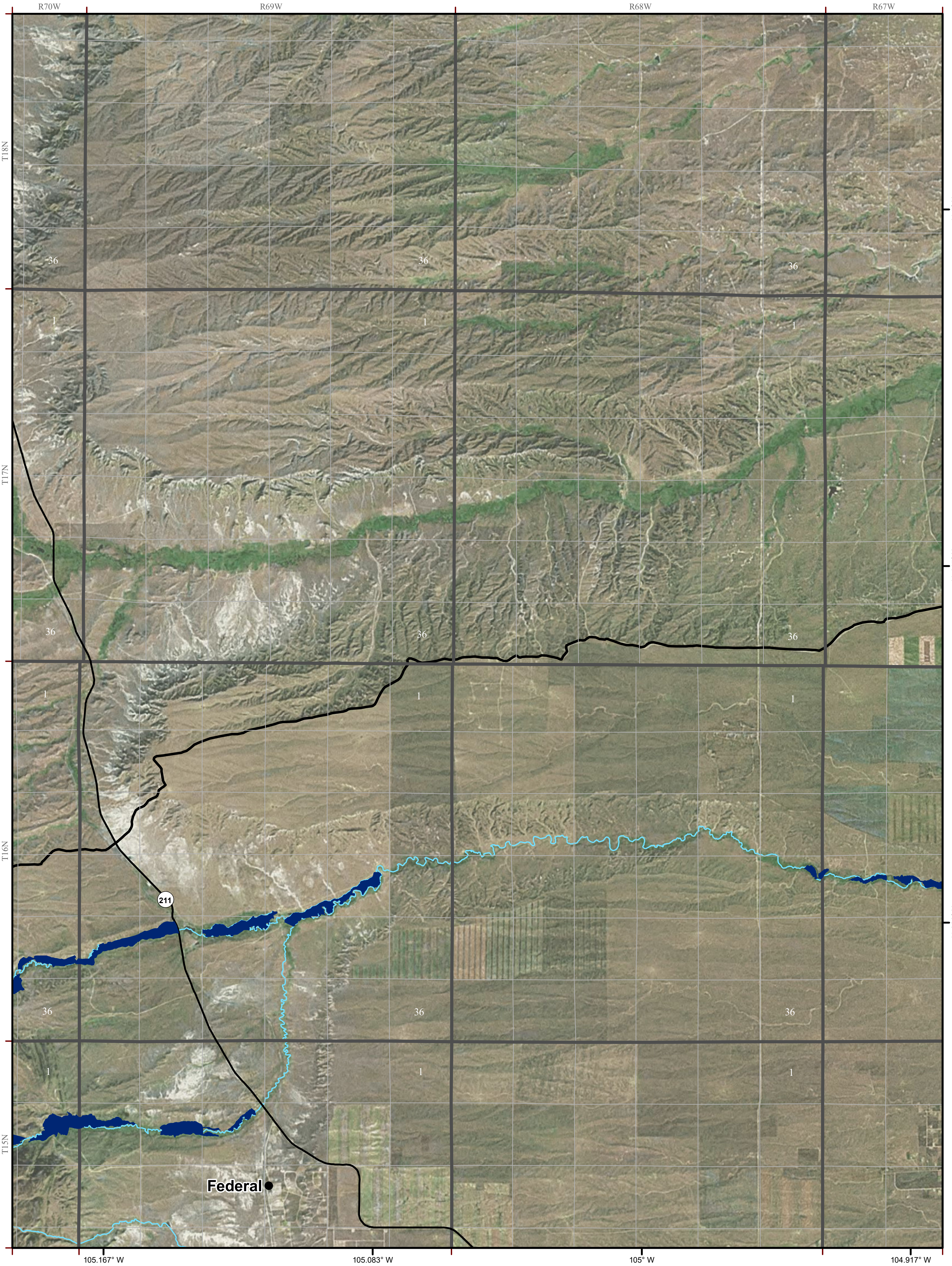

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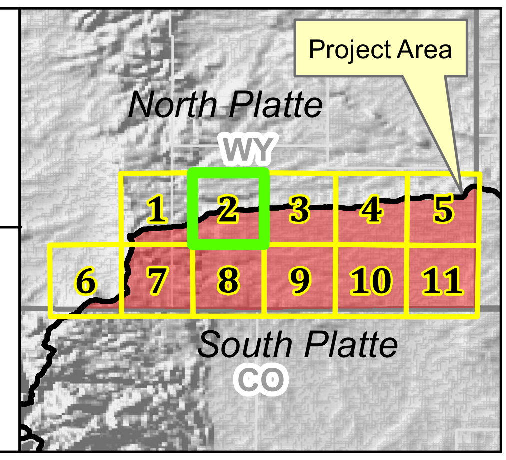

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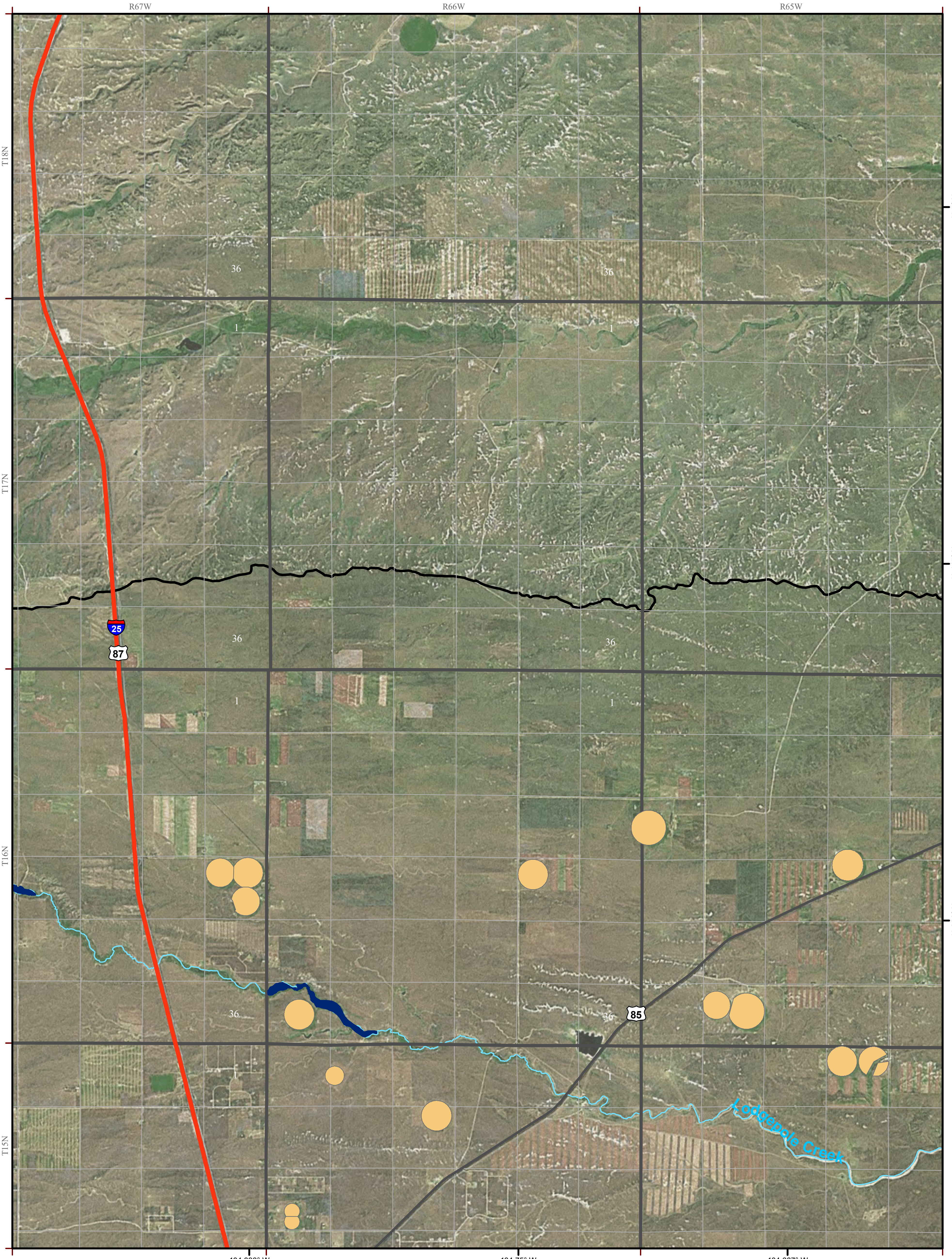

Cities and Towns
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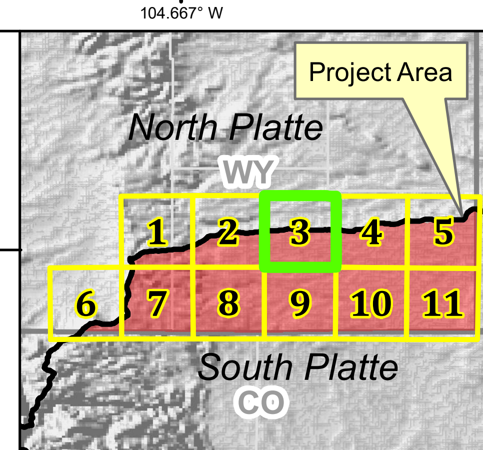

Figure B4-4. Surface and Groundwater Irrigation Lands - Page 4 of 12

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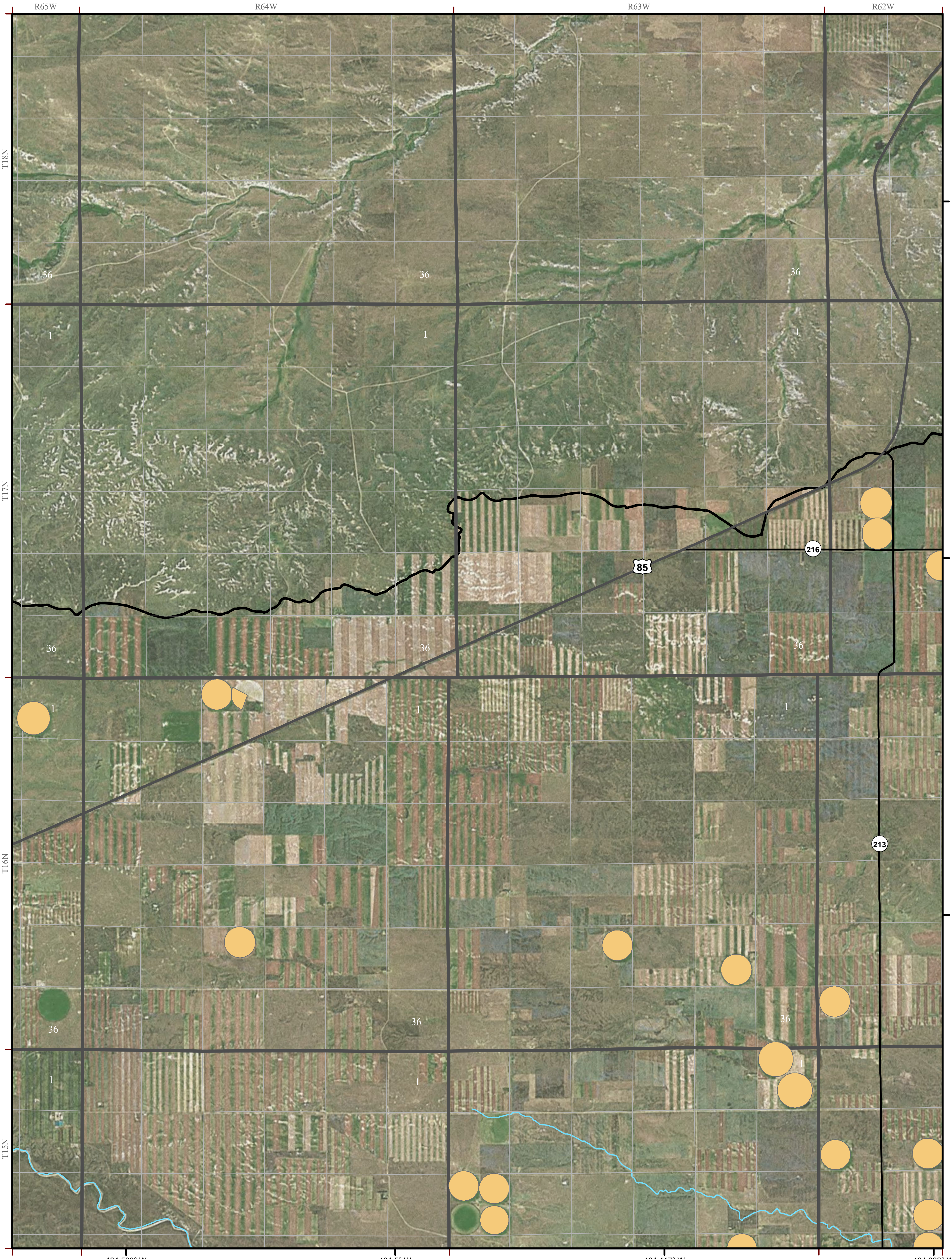

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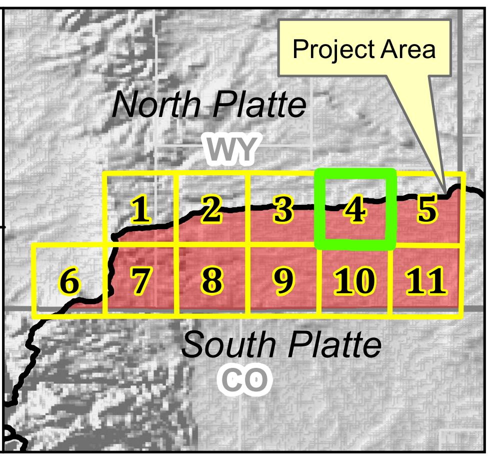

Figure B4-5 Surface and Groundwater Irrigation Lands - Page 5 of 12

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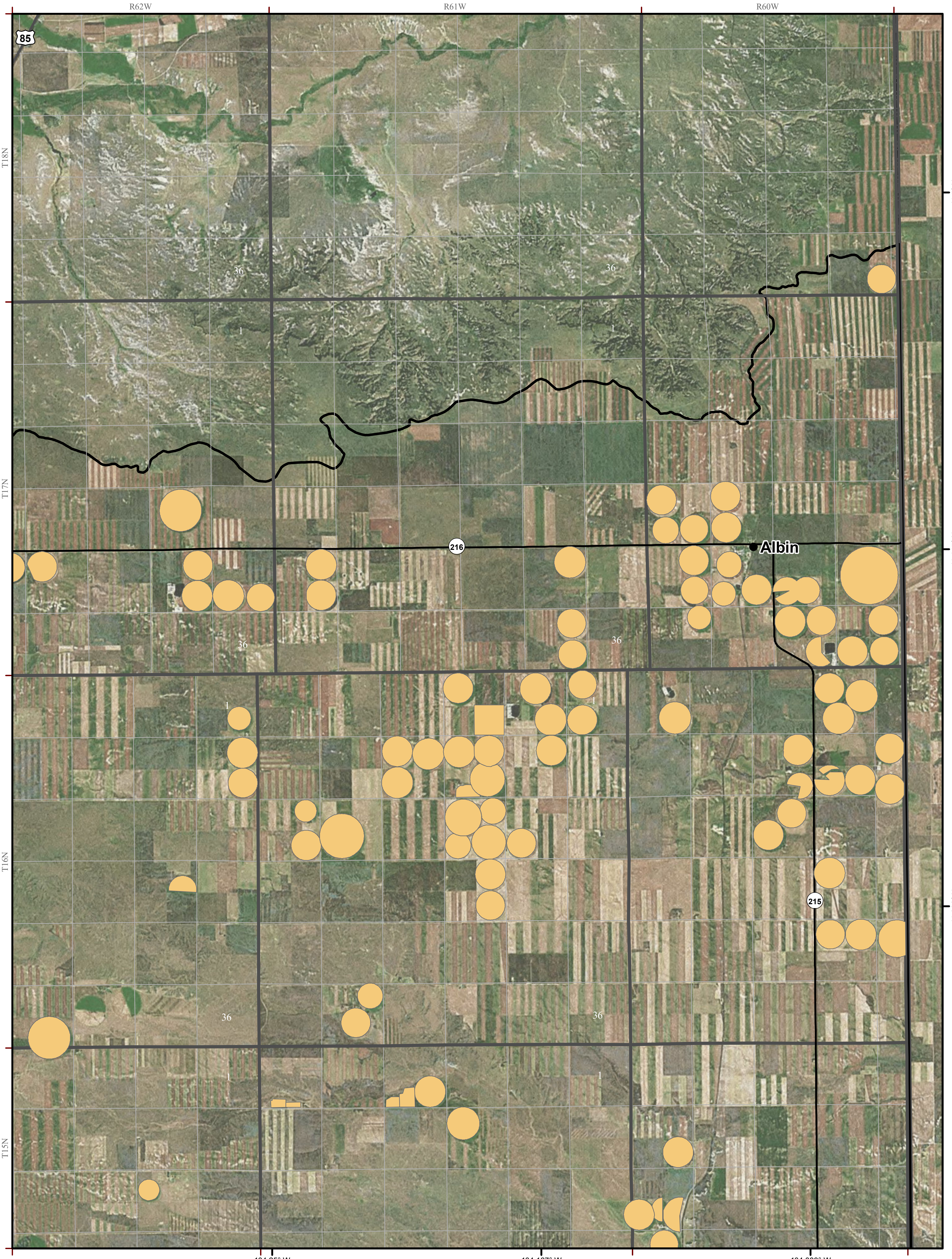

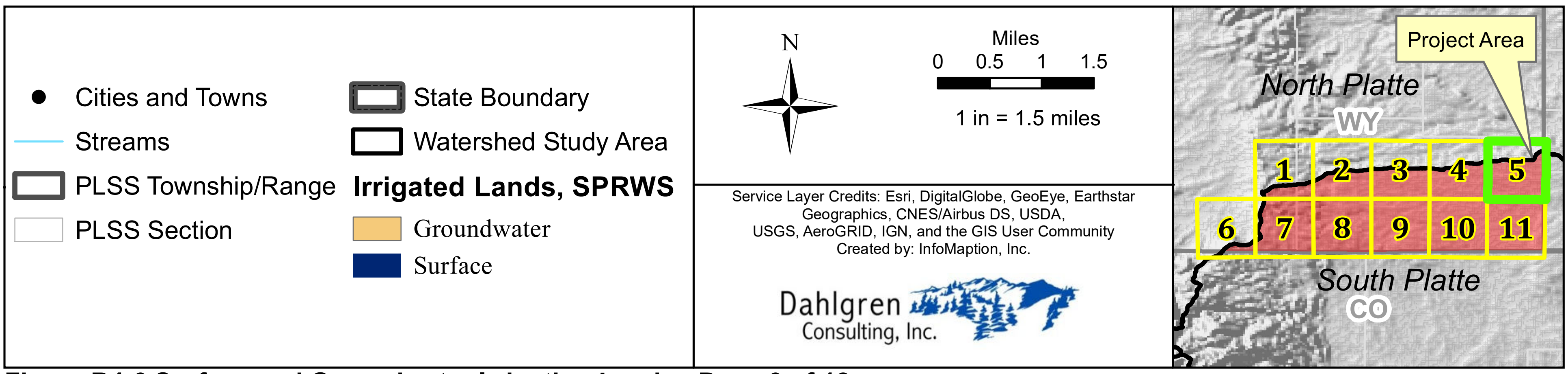

Figure B4-6 Surface and Groundwater Irrigation Lands - Page 6 of 12

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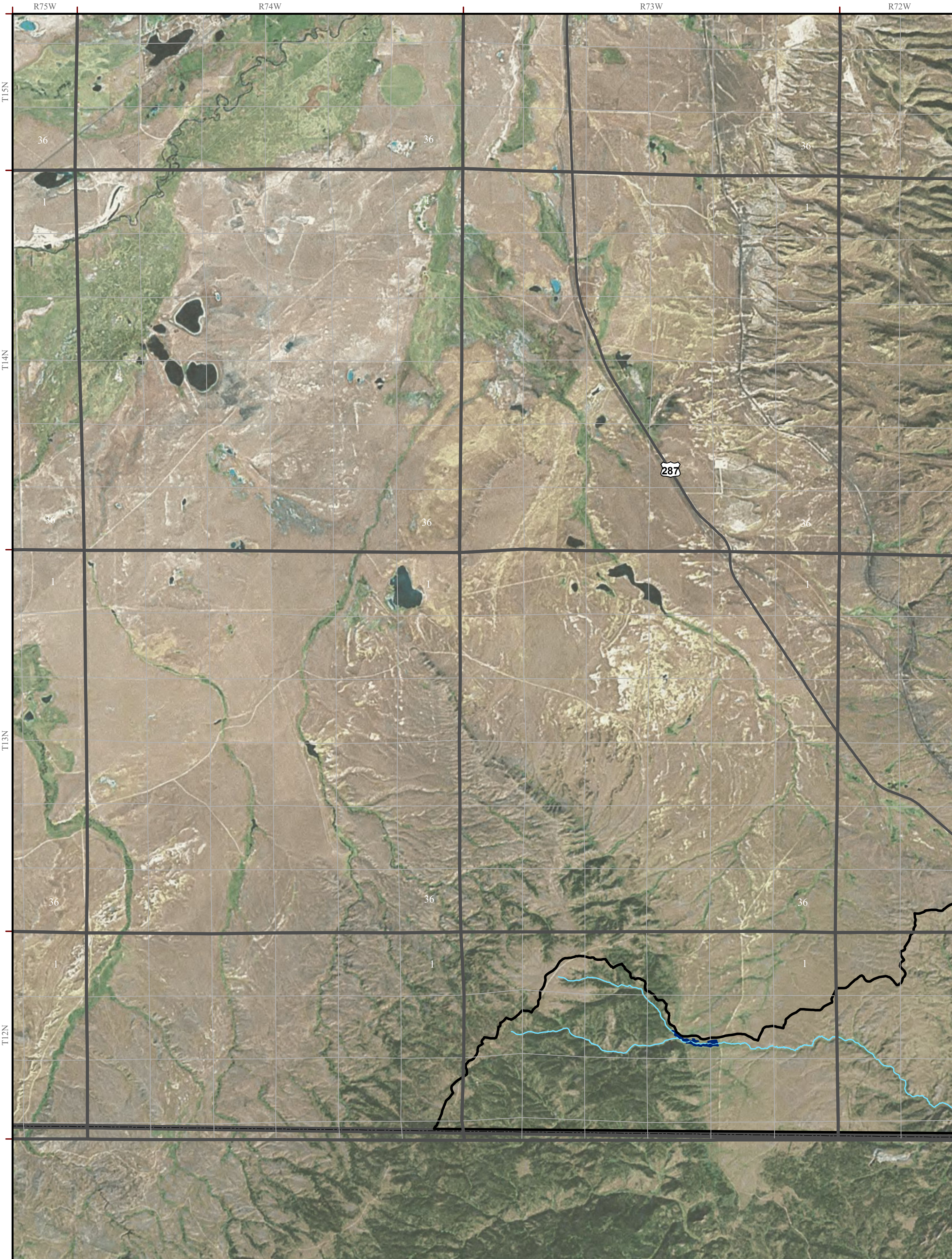

- Cities and Towns
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- PLSS Section
- State Boundary
- Watershed Study Area

Irrigated Lands, SPRWS

- Groundwater
- Surface

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1 in = 1.5 miles

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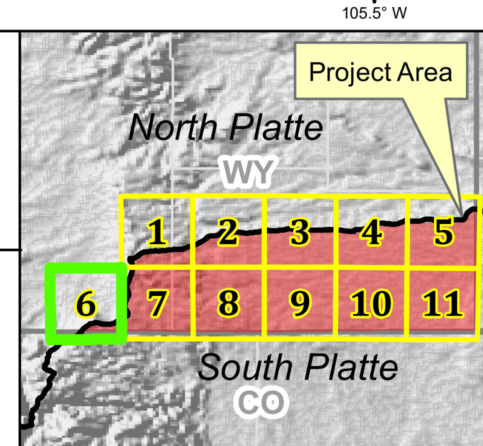

Figure B4-7 Surface and Groundwater Irrigation Lands - Page 7 of 12

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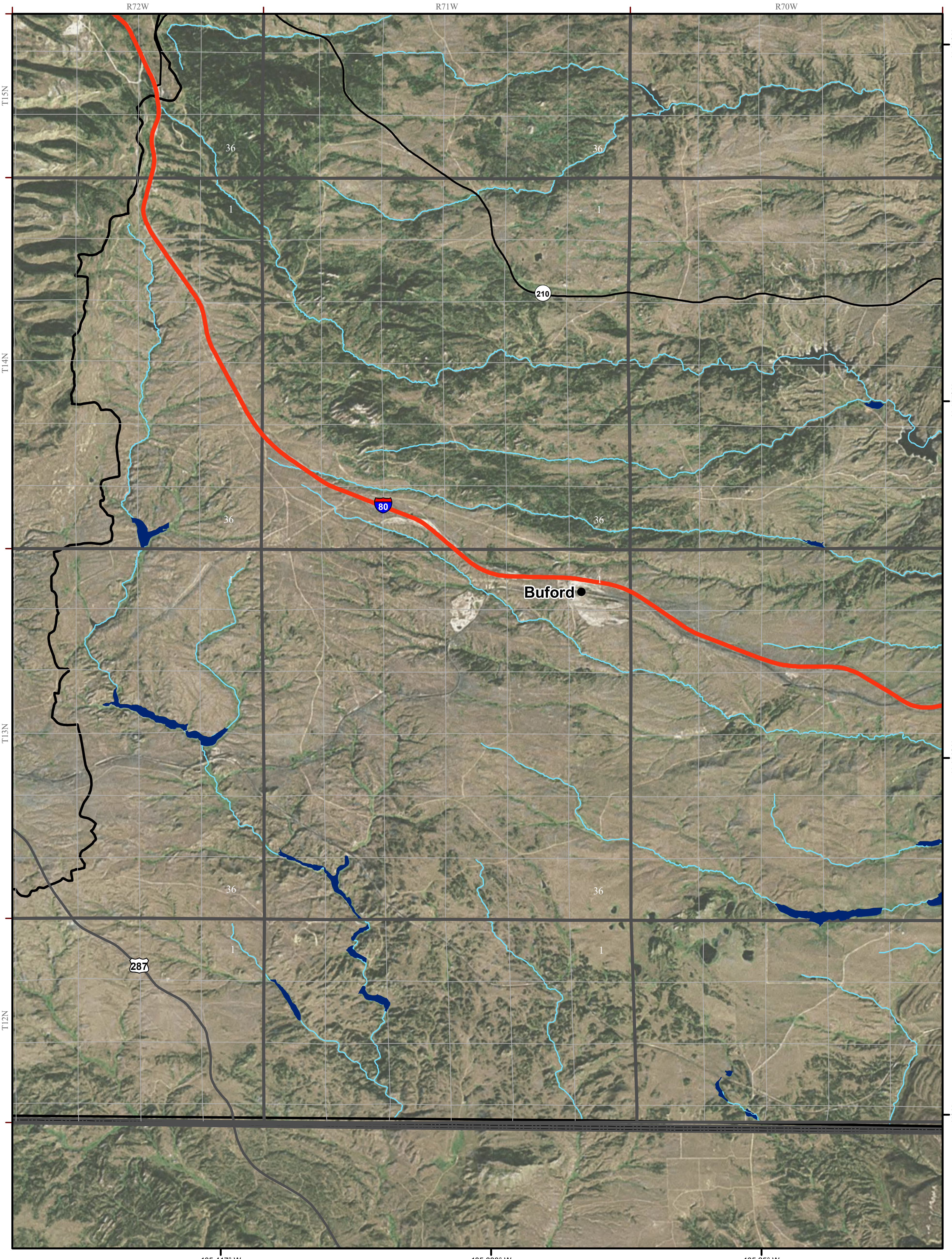

Cities and Towns
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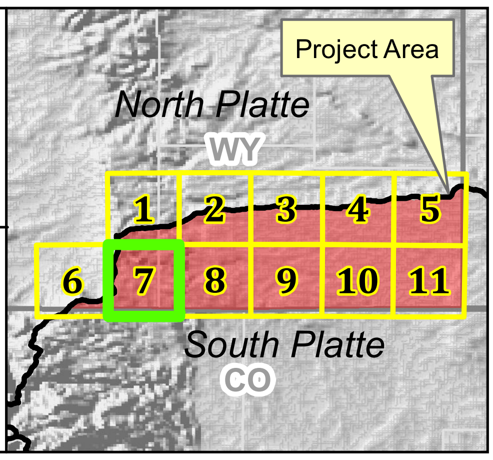

Figure B4-8 Surface and Groundwater Irrigation Lands - Page 8 of 12

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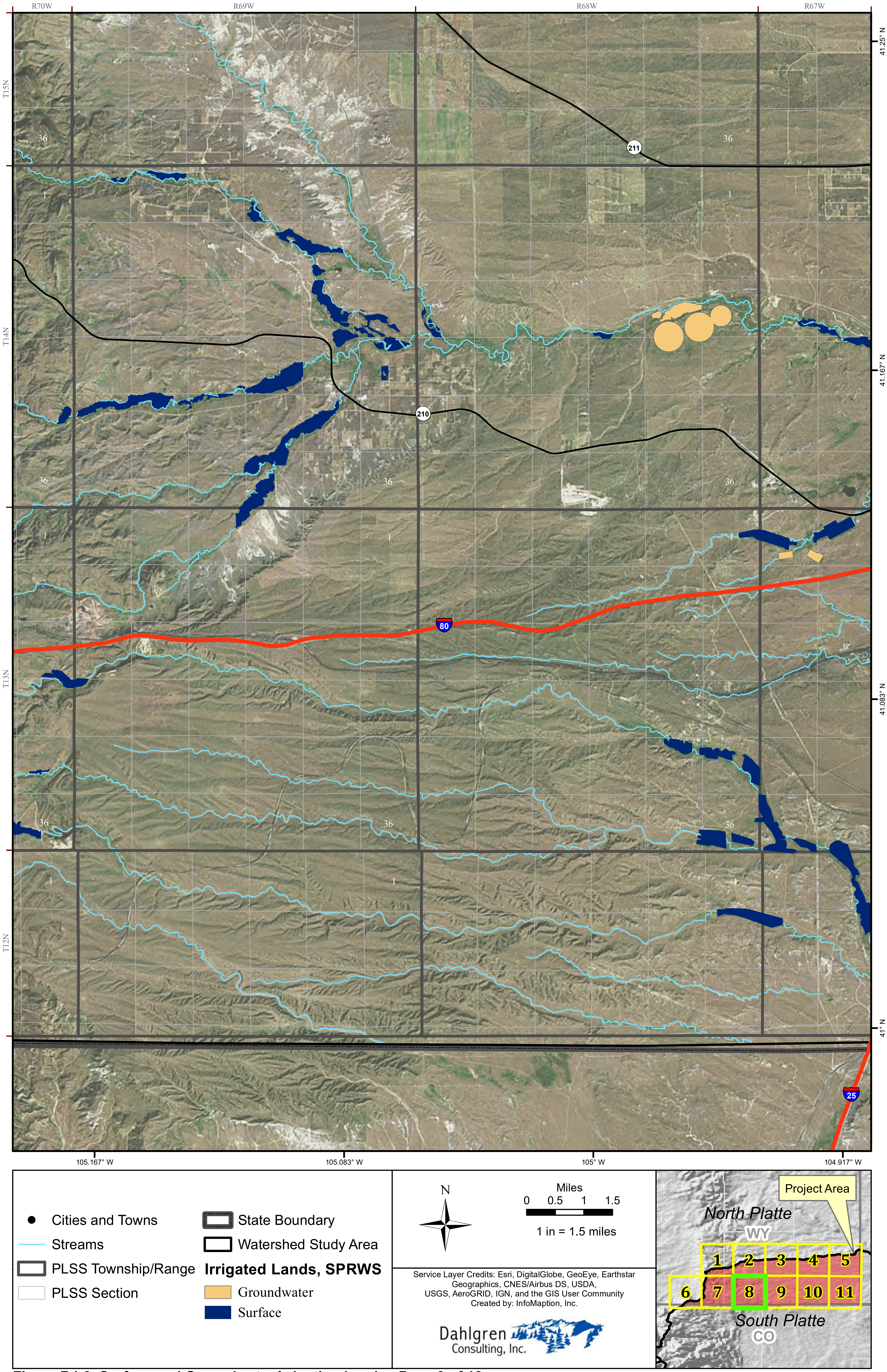

Figure B4-9. Surface and Groundwater Irrigation Lands - Page 9 of 12

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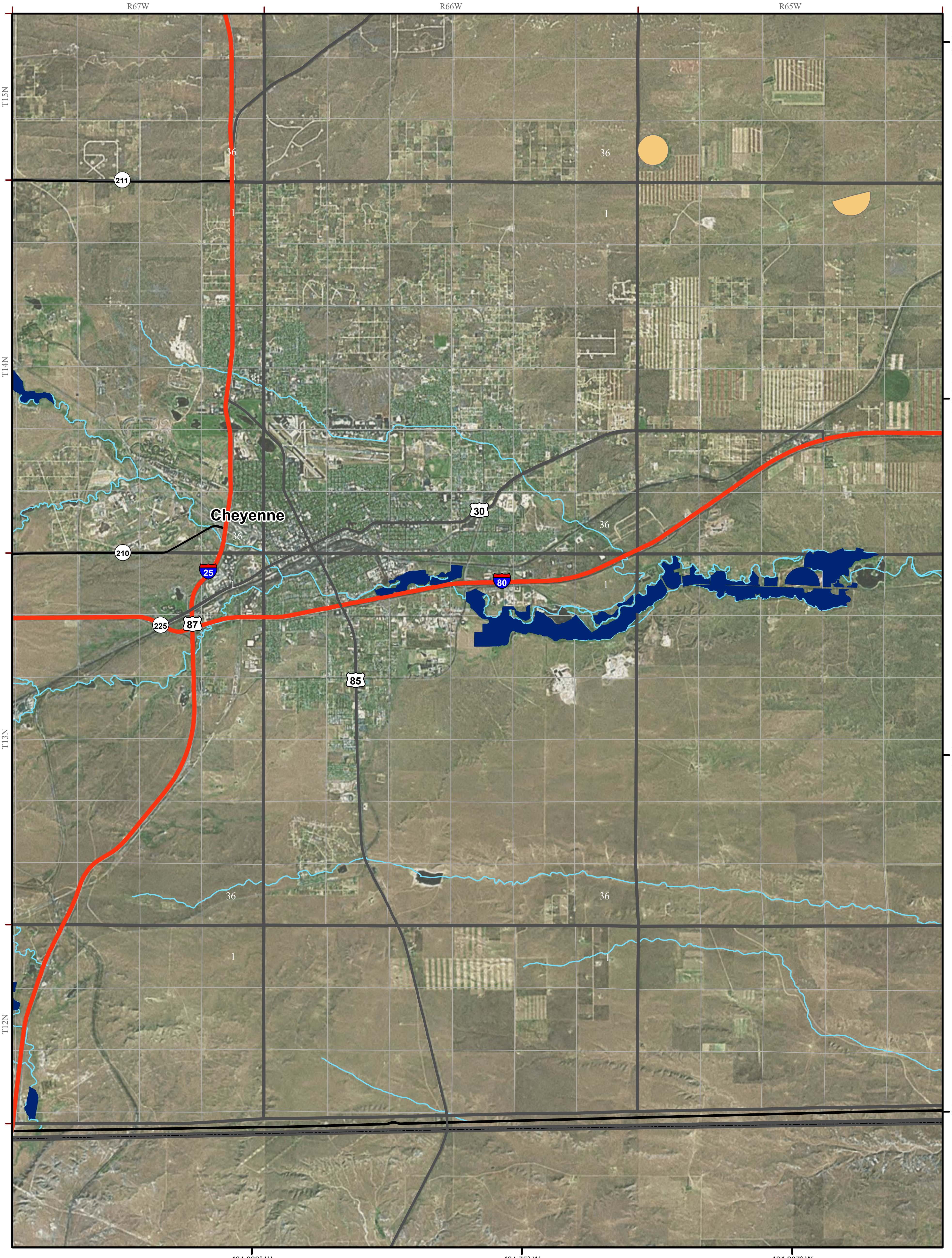

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- State Boundary
- Watershed Study Area

Irrigated Lands, SPRWS

- Groundwater
- Surface

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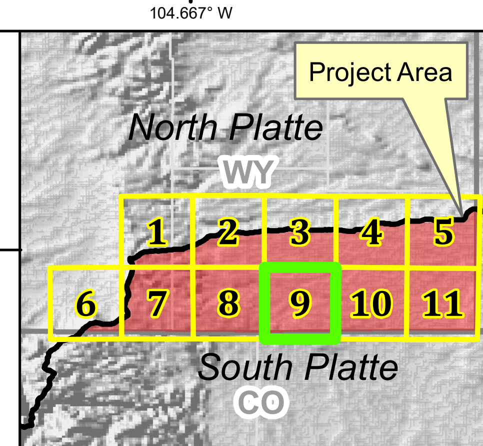

Figure B4-10 Surface and Groundwater Irrigation Lands - Page 10 of 12

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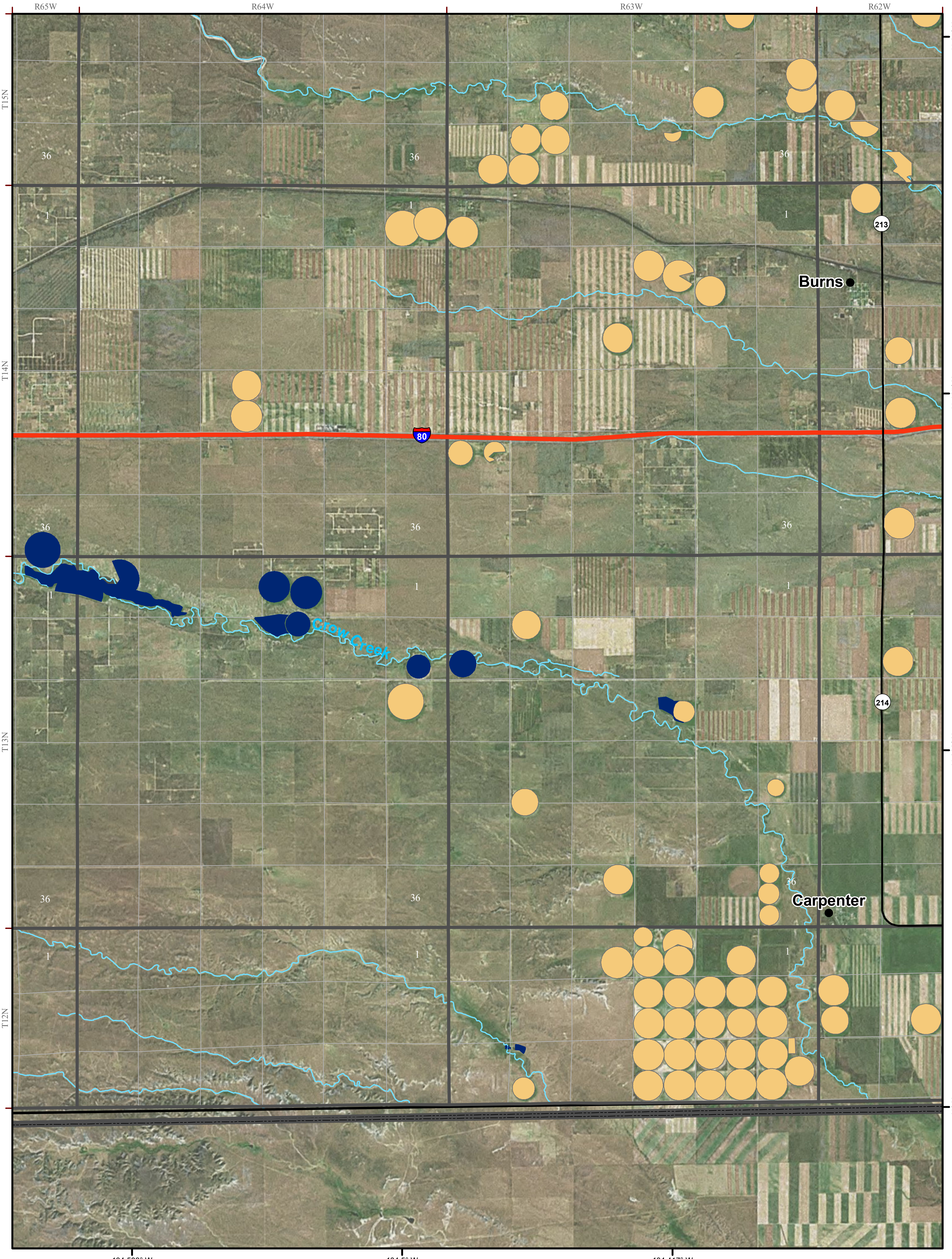

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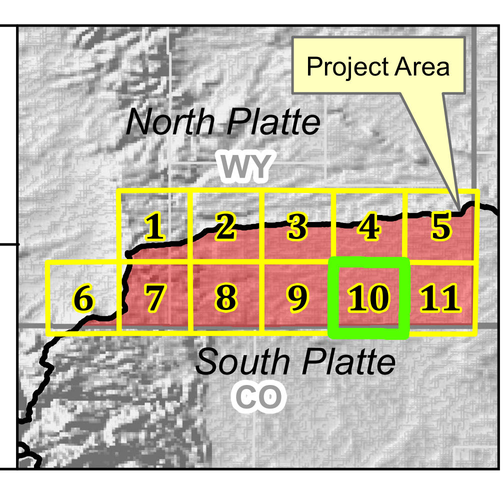

Figure B4-11. Surface and Groundwater Irrigation Lands - Page 11 of 12

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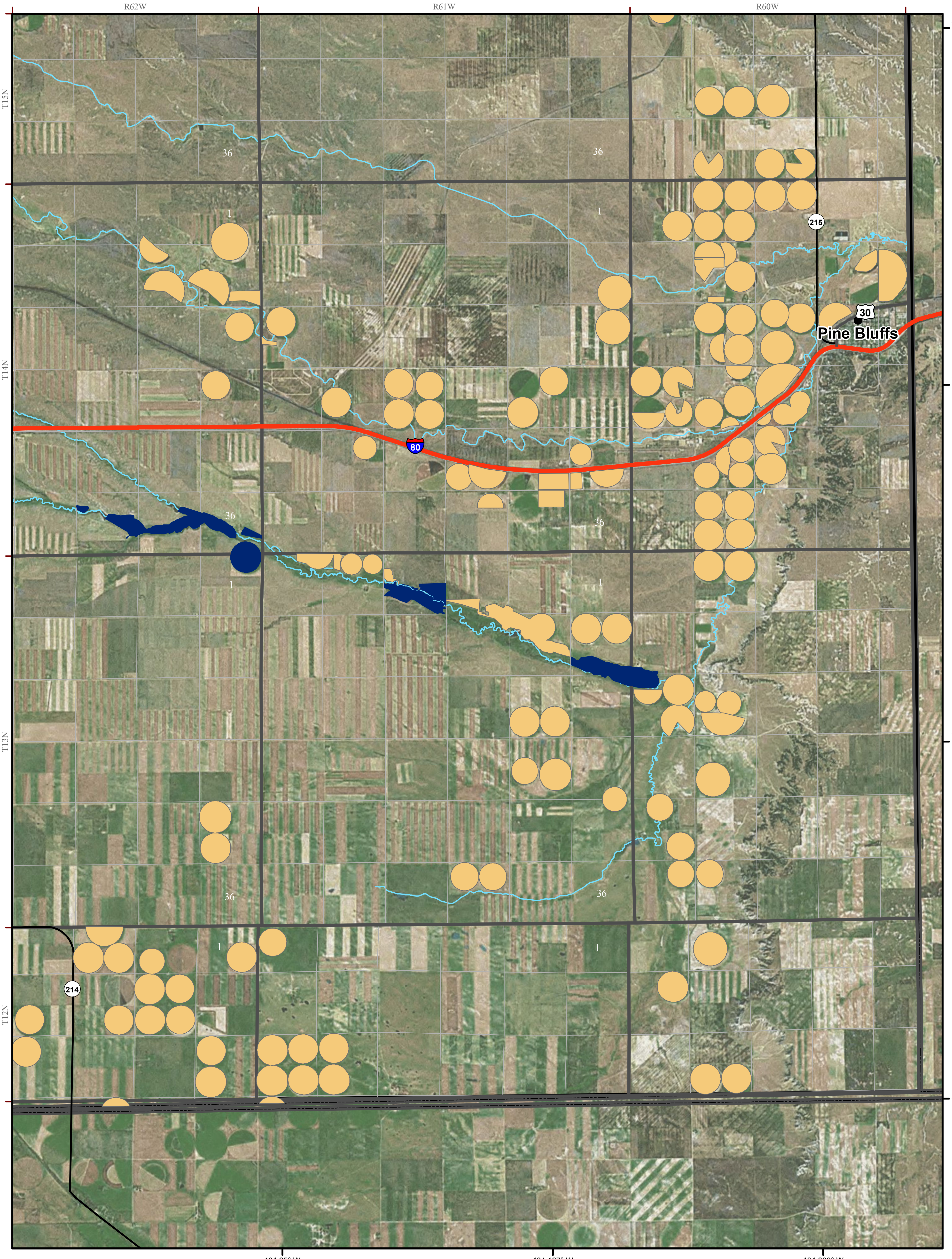

Cities and Towns
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Irrigated Lands, SPRWS

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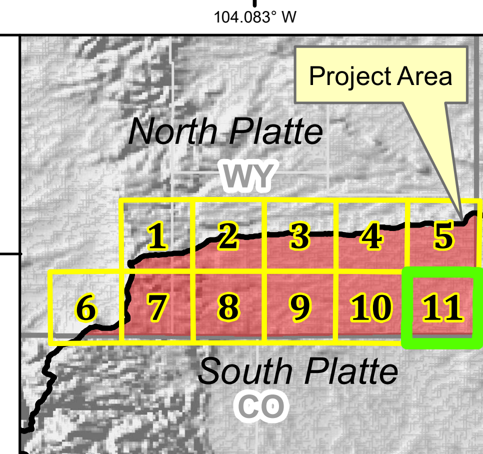


Figure B4-12 Surface and Groundwater Irrigation Lands - Page 12 of 12

Document Name: Irrigation_Mapbook_11x17
Date Saved: 6/19/2017

Appendix C

South Platte River Watershed
Level I Study

July 2017 Summary report from Dr. Bradley Carr with UWNSG

Geophysical Pilot Study to Image the top of the Brule Formation
near Pine Bluffs, Wyoming

UW Geology and Geophysics – UWNSG

Report:

Geophysical Pilot Study to Image the top of the Brule Fm. near Pine Bluffs, Wyoming

Prepared for: Russ Dahlgren, Dahlgren Consulting, Inc.

Prepared by:

Bradley J. Carr, UW – Dept. of Geology and Geophysics - UW Near-Surface Instrument Center (UWNSG)

July 22, 2017

All results are provided without warranty, whether express or implied.

UWNSG University of Wyoming, Laramie, WY 82071 **T** 307-761-3884 **F** 307-766-6679 bcarr1@uwyo.edu

Abstract

On June 21-22, 2017, Dr. Bradley Carr of the UW Near-Surface Instrument Center (UWNSG) & the UW Dept. of Geology and Geophysics conducted surface and borehole geophysical data acquisition near Pine Bluffs, Wyoming. This study explored the use of non-invasive, near-surface geophysical exploration methods for predicting the depth to the Brule Fm. as well as geophysical logging to study in situ fracturing within the upper Brule Formation. To this end, 2D surface seismic refraction and Direct Current resistivity profiling were centered about a stock well (referred to as DS1). The well provides direct correlation between the geophysical data sets and the local geology/hydrogeology. This well was cased to 2.84 m (9.31 ft.) bgs and open hole to a total depth (TD) of 12.33 m (40.45 ft.) bgs. Geophysical logs (Caliper, Spectral Gamma, Electromagnetic, Optical & Acoustic Televiewer, Impellor flowmeter were collected in DS1. Specifically, the borehole logging data provides detailed information about the fracture orientations and fracture density in the upper Brule Fm.

The results of this study show that surface geophysics can detect the top of the Brule Fm. as well as be used as a tool for predicting zones in the upper Brule Fm. that have interpreted higher porosity/permeability capability (as shown by lower measured seismic velocities in combination with lower measured DC resistivity). Groundwater resource potential in this area is highly variable and understanding the Brule Fm. fracturing is critical for siting water wells with increased productivity.

Site Location & Geologic Background

The site & DS1 borehole are NE of the town of Pine Bluffs, WY at 41.197736° N, 104.106064° W (Figure 1). Figure 2 shows a detailed map of the site including the two surface geophysics lines relative to the DS1 borehole. Due to location of the various corral gates and man-made features, it was not possible to have Line 2 adjacent to the well. Therefore, Line 2 was offset ~ 12 m to the east of DS1.

Geologically, the site has ~3 m of unconsolidated soils above siltstones of the Oligocene Brule Formation (Appendix 1). In a study by Barrash & Moon, 1987 (GSA Bull. v. 99, p.445-462), fracture zones in the Brule Formation were recognized from enlargements in the caliper log that are later to be interpreted from acoustic televiewer logs to be fractured siltstones. This secondary permeability of the Brule noted by the Barrash work is supported by well logs from wells near the site (Dahlgren, pers. comm.).

To date, no surface geophysical studies are known that looked at both the detectability of the top of the Brule Formation as well as the effects of Brule fracturing on geophysical profile data. Further, no known previous studies correlate the aforementioned surface geophysical data directly to fracture permeability interpreted from geophysical logs in an adjacent borehole.

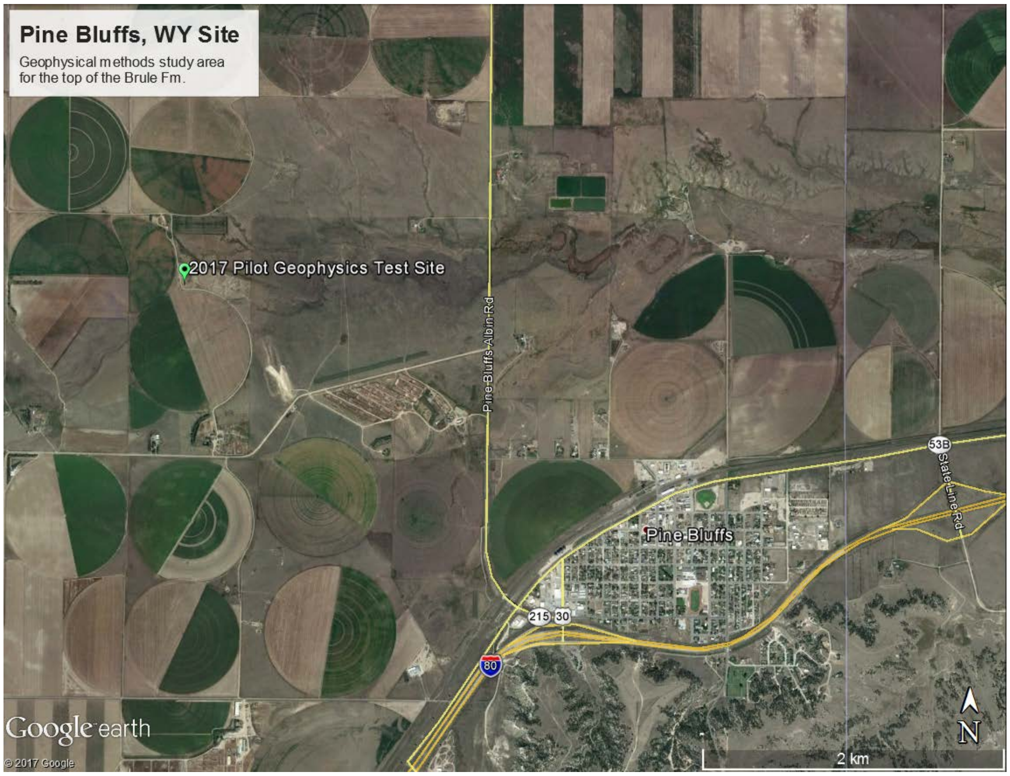


Figure 1. Site Location for Brule study near Pine Bluffs, WY

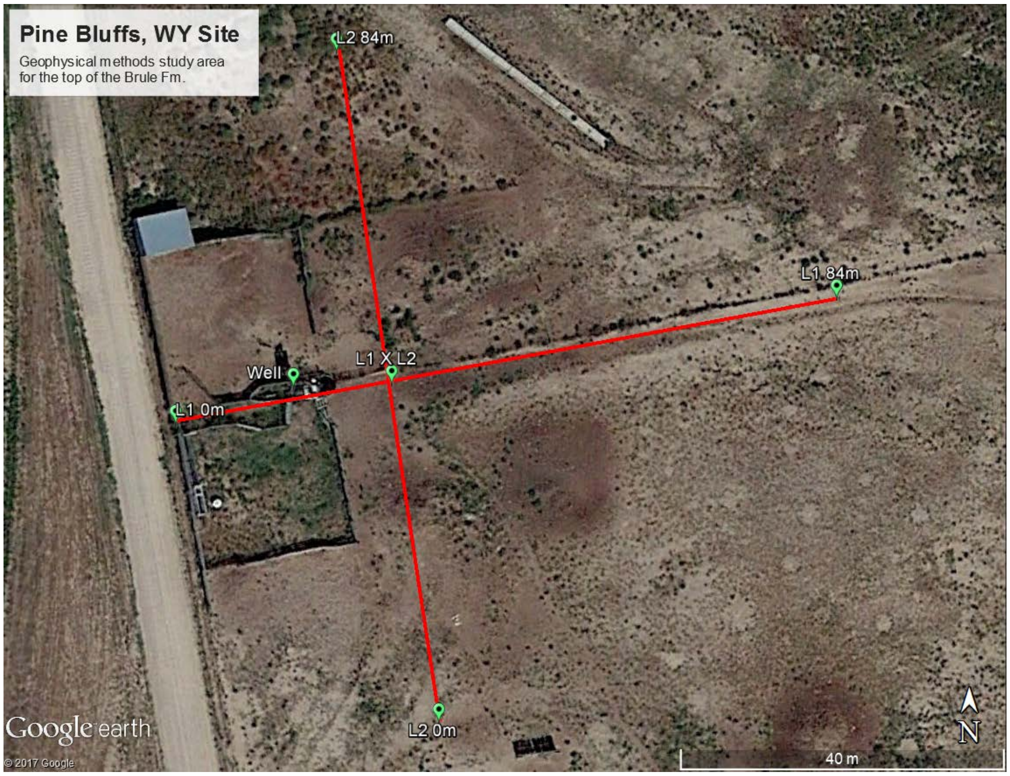


Figure 2. Detailed view of the site where Line 1, Line2, and well (DS1) are highlighted. Both lines (L1 &L2) are shown in red with the distances (in m) indicated at the start and end. Generally, L1 is E-W and L2 is N-S. The two lines cross at 27 m (L1) and 42 m (L2).

Objectives

The two main objectives of this project are: 1) to study if non-invasive, near-surface geophysical exploration methods are useful for predicting the depth to the Brule Fm. through the unconsolidated overburden, and 2) tie borehole geophysical logging data to surface geophysics regarding fracturing and inferred permeability within the upper Brule Formation. It is hypothesized that knowledge about upper Brule Fm. fracturing provides a first step to understanding the local hydrogeology and groundwater potential.

Work Conducted

Surface Geophysical Imaging:

Figure 2 shows the two geophysical profiles lines collected during this study. On both lines, Seismic refraction and DC resistivity data were collected, processed and inverted to give models of the subsurface velocity and resistivity distribution. For a more detailed description of these two geophysical methods, please refer to Appendix 8. These material properties are used to infer the depth to the top of consolidated rock, fracture density and porosity state at the site. Due to pre-existing knowledge from DS1 that the top of the Brule was only ~2.8 m bgs, these surveys had to be focused for very shallow depths.

Seismic data were collected along a 48 m transect with four, Geode seismographs (96 channels), 10 Hz vertical geophones, 0.5 m geophone spacing and 3 m shot spacing (using a 10lbs. hammer and plate). Line 1 refraction data begin at the start of the line (0 m). Line 2 refraction data started at 17 m into the profile so that the middle of the image would intersect Line 1 (and the projection of DS1).

DC resistivity data were acquired with an AGI – SuperSting R8 system of 112 electrodes spaced at 0.75 m spacing. The total resistivity profile spanned 84 m for each line. A mixed array of dipole-dipole and gradient configurations were collected.

Borehole Geophysical Logging:

The geophysical logs collected in DS1 include: Caliper, Spectral Gamma, Electromagnetic Induction, Magnetic Susceptibility, Fluid Temperature, Fluid Conductivity, Flowmeter (spinner), and Televiewer (Acoustic and Optical). The aim with the geophysical logging was to image the fractures and in situ lithology as well as obtain some basic groundwater flow information. All data were collected with Mount Sopris Instruments equipment and slimhole tools. Data processing was conducted using WellCAD (vrs. 5.1.504) software.

Results & Interpretations

Results of the surface geophysical imaging and borehole logging for this project are included in Appendices 2 – 6. The results and interpretations for the surface geophysical images are shown immediately underneath the profile results in Appendix 2. A map view of the interpreted fracture zones is displayed at the end of the Appendix 2. Appendix 3 contains the DS1 borehole log data followed by images of the picked fractures, and fracture density. DS1 provides calibration on the contact and fracture depths. Appendix 4 contains the Acoustic Televiewer data. Appendix 5 shows Optical Televiewer fracture images of present in DS1. Appendix 6 is the DS1 fracture strike and dip plots. Appendix 7 displays the borehole deviation information.

Overall, both seismic profiles show a clear increase in velocity at the transition from the unconsolidated to the top of the Brule Formation above the static water table. Additionally, low velocity zones are highlighted within the Brule Fm. This low velocity is interpreted as increased fracture density. The fractures would be water filled which would lower the bulk density and velocity of this area.

The resistivity profiles do not show any clear indication the contact of the unconsolidated and Brule Fm. However, these data provide very strong indications of the porosity/permeability state of the subsurface. The low resistivity data (light-dark blue) sharply delineate the static water table (red line) and deeper zones that are interpreted as wet fractures. Therefore, in combination with the surface seismic, these methods are very appropriate to site future water wells in the area.

Geophysical logging results are shown in Appendices 3 – 7. Detailed discussions on the results and observations for these data are included with the figures. In short, the upper Brule Fm. in DS1 is a nearly homogeneous siltstone and the nature of fracturing differs a bit from the top of the borehole to the bottom. In the ambient condition, water is mostly flowing into the hole from the deepest fractures. However under pumping, two fracture zones near the top of the Brule Fm. produce water to the borehole while the majority of water leaving the hole does so from fractures between 6.5 – 8.3 m bgs. Therefore, hydraulically connected fractures are confirmed.

Summary

In this study, it is shown that a combination of surface geophysics methods (i.e. seismic reflection and DC resistivity) can identify both the top of the Brule Formation, zones of high subsurface fracture density, and subsurface zones of high porosity/permeability. These conclusions are supported by empirical data from borehole geophysical logging data at the site. Therefore, future water well development could benefit from a combination of surface refraction and DC resistivity to site well locations.

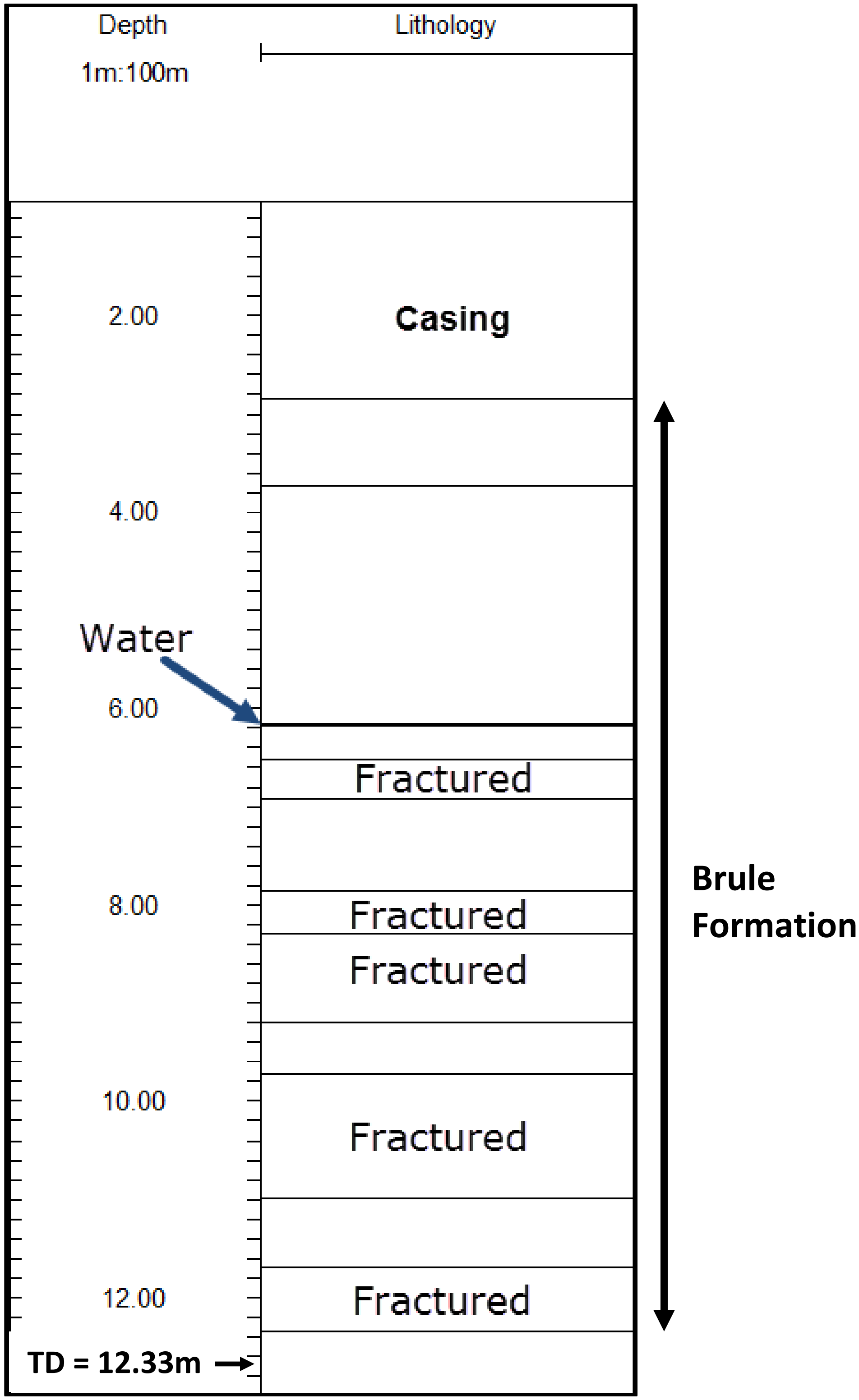
Most of the logging data from DS1 provided useful petrophysical data and imaging of the water producing fracture intervals. Unfortunately, this was not a recent nor ideal well for running logs that require centralization (specifically, Optical and Acoustic). Fortunately, the Optical televiewer is more forgiving and provided useful data. The Acoustic televiewer yield data that was not useful at all. To continue a more rigorous study of the fracturing and groundwater potential, another well needs to be studied or drilled.

Appendices

Appendix 1 – Generalized Stratigraphy for the Pine Bluffs, WY area:

SERIES OR SYSTEM	LITHOSTRATIGRAPHIC UNIT		HYDROSTRATIGRAPHIC UNIT	
Holocene-Quaternary	Alluvium		Alluvial Aquifer	
Miocene	Ogallala Group		Ogallala Aquifer	High Plains Aquifer
	Arikaree Group		Arikaree Aquifer	
Oligocene	White River Group	Brule Formation	Brule Aquifer or Aquitard	
		Chadron Formation	Chadron Clay Aquitard Chadron Sand Aquifer	

Generalized stratigraphy of the High Plains Aquifer of the central U.S. from Barrash and Morin, 1987 (GSA Bull., v. 99, p. 445-462). The Brule Formation which is exposed near the site area is Oligocene in age and the upper member of the White River Group and widely distributed in the eastern part of WY.

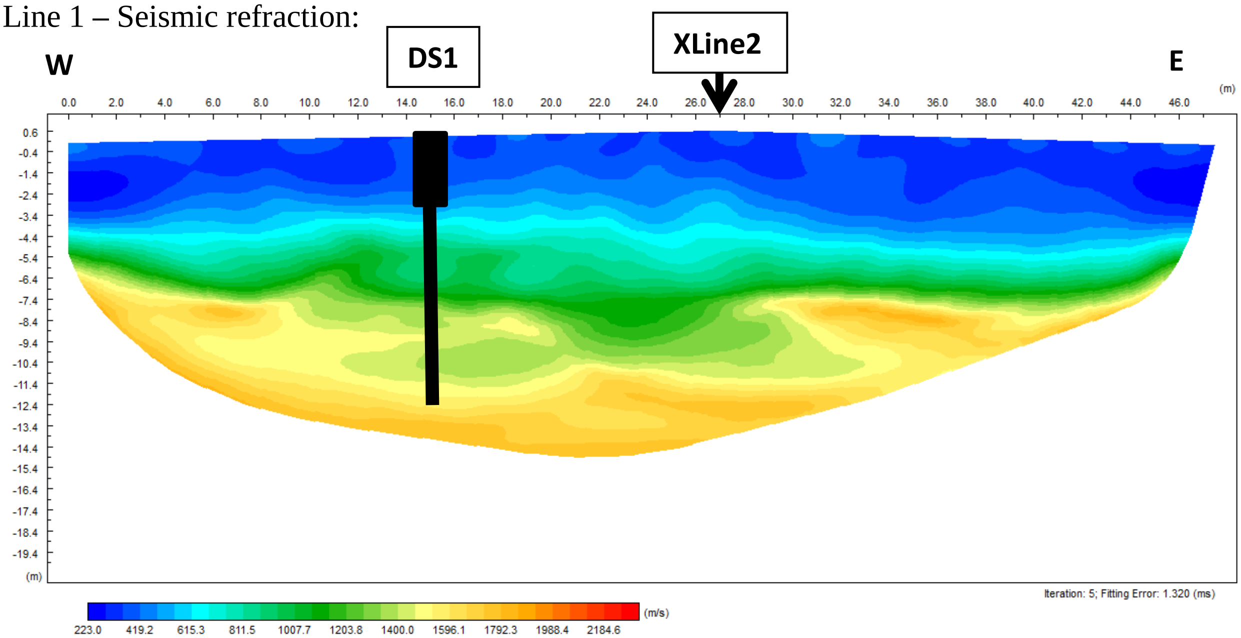


Above: DS1 (Duello) Well Summary from log data. The cased interval and the water level (on June 15, 2017). Fractured intervals in the Brule Formation were determined from the caliper and optical televiewer. The diameter of the cased interval at the surface is 16.51 cm (6.5 in.).

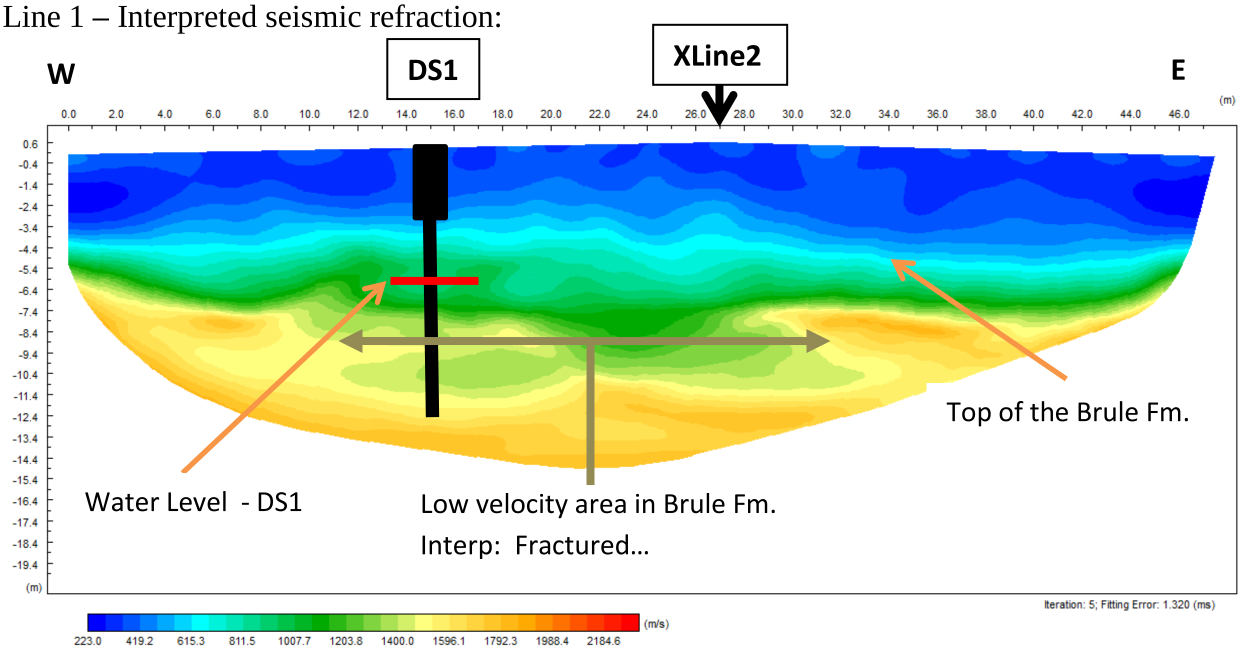
Appendix 2 –Surface Geophysical Imaging results:

(DS1 is at ~ 15 m on Line 1 and ~ 42 m on Line 2 // Line 1 crosses Line 2 at 27 m, Line 2 crosses Line 1 at 42m)

Line 1 – Seismic refraction:

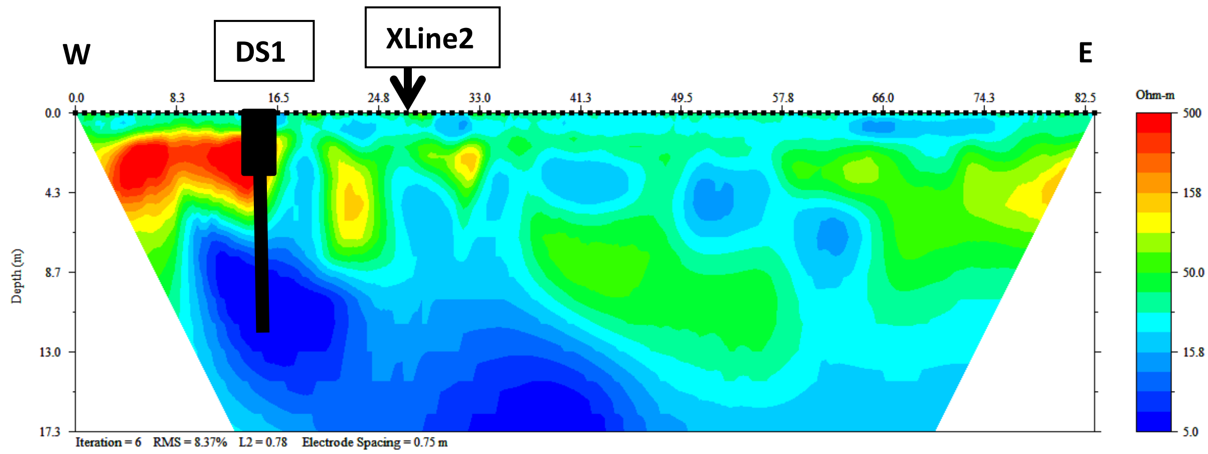


Line 1 – Interpreted seismic refraction:

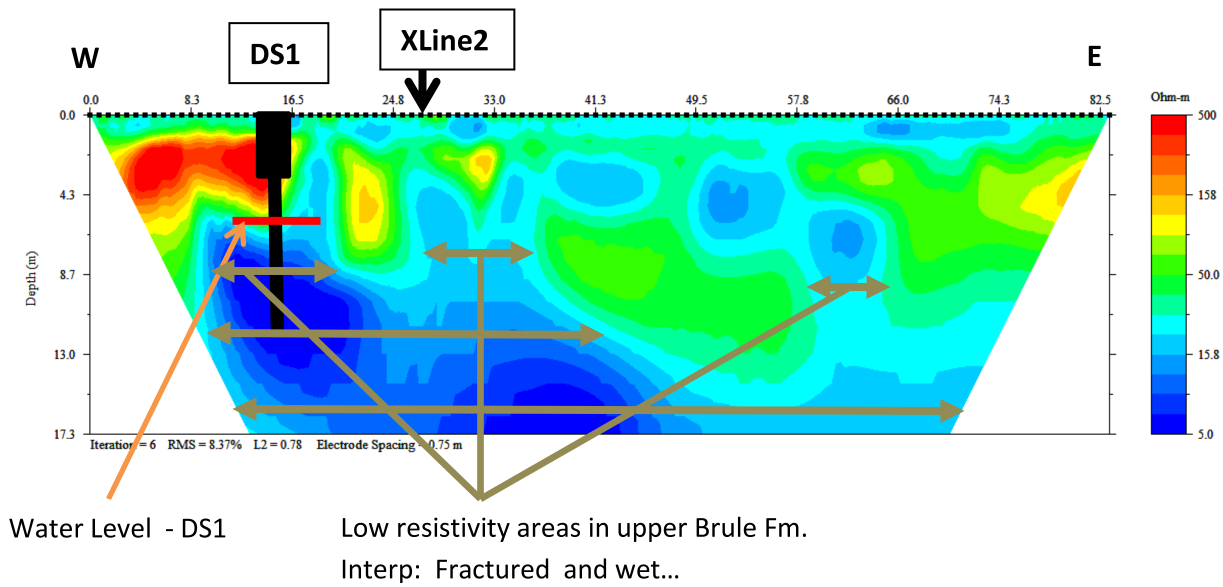


Top: Line 1 seismic refraction results. Bottom: Interpreted results for Line 1 seismic refraction. DS1 and the intersection of Line2 are indicated. The top of the Brule Formation is known from DS1 and is clearly contoured from the dark blue to light blue transition (~ 600 m/s). The velocities are low since the contact is above the static water table (red line). Interestingly, a low velocity zone in the Brule Fm. is observed between 10 – 32 m of the profile line. This includes the area around DS1. This low velocity zone is interpreted to highlight an area with increased fracture density. These fractures would be water filled at this depth.

Line 1 – DC resistivity:

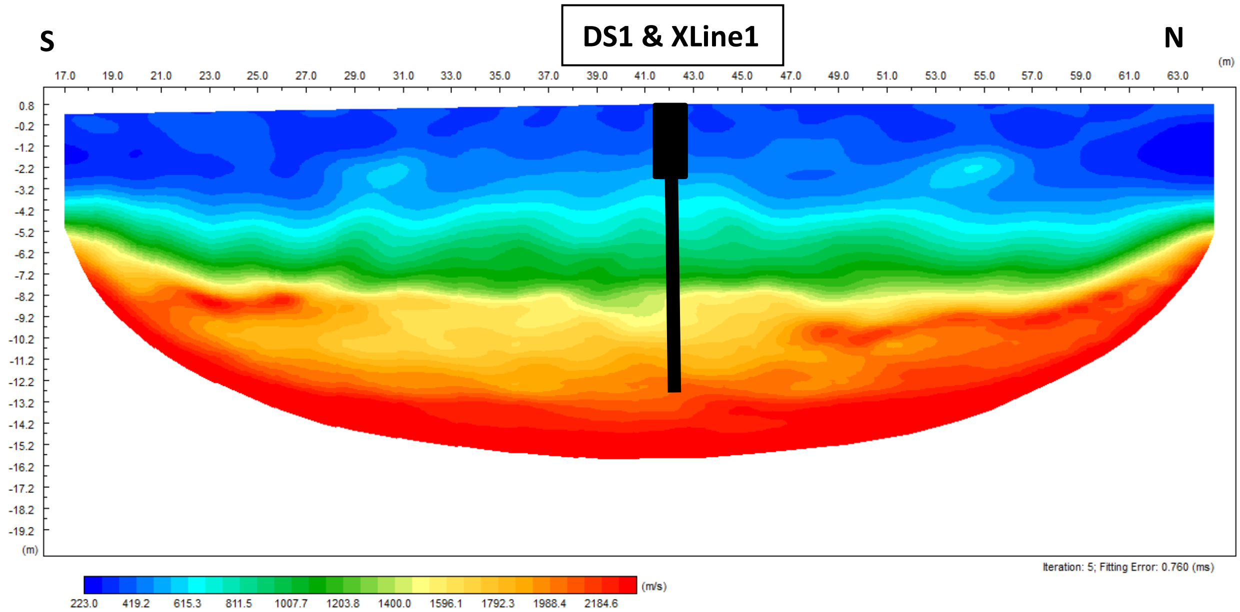


Line 1 – Interpreted DC resistivity:

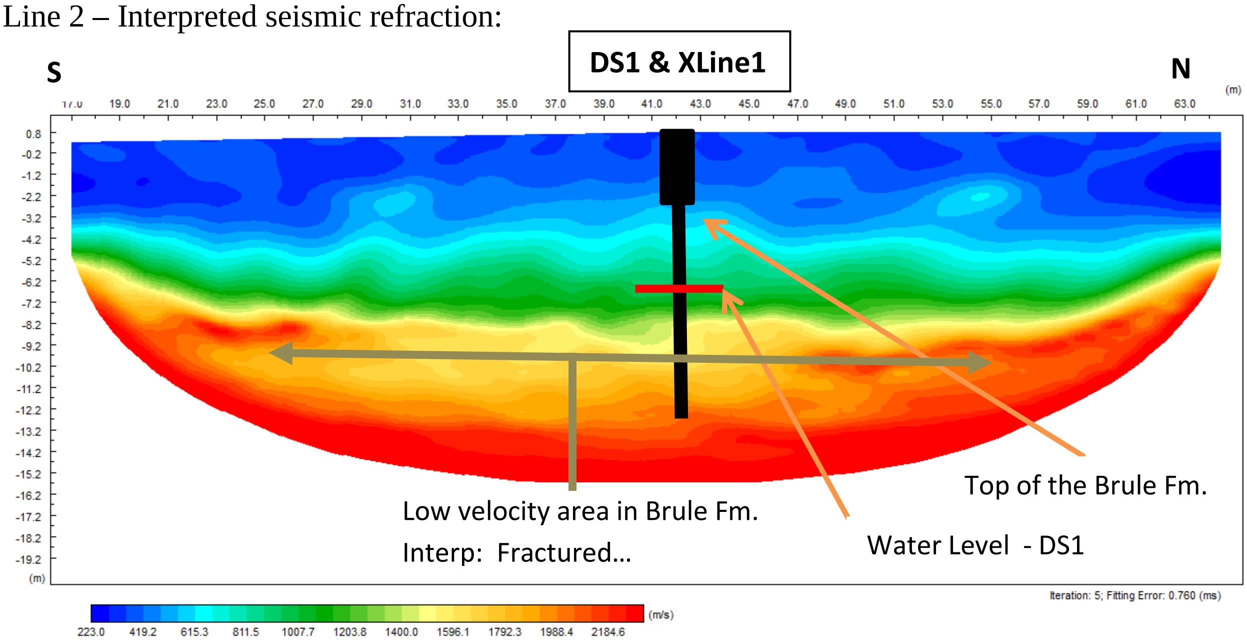


Top: Line 1 DC resistivity results. Bottom: Interpreted results for Line 1 resistivity. DS1 and the intersection of Line2 are indicated. The resistivity data do not show any clear indication the contact of the unconsolidated and Brule Fm. However, these data provide very strong indications of the porosity/permeability state of the subsurface. The low resistivity data (light-dark blue) sharply delineate the static water table (red line) and deeper zones that are interpreted as wet fractures. These zones continue deeper than DS1 to the E (NE). The very low resistivity (dark blue ~ 5-10 ohm-m) zones are interpreted to indicate fracture connected permeability which acts to lower the bulk resistivity further than simply higher bulk porosity (light blue). Since there are no clay lenses observed in DS1 where these resistivity values are ~ 5 ohm-m, water filled fractures must be causing this result. Interestingly, the low velocity zone seen in the seismic data is also observed in the resistivity between ~ 10 – 32 m of the profile line. This includes the area around DS1. This is also the area of lowest resistivity which is interpreted as a consequence of the pumping on connected fractures. Additional low resistivity areas in the upper Brule are seen further east but are slightly higher resistivity which infers that they are not connected to the producing fractures further west.

Line 2 – Seismic refraction:

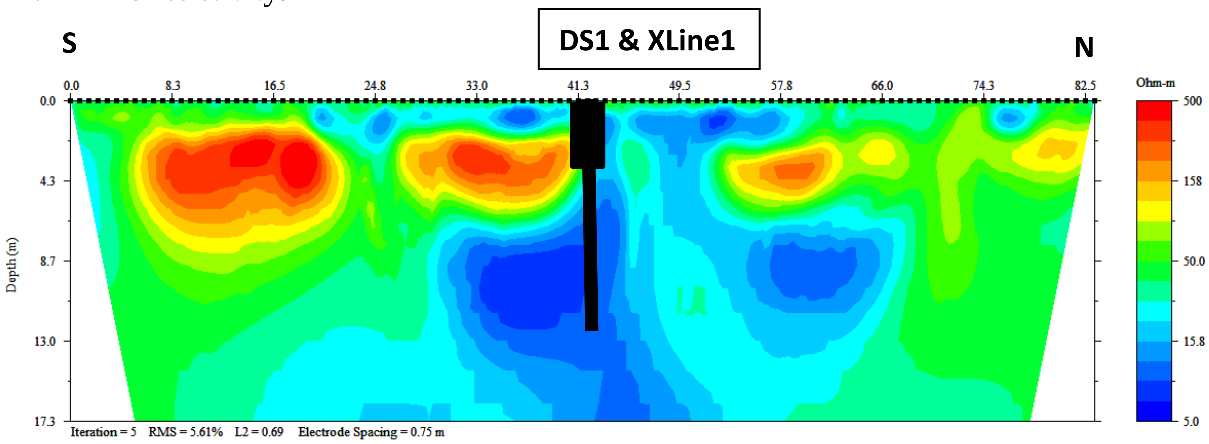


Line 2 – Interpreted seismic refraction:

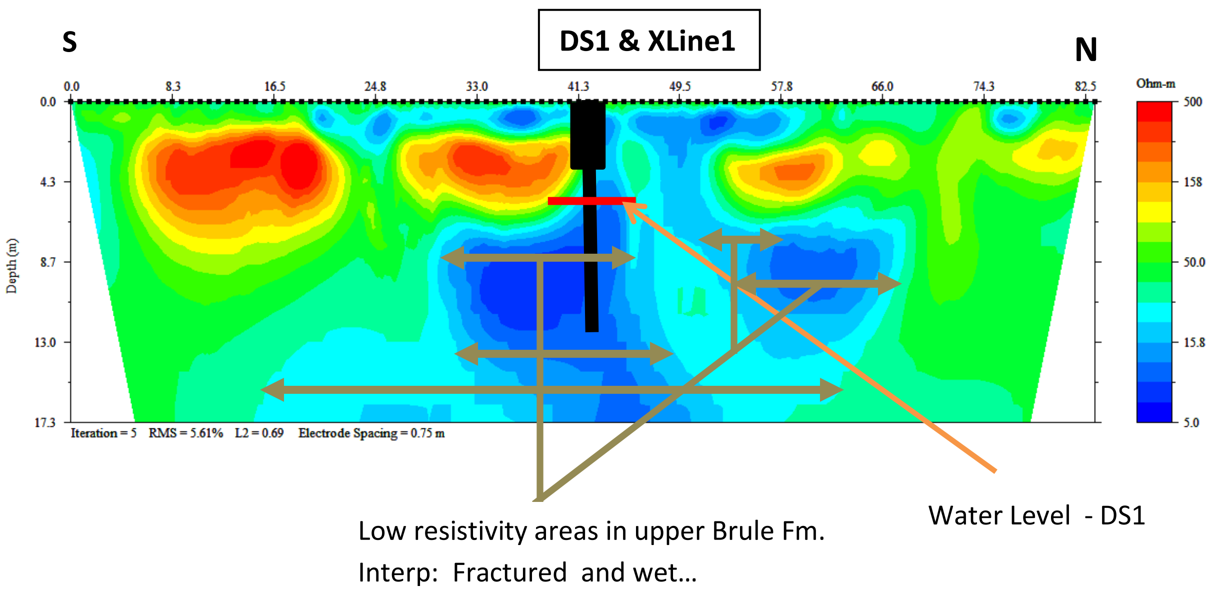


Top: Line 2 seismic refraction results. Bottom: Interpreted results for Line 2 seismic refraction. DS1 and the intersection of Line1 are indicated. The top of the Brule Formation is known from DS1 and is clearly contoured from the dark blue to light blue transition (~ 600 m/s). The velocities are low since the contact is above the static water table (red line). Interestingly, a low velocity zone in the Brule Fm. is observed between ~ 23 –55 m of the profile line. This includes the area around the projected location of DS1. This low velocity zone is interpreted to highlight an area with increased fracture density. These fractures would be water filled at this depth.

Line 2 – DC resistivity:

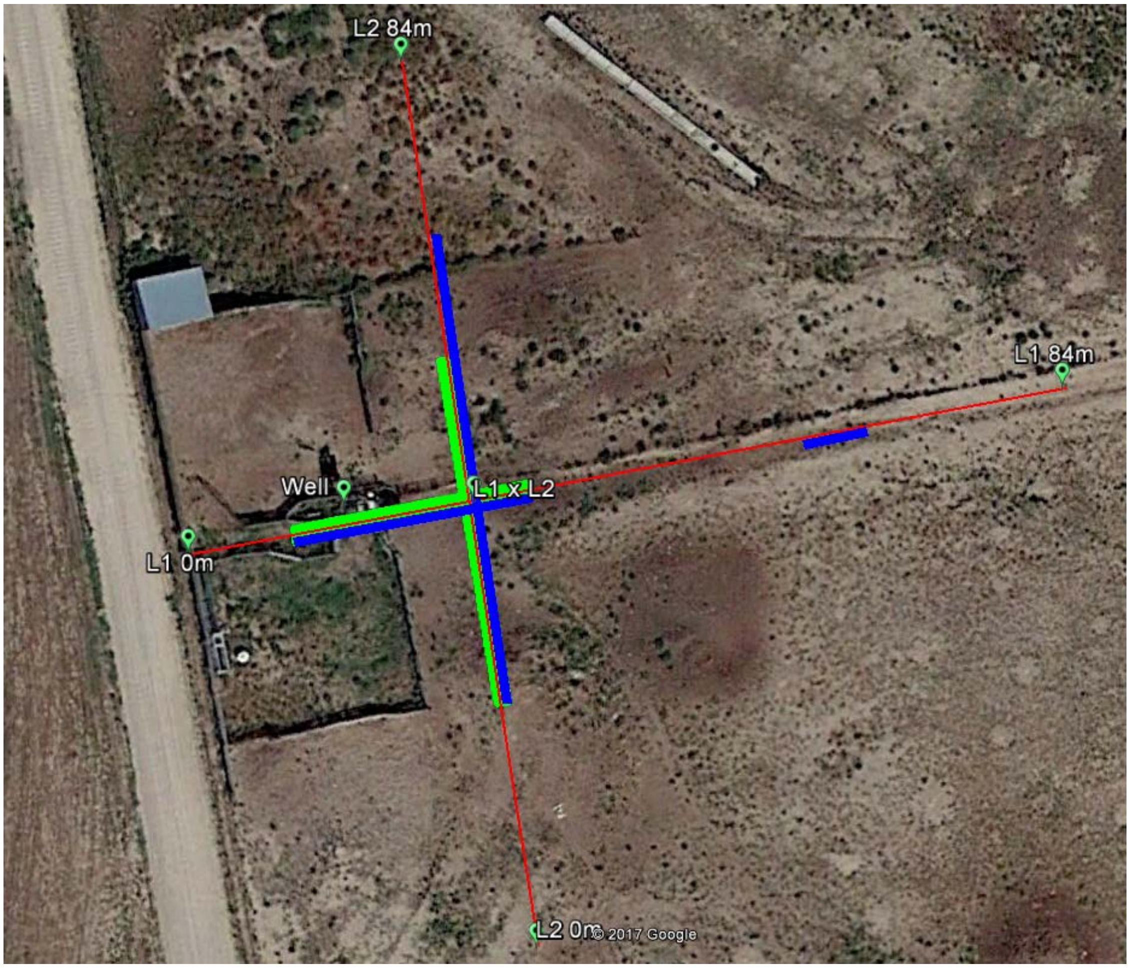


Line 2 – Interpreted DC resistivity:



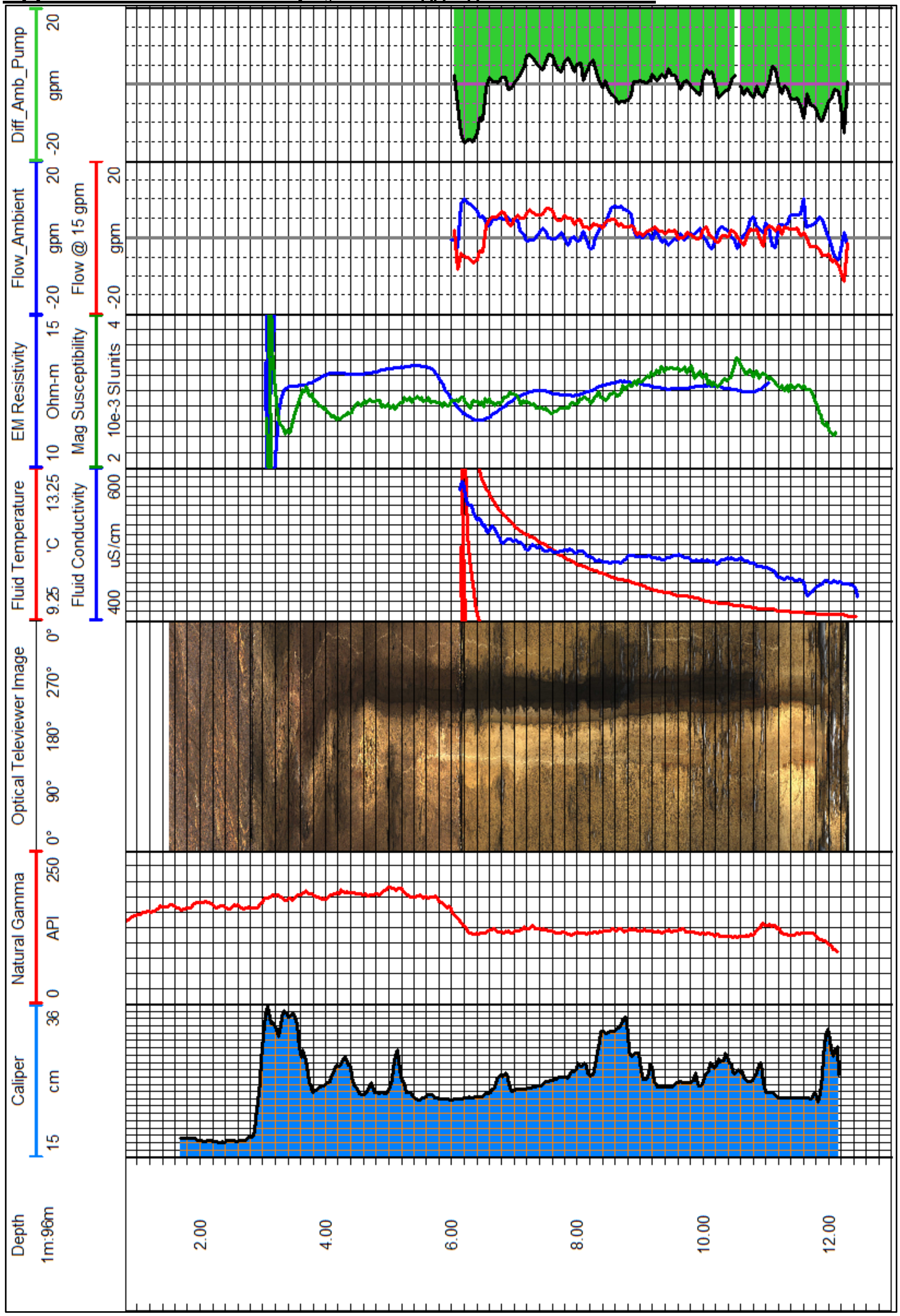
Top: Line 2 DC resistivity results. Bottom: Interpreted results for Line 2 resistivity. Projected DS1 location and the intersection of Line1 are indicated. The resistivity data do not show any clear indication the contact of the unconsolidated and Brule Fm. However, these data provide very strong indications of the porosity/permeability state of the subsurface. The low resistivity data (light-dark blue) sharply delineate the static water table (red line) and deeper zones that are interpreted as wet fractures. These zones continue deeper than DS1 to the N (NW). The very low resistivity (dark blue ~ 5-10 ohm-m) zones are interpreted to indicate fracture connected permeability which acts to lower the bulk resistivity further than simply higher bulk porosity (light blue). Since there are no clay lenses observed in DS1 where these resistivity values are ~ 5 ohm-m, water filled fractures must be causing this result. Interestingly, the low velocity zone seen in the seismic data is also observed in the resistivity between ~ 26 – 66 m of the profile line. This includes the area around the projected DS1 location. This is also the area of lowest resistivity which is interpreted as a consequence of the pumping on connected fractures. Additional low resistivity areas in the upper Brule are seen both further south and north but are slightly higher resistivity which infers that they are not connected to the producing fractures further west. The overall dip of the low resistivity (connected fracture permeability) is to the N (NW).

Summary of Interpreted Fracture Zones on the profile lines:



Above: Map view summary of the surface geophysical results along the two profile lines. Low velocity zones (green) from the seismic refraction and low resistivity (blue) are indicated. These areas are interpreted to have higher fracture density in the upper Brule Fm. Note: The resistivity data extend further and deeper than the seismic data which is why blue areas extend beyond the green areas.

Appendix 3 – Borehole Geophysical Logging Data from DS1:



Above: Borehole Geophysical Logs from DS1. Depths are recorded in meters. The displayed logs are: Caliper (cm), Natural Gamma (API), Optical Televiewer Image oriented to true north, Fluid Temperature (degrees C), Fluid Conductivity (microSiemens/m), Spinner Flowmeter (gpm) – Ambient & Pumping & Difference.

<u>Log Observations:</u>
Caliper:
1) The surface casing is narrower than the borehole. This makes centralizing logging tools like the Optical and Acoustic Televiewer impossible. Fortunately, the Optical Televiewer data is less sensitive to "ideal" centralization and the data are still very good. Unfortunately, the Acoustic Televiewer is unusable due to this situation.
2) There are numerous washouts indicated. These washouts are indicative of fractured intervals (as will be highlighted in other figures later).

Gamma:
1) The largest deviation is at the static water table (6.134m bgs). There are very smaller deviations present above and below the water table such as: a) the unconsolidated/Brule contact - 2.8 m bgs, b) slight increase in clay contents at: 3.2 m, 3.7 m, 4.3 m, 5.2 m, 7.3 m, and 11.1 m bgs, c) slight increase in sand content at: 8.0 m, 10.6 m, and 12.1 m bgs.
2) Overall, the gamma values are fairly constant and low. This is indicative of a sand dominate siltstone. The unit does not show any significant lithologic variability within these depths. The very slight clay increase fluctuations are interpreted to be the result of weathering near fractures.

Optical Televiewer:
1) The "homogenous" appearance of this siltstone of the upper Brule is clear.
2) Fractured intervals are readily apparent. Few of the fractures are open across the entire borehole diameter. As seen later in larger scale view of the fractures, most of the fractured intervals appear "vuggy" (i.e. multiple, high density, small aperture openings).
3) A large vertical opening that propagates to the west is present. It is interpreted to be a consequence of drilling the stock well approximately 6 m west of DS1.

Fluid Temperature/Fluid Conductivity:
1) Fluid Temperature data is difficult to interpret since this interval is still affected by the surface temperature. However, minor deviations in this curve are still visible and would indicate inflow into the borehole. This is more noticeable below 10 m bgs.
2) Fluid Conductivity data are easier to observe deviations indicative of water inflow to the borehole. The greatest inflows of formation water to the borehole starts from fracture zones at 10.7 m bgs and 11.7 m bgs, respectively.

EM – Resistivity & Magnetic Susceptibility:
1) EM resistivity provides relative, bulk resistivity values in both the wet and dry sections of the borehole below the steel surface casing. These data show the largest deviation at the static water table but are relatively constant both above and below this zone. Given the earlier interpretation of formation homogeneity and small aperture fracturing, it is not surprising that these data are indicating a relatively constant formation resistivity and not very sensitive to the water filled fractures.
2) EM – Magnetic Susceptibility shows our only indication of small lithologic changes at 7.0 m and 8.2 m bgs. The magnetic susceptibility will increase or decrease depending on the amount of magnetically susceptible minerals (Fe, Mg, etc.) present in the matrix. For example, a clean quartz sand would have low magnetically susceptibility compared to a granite. In this case, we can interpret three layers in the upper Brule: above 7.0 m bgs, between 7.0 – 8.2 m bgs, and below 8.2 m bgs. Therefore, there are three zones in the upper Brule siltstone that are slightly different due to various heavier metal impurities.

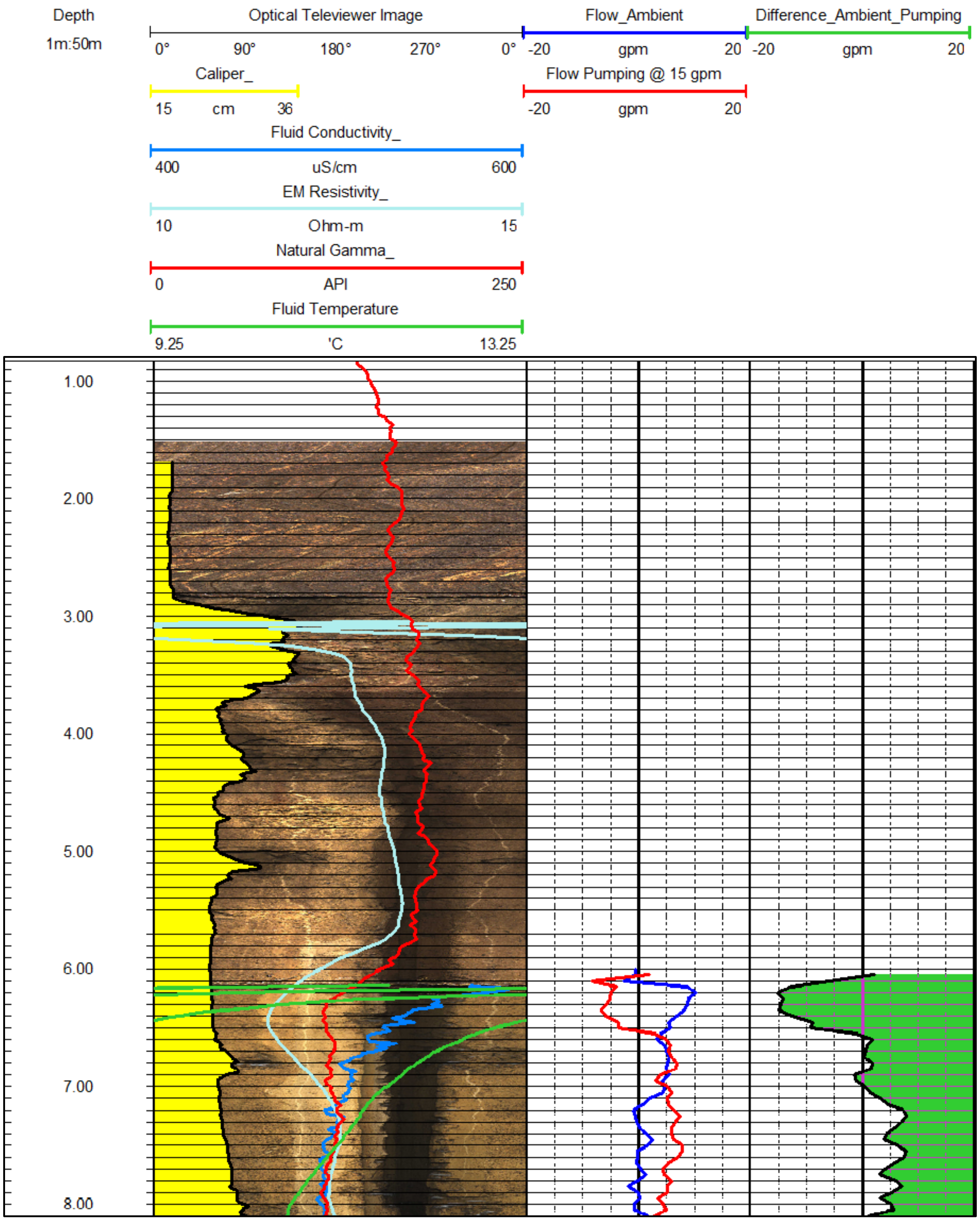
Flowmeter logs:

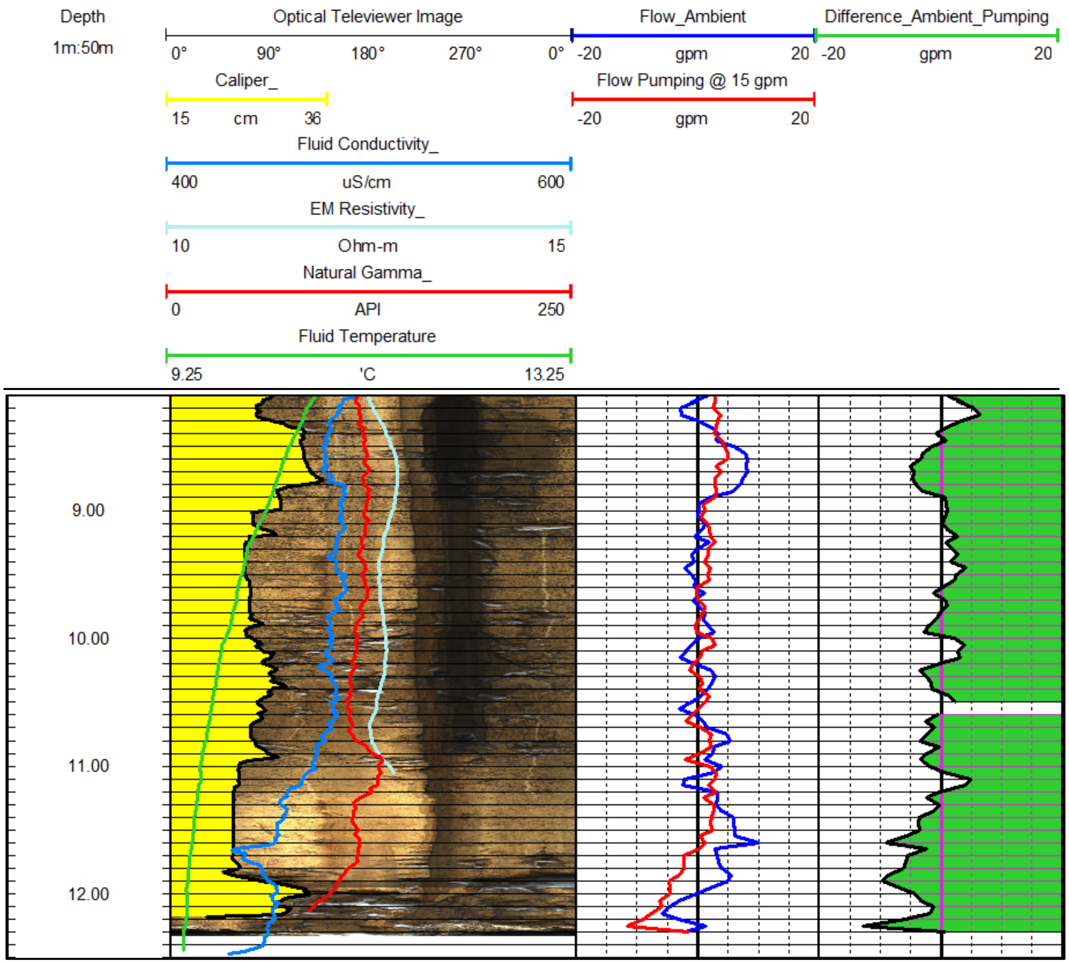
1) Deviations to the left & right of zero in the ambient and pumping flow logs indicate inflow and outflow from the borehole respectively. It is important to remember that the pumping was at 15 gpm from a well approximately 6 m west of DS1 (i.e. the pumping was not from DS1). Therefore, the water would be moving thru DS1 (versus “out of” DS1).

2) In the ambient flowmeter data (blue line), the significant outflow fracture zones are at: 6.2 m bgs, 8.7 m bgs, 10.8 m bgs and 11.8 m bgs. The significant inflow fracture zones are at: 8.3 m bgs, 10.2 m bgs, 10.5 m bgs, 11.2 m bgs, and 12.2 m bgs.

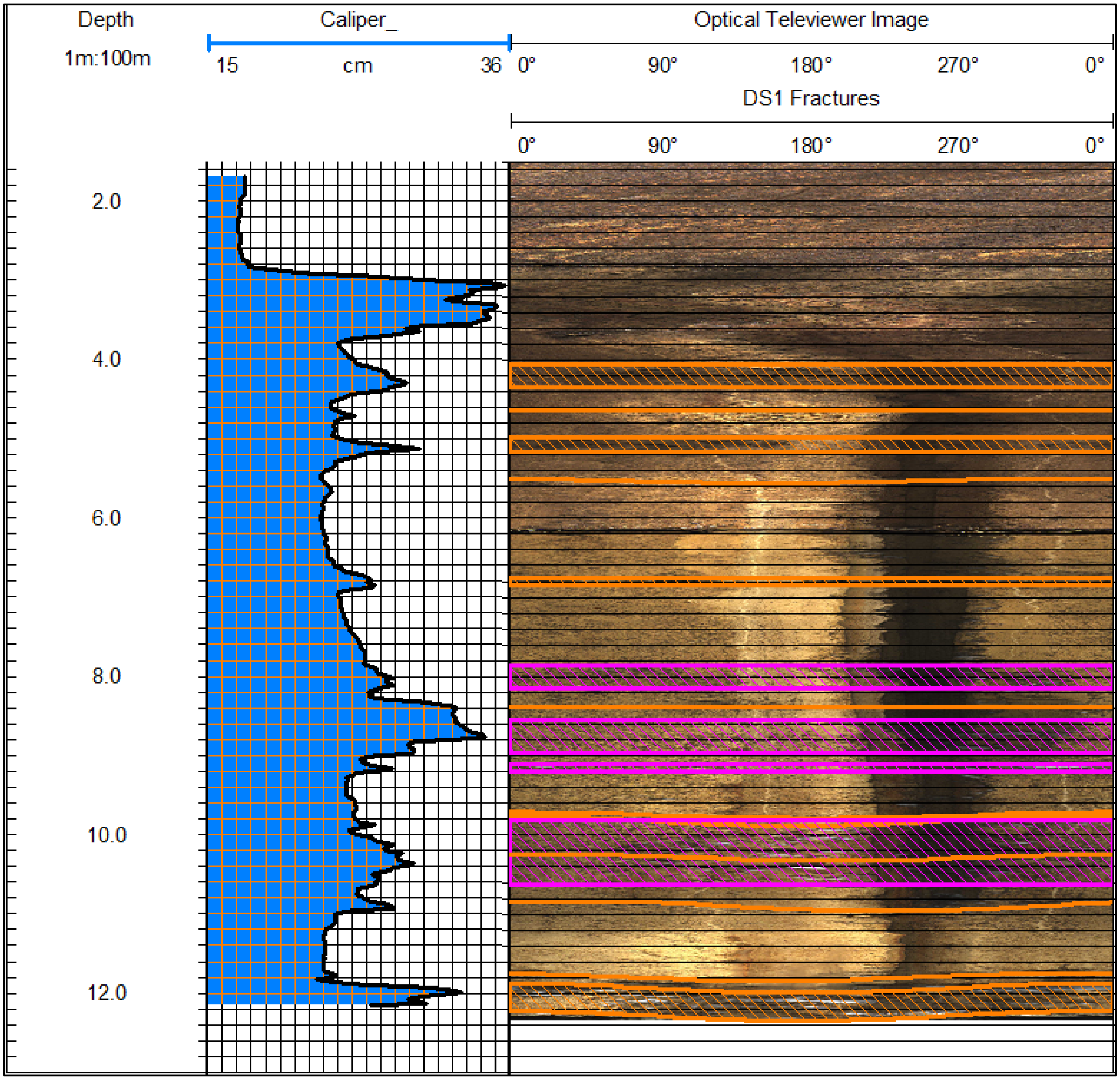
3) During the pumping, two regions dominate the inflow response: 6.0 - 6.5 m bgs, and 11.6 – 12.2 m bgs. The zone from 6.5 – 8.3 m bgs is now dominating the outflow response from the borehole. During the ambient measurement, this zone was mostly not involved in either inflow or outflow which is very interesting. Given this result, it’s assumed that the water is coming into DS1 just below the casing and flowing down as well as at the bottom and flowing up until the 6.5 – 8.3 m bgs zone where water is leaving the borehole to the pumping well. The fracture zone at 8.7 m bgs that had taking been water from the hole in the ambient condition is now taking less water under pumping which is interesting.

4) A difference log between the ambient and pumping response highlights the observations made above and the groundwater flow dynamic. Again, anomalies to the left (“negative” gpm) are flow into the hole while anomalies to the right (“positive” gpm) indicate water out of the borehole. This nicely highlights the observation that the fractures at 8.7 m bgs are “producing” some water to the hole or more correctly, taking less water from the borehole under pumping in the adjacent well. Additionally, the fractures under the casing reverse the flow direction from out of the hole to into the DS1 during pumping. Finally, the fractures at the bottom of DS1 produced more water to the borehole under pumping.

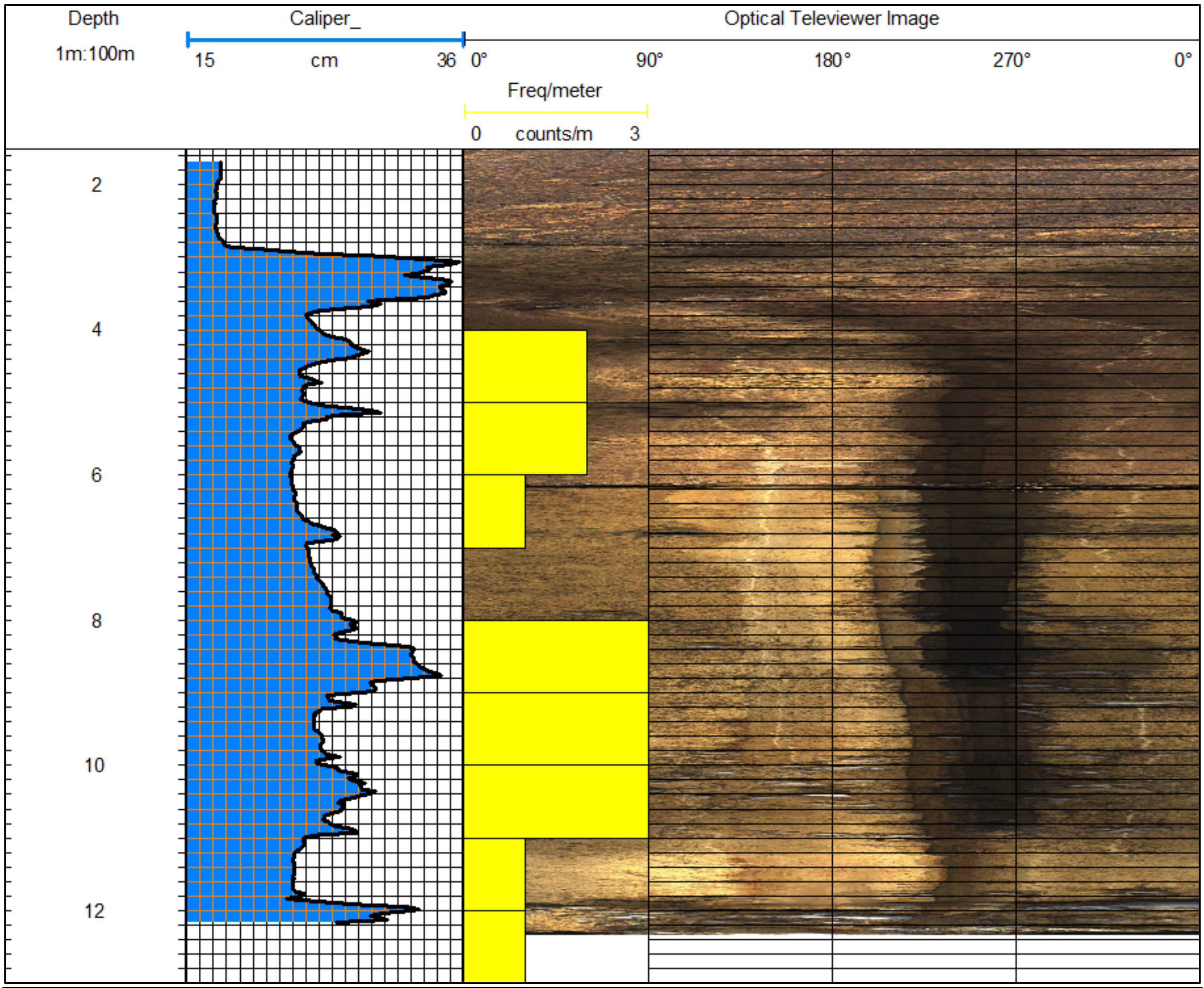

Depth
1m:50m
Optical Televiewer Image
0° 90° 180° 270° 0°
Caliper_
15 cm 36
Fluid Conductivity_
400 uS/cm 600
EM Resistivity_
10 Ohm-m 15
Natural Gamma_
0 API 250
Fluid Temperature
9.25 'C 13.25
Flow_Ambient
-20 gpm 20
Flow Pumping @ 15 gpm
-20 gpm 20
Difference_Ambient_Pumping
-20 gpm 20
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00



Above (& previous page): Overlain borehole Geophysical Logs from DS1. Depths are recorded in meters. The display is to highlight the lithologic, fracture and hydrogeologic intervals defined by the logging data. The observations referenced earlier are shown.

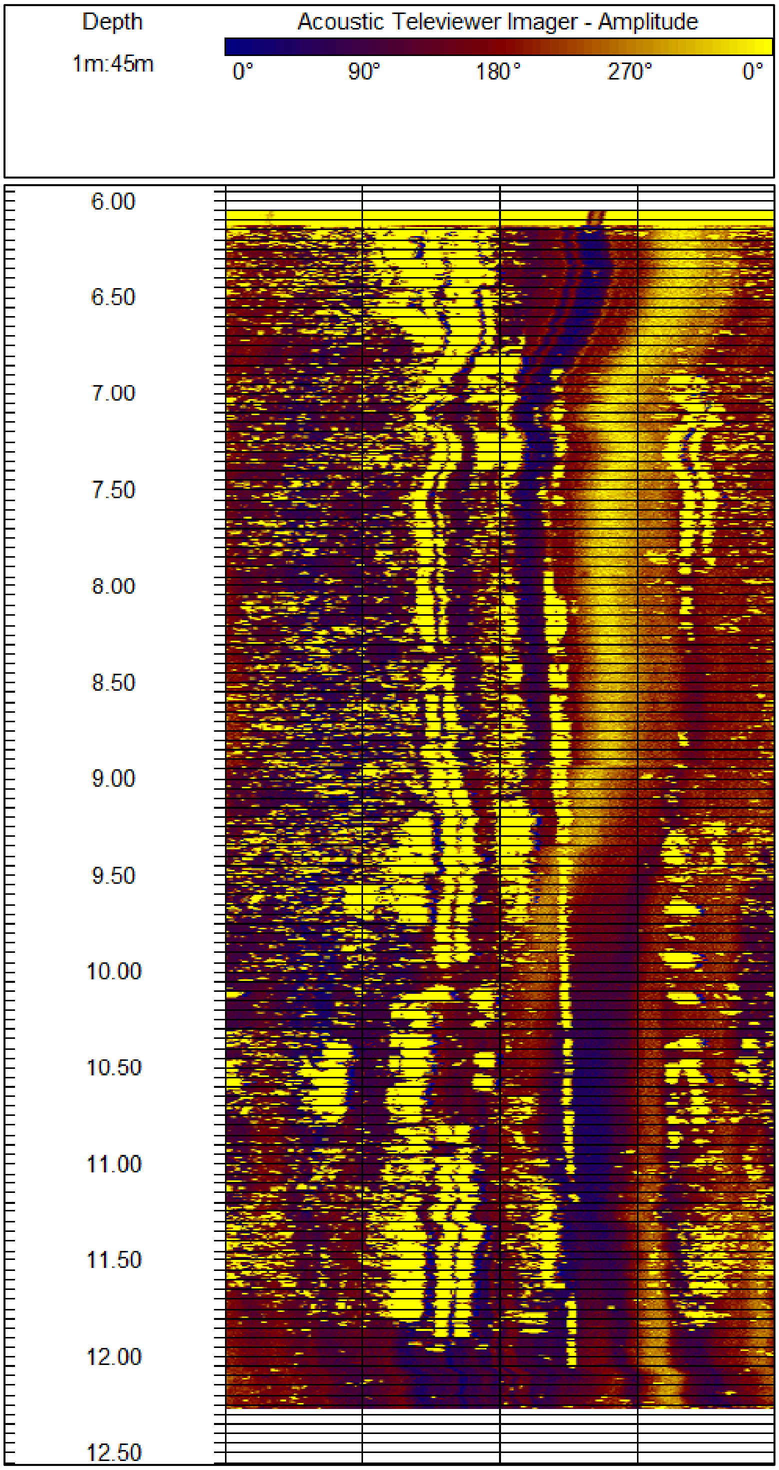


Above: Caliper log next to the OBI Image and picked fracture intervals in DS1. Depths are recorded in meters. The orange fractures are partially open fractures. The pink fractures are fully open fractures.



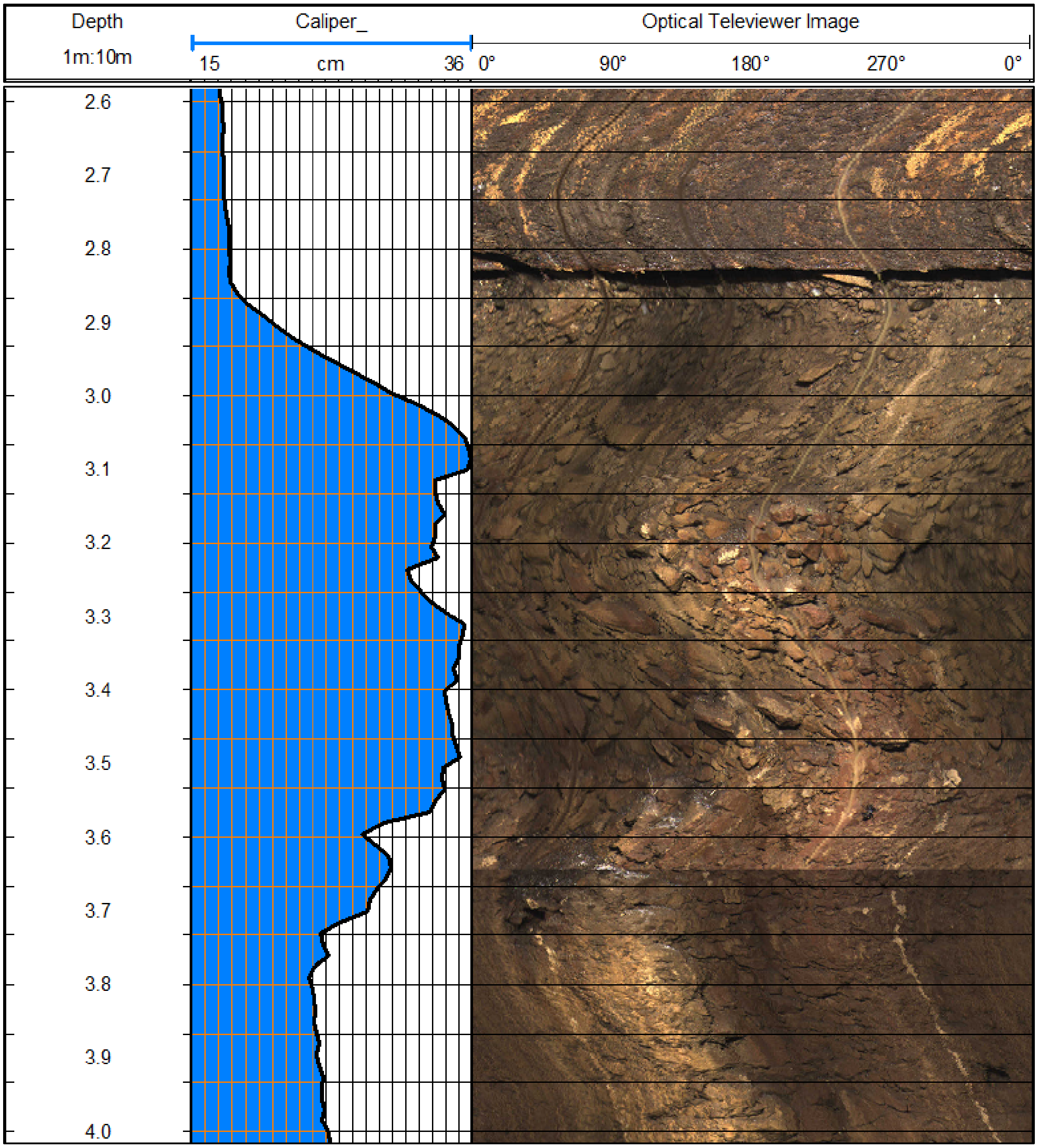
Above: Caliper log next to the OBI Image and fracture density/m histogram in DS1. Depths are recorded in meters. The upper and lower fractures are separated by a small zone that has no observed fractures. These data do not reflect the water productivity of any individual fracture or fracture zone in DS1. However, they are useful to confirm the surface data interpretation of higher fracture density and bulk water availability.

Appendix 4 – DS1 Acoustic Televiewer Data:

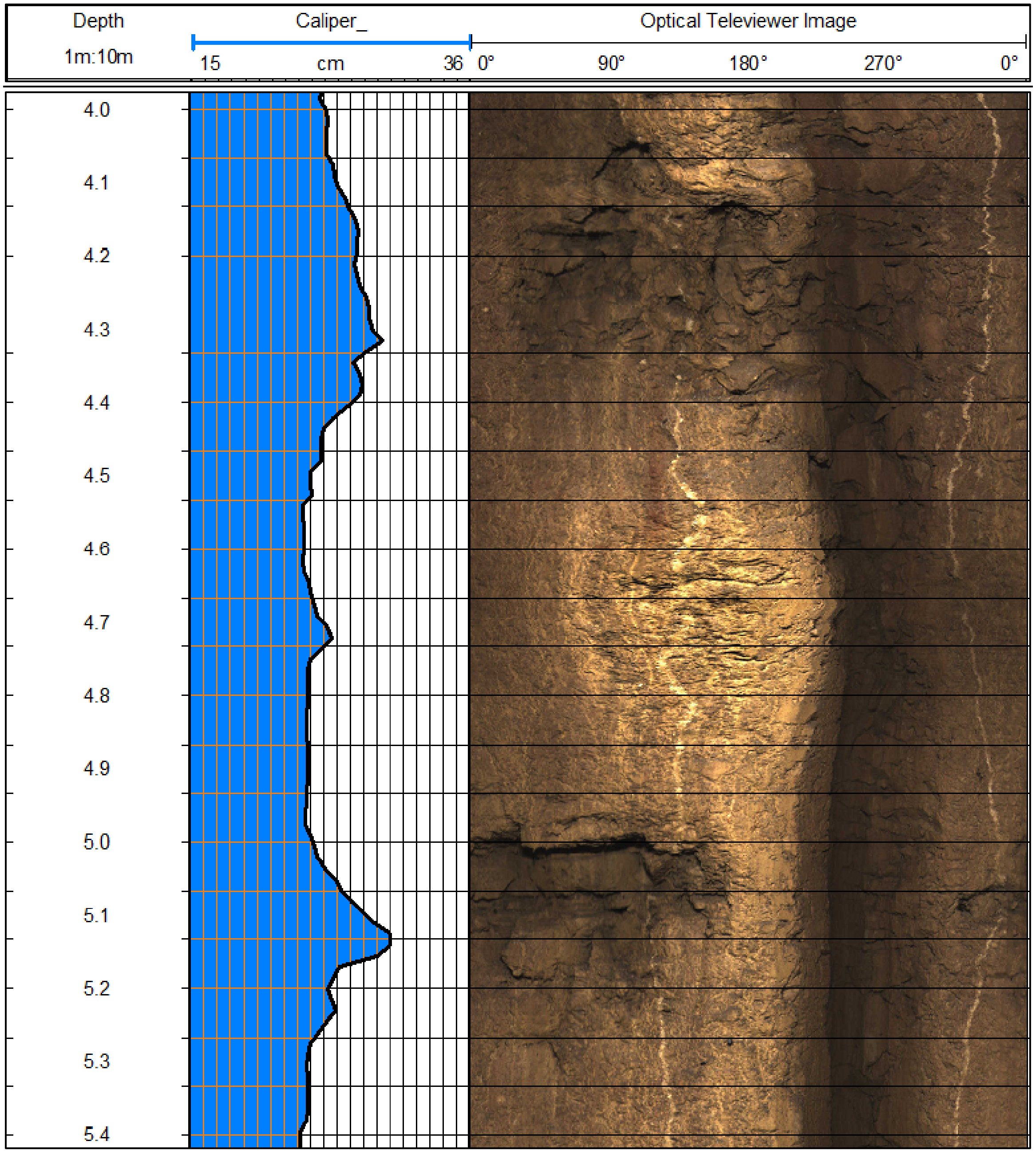


Above: Acoustic Televiewer log Depths are recorded in meters. As mentioned earlier, the configuration of the borehole made it virtually impossible to acquire good (or even useful) ATV data in DS1. This is unfortunate since these data are complimentary to Optical Televiewer data. For further study, it is recommended that a new (more modern) hole either be found or drilled (the authors recommendation).

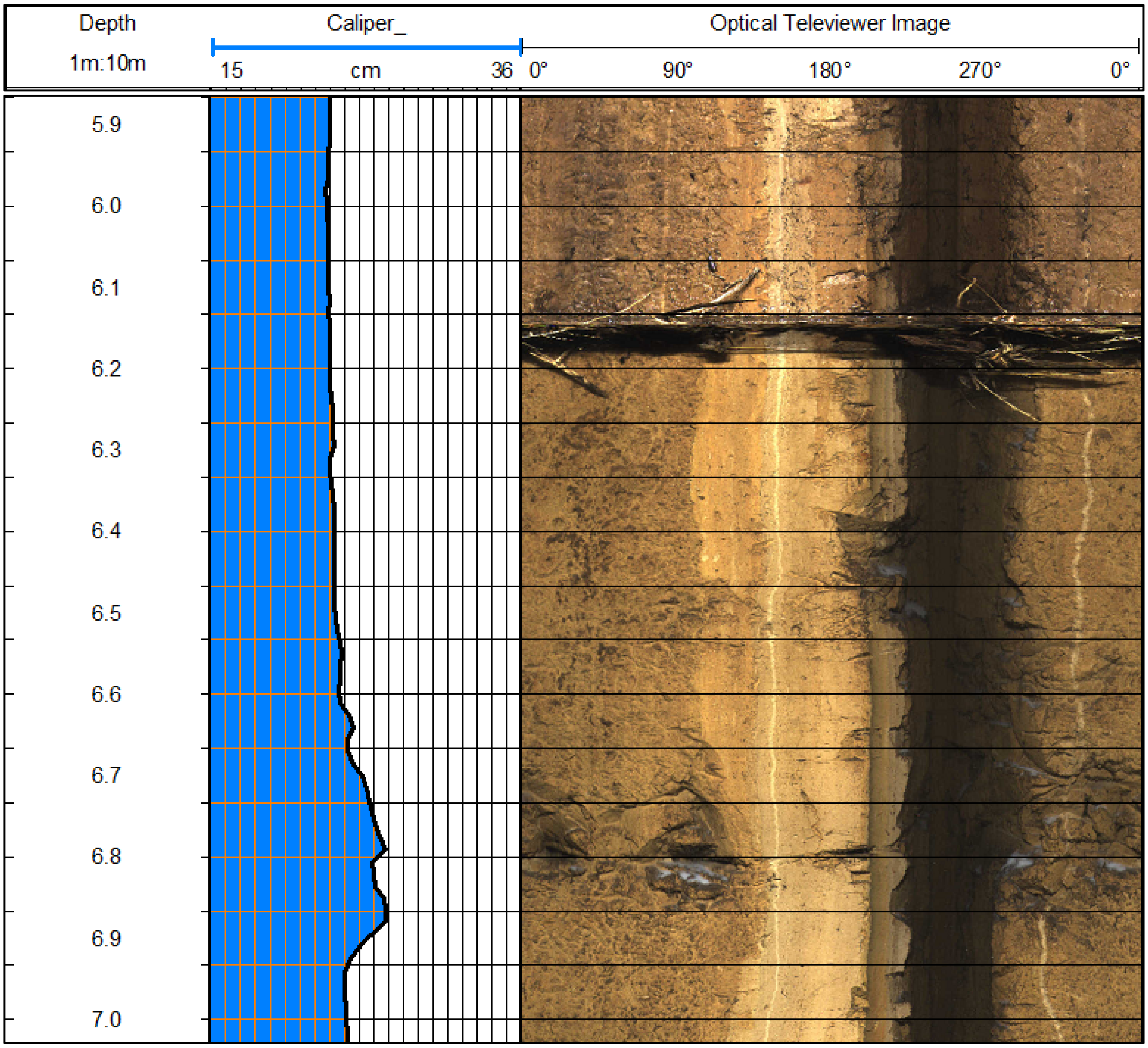
Appendix 5 – Larger Scale DS1 Images (OBI data):



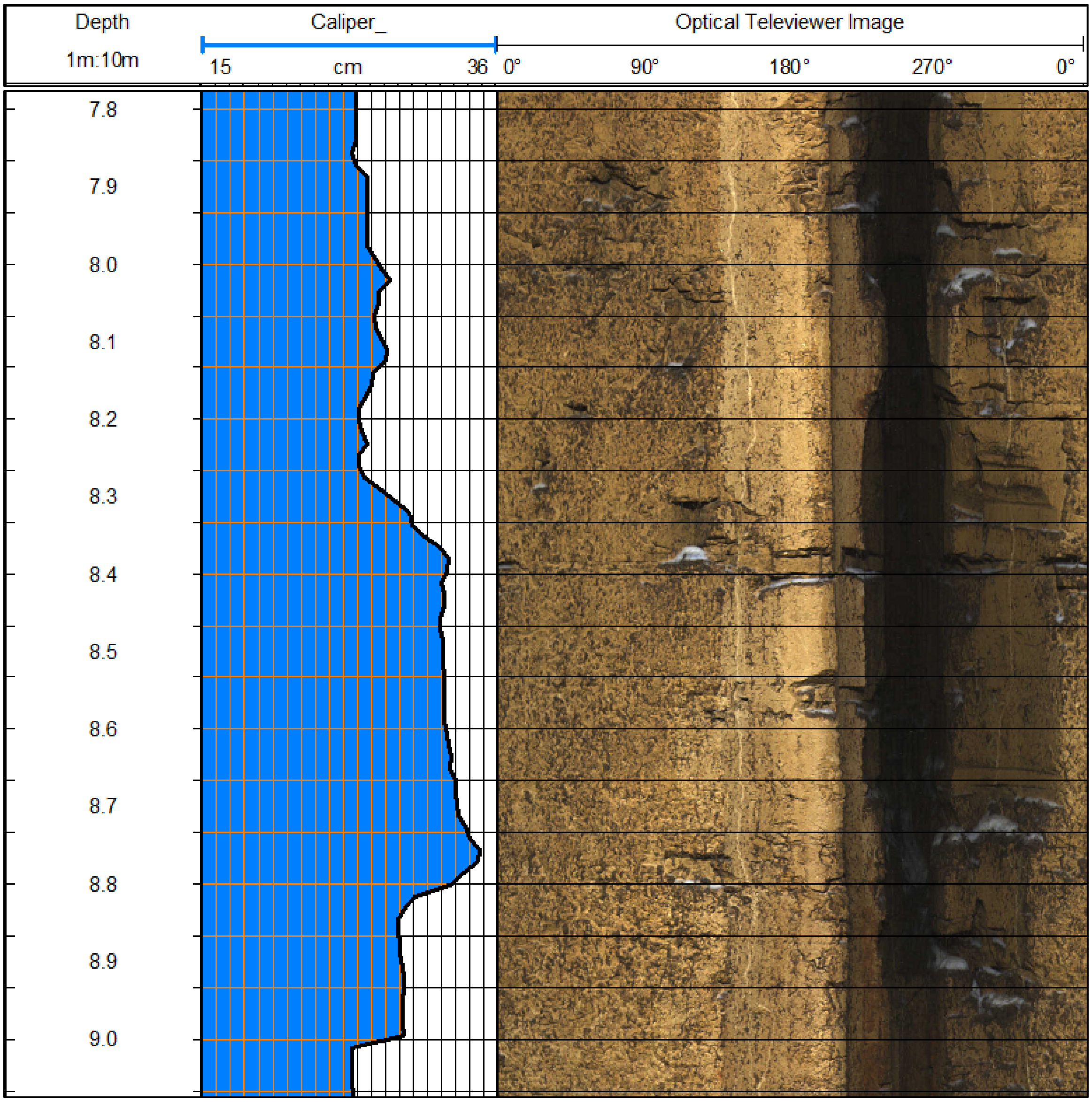
Above: Caliper log next to the OBI Image and at a larger scale to observe the fractures in DS1. Depths are recorded in meters. In these data, one can see the bottom of the surface casing and the weathering interface of the upper Brule Fm.



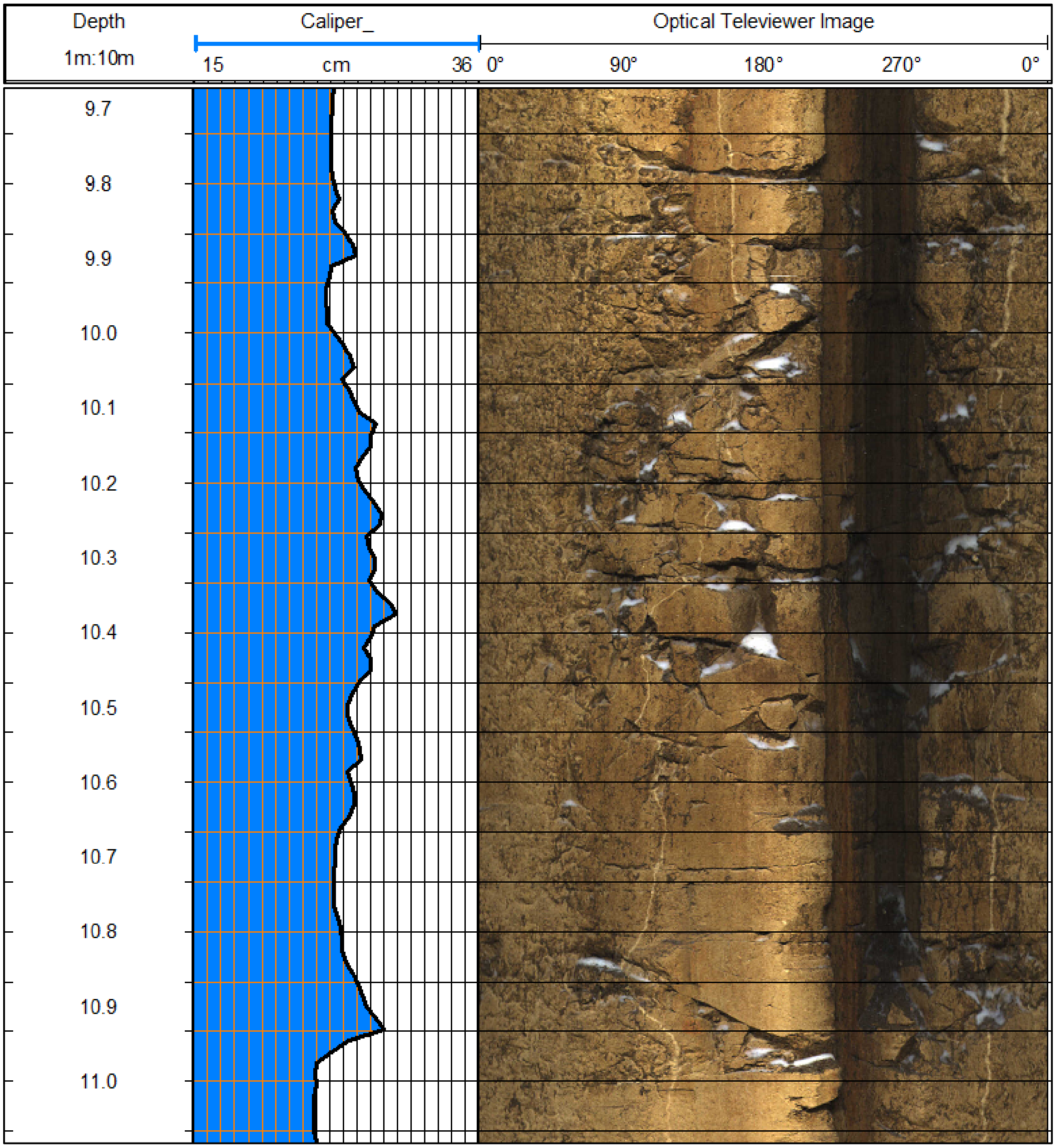
Above: Caliper log next to the OBI Image and at a larger scale to observe the fractures in DS1. Depths are recorded in meters. In these data, the "vuggy" nature of fracturing in the top depths of the Brule Fm.



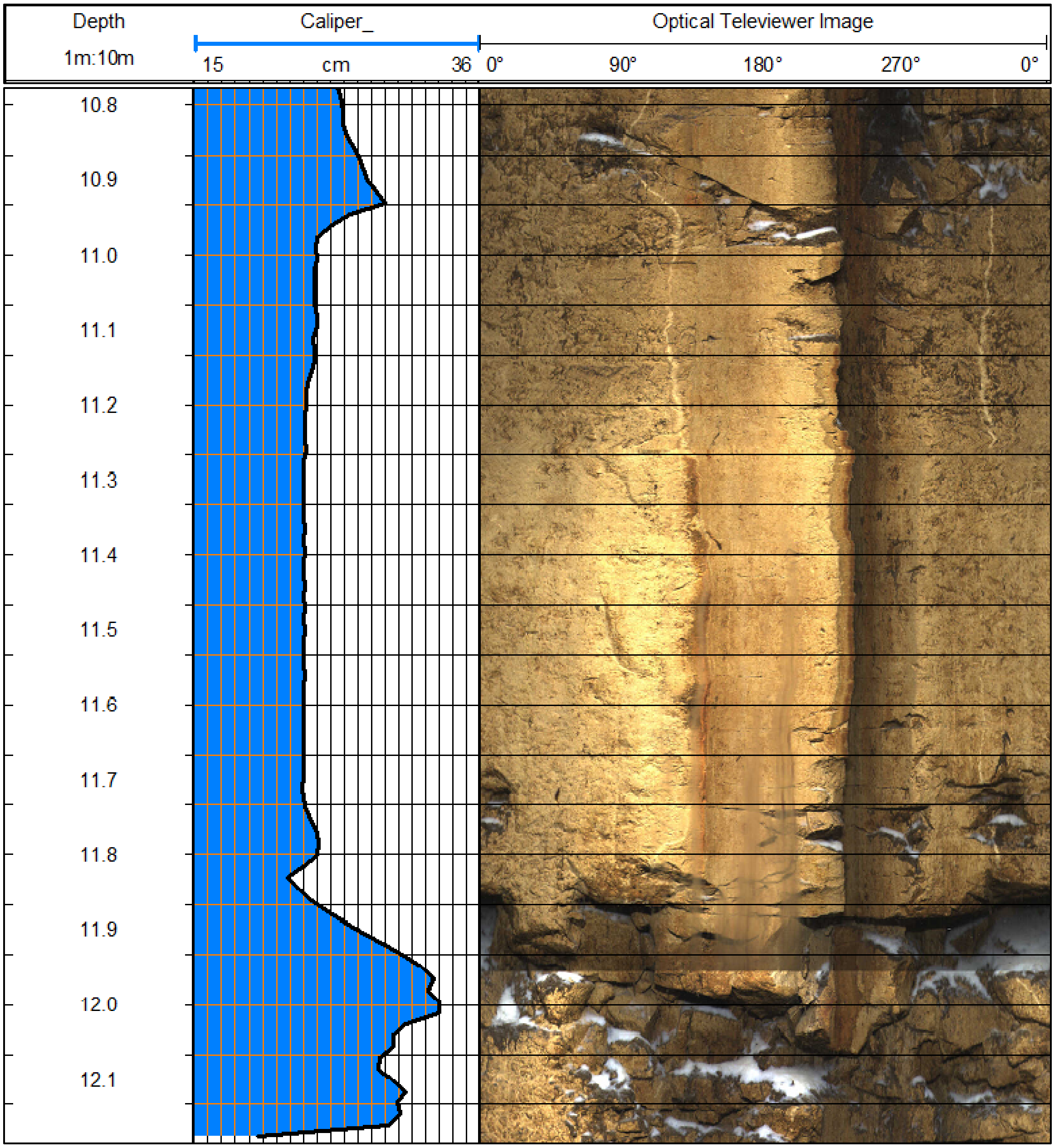
Above: Caliper log next to the OBI Image and at a larger scale to observe the fractures in DS1. Depths are recorded in meters. In these data, the static water table is shown with floating organic material. Also, the "vuggy" nature of fracturing at ~6.8 m bgs is shown.



Above: Caliper log next to the OBI Image and at a larger scale to observe the fractures in DS1. Depths are recorded in meters. In these data, more partially open fractures are observed.



Above: Caliper log next to the OBI Image and at a larger scale to observe the fractures in DS1. Depths are recorded in meters. In these data, the nature of the "deeper" fractures is observed. They are larger aperture and more pervasive around the entire diameter of the borehole.

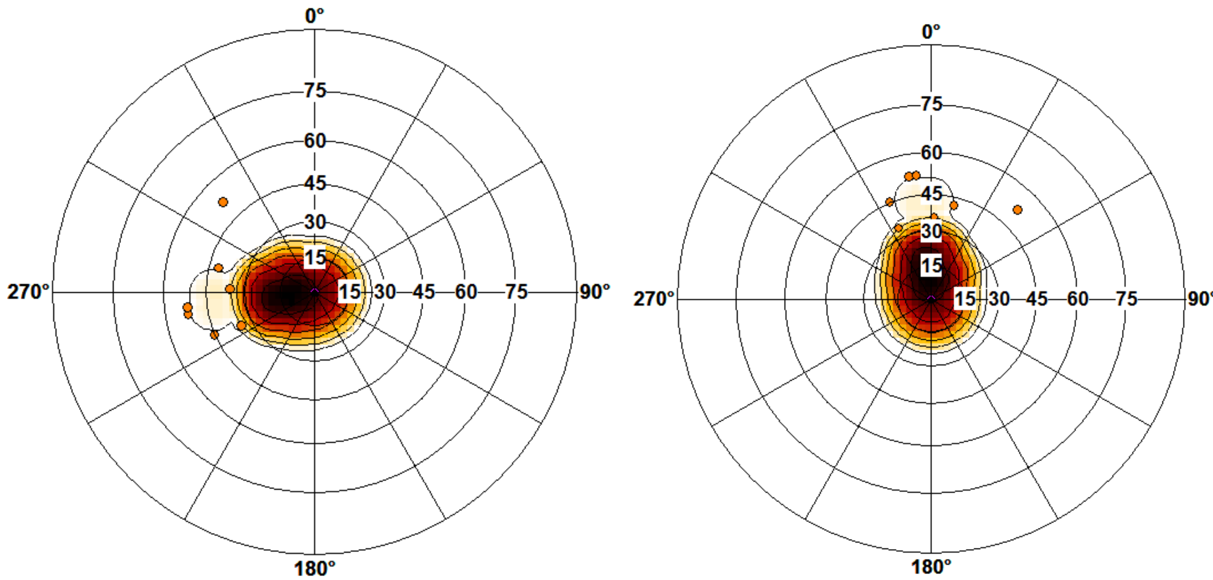


Above: Caliper log next to the OBI Image and at a larger scale to observe the fractures in DS1. Depths are recorded in meters. In these data, the fracture zone at the bottom of DS1 is observed. This fracture zone is always producing water to DS1 (in both ambient and pumping states).

Appendix 6 – DS1 Fracture Strike and Dip – Wulff (Angle-Equal) Polar Projection Stereonets:

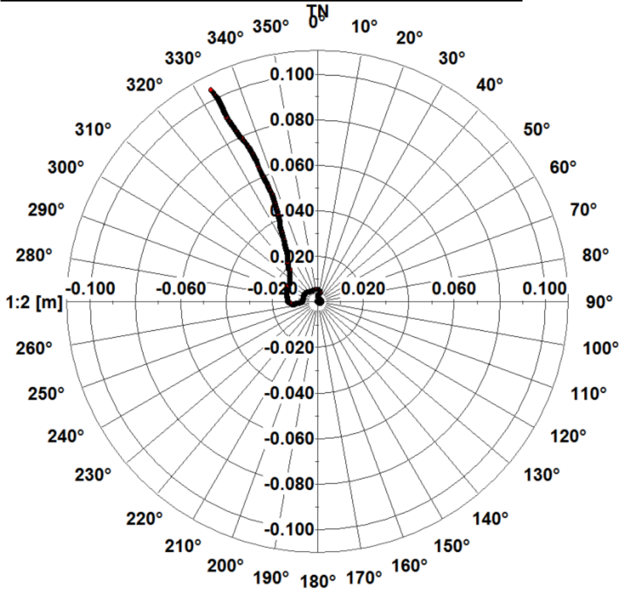
(Southern (Lower) Hemisphere, Kamb contouring, Number of standard deviations = 2)

Strike and dip of fractures in DS1 relative to true north. Fracture data are picked from the OBI dataset.

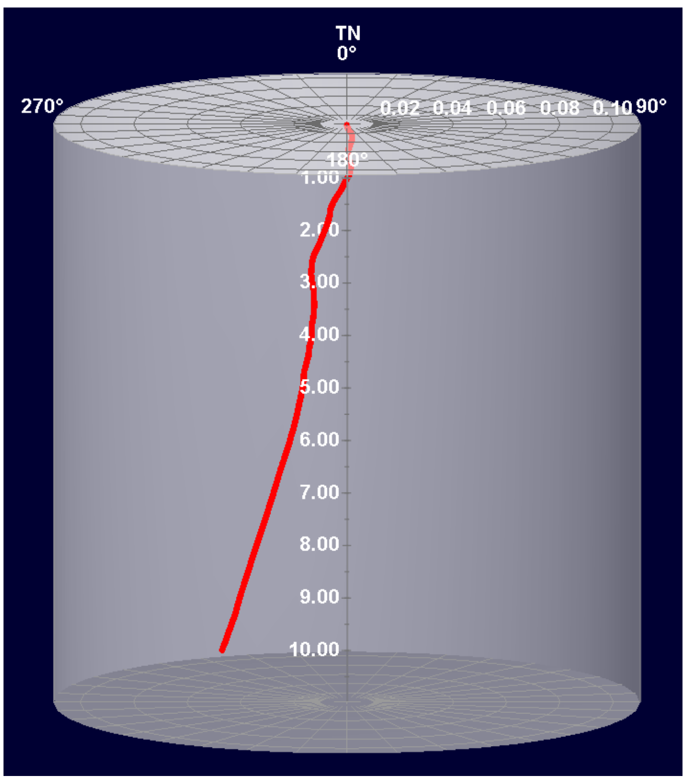


Above (left): Strike and dip angle of the fractures within DS1 (16). Fractures strike to the W.
Above (right): Dip azimuth & dip angle of the fractures within DS1. Low angle (i.e. < 30 degrees) fractures dominant the borehole interval with a few with dips ~ 45 degrees. The fracture dip direction is to the North.

Appendix 7: DS1 Borehole Deviation:

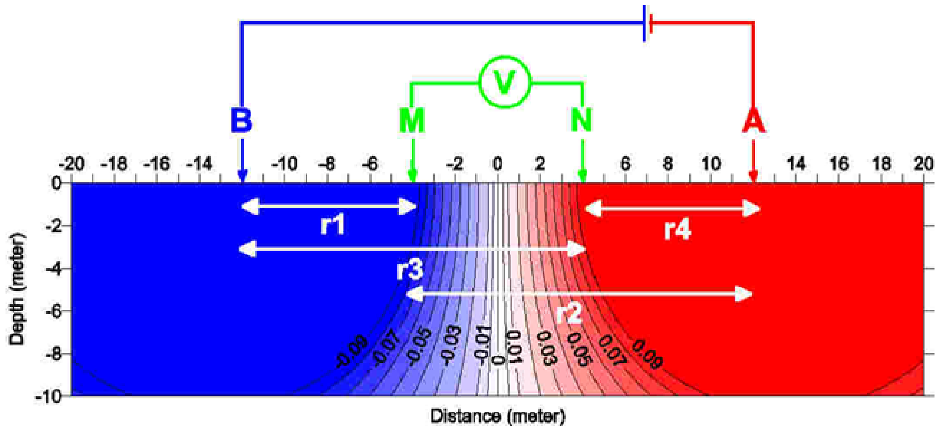


DS1 Borehole deviation determined from the OBI tools (ABOVE – Stereonet; BELOW – 3D cylindrical view). The deviation being absolutely less than 0.11 m over the entire depth, the borehole is clearly deviating to the NW. The implication from these data is the borehole is deviating toward in the fracture dip direction (slightly).



Appendix 8: Information on Surface Geophysical Methods Utilized:

DC Resistivity:



General formula for calculating apparent resistivity

$$\rho_a = \frac{2\pi\Delta V}{i}\left[\frac{1}{\left(\frac{1}{r_1}-\frac{1}{r_2}-\frac{1}{r_3}+\frac{1}{r_4}\right)}\right]$$

Summary

Target physical property: Subsurface Electrical Resistivity/Conductivity.

Geological Applications: Subsurface Porosity/Permeability, subsurface lithologic mapping, bedrock depth and structure, porosity water table location, fault zone detection.

Equipment: Advanced Geosciences, Inc. (AGI) SuperSting™R8/IP/SP Resistivity meter, 56-electrodes@4-5 m electrode spacing, 56 electrode stakes, and Toughbook.

Fundamental measurements: Electrical resistance and injected current from source dipole to receiver dipole(s).

Data analysis: Forward modeling & tomographic inversion of resistance, injected current and electrode location (i.e. apparent resistivity) data.

Software: AGI EarthImager™ software, installed in the PC lab (ESB 1006).

Overview

DC Resistivity provides information about the electrical resistivity distribution in the subsurface. This method provides in-situ information about lithologic composition, metal content, pore fluid chemistry, porosity, and permeability. This method is particularly well suited to finding zones that have saturated materials. Of the methods you'll learn in this course, DC RES is effort-intensive in the field but relatively easy for data analysis.

The basic chain of events in collecting and analyzing DC Resistivity data is this:

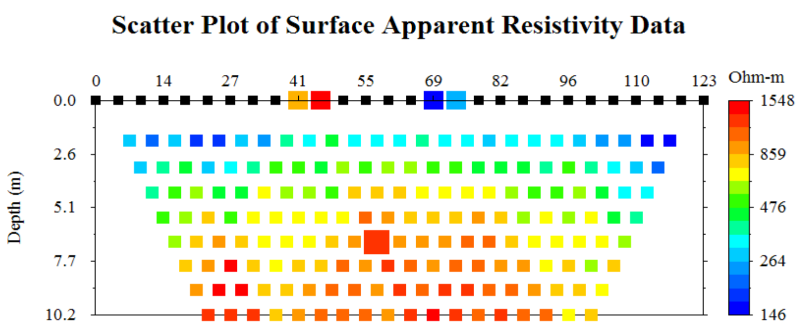
1. Plan line location and decide on acquisition parameters (line length, electrode spacing).
2. Deploy resistivity cable(s), and electrode stakes. Typically, 4-6 electrode stakes while in the granite and 2 electrode stakes when in the valley floor alluvium.
3. Deploy Switch box and SuperSting resistivity meter to the middle of the profile line. Connect all cabling together.

4. Acquire datafile in the SuperSting by selecting preloaded command file(s) (i.e. electrode array files) to execute. Meanwhile, survey team collects elevation data and records GPS positions of start/end of line (WGS-84 ellipsoid, please).
5. Copy data from SuperSting to Toughbook (and a USB memory stick) before leaving field.
6. Input elevation data into a spreadsheet and determine the topographic relief along the profile line.
7. Read raw data into Inversion software (EarthImager), select data default, input terrain file and conduct resistivity inversion to produce the resistivity section.

Data example

The figure displays an example of the raw, "apparent resistivity" data produced by this method in a "Pseudosection" display. The four electrode locations at the top represent the two current electrodes (blue colors, "A" & "B") and the two potential (i.e. receiver) electrodes (red colors, "M" & "N") that resulted in the highlighted data point. Each resistance value is plotted at a unique point in the pseudosection display – the horizontal axis is the midpoint between the two dipoles, and the vertical axis is horizontal separation of the two dipoles. The "pseudo" part comes from the fact that the vertical axis appears to be depth even though it is not.

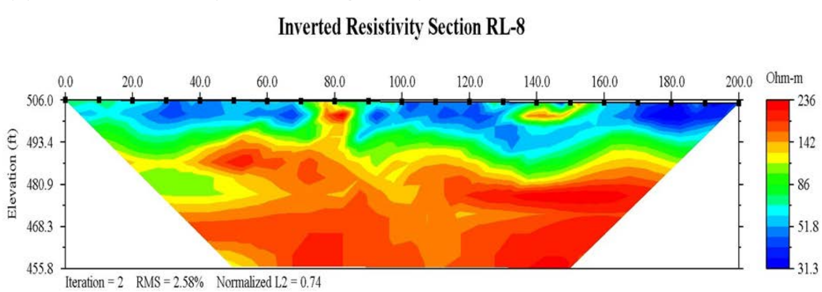
Apparent resistivity is a weighted average of the resistivities under the four electrodes (Note: if the ground is homogenous, the apparent resistivity equals the true resistivity).



A

Example of results

The figure below shows an Inverted Resistivity section created by tomographic inversion of the apparent resistivity data along one profile.



<u>**Refraction Seismology:**</u>

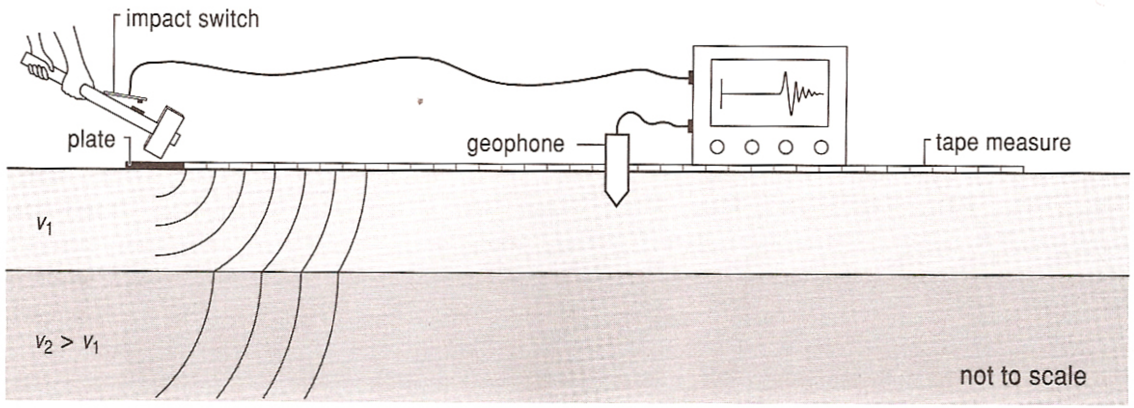


Figure 6.13 Hammer system.

Summary

<u>Target physical property:</u> Seismic P-wave velocity in the subsurface.

<u>Geological Applications:</u> Weathering zone thickness, bedrock depth and structure, porosity constraints, water table location, detection of fault zones.

<u>Equipment</u>: Geometrics® Geode seismograph, 24-channel, 40-Hz vertical-component geophones, sledgehammer source, Toughbook PC.

<u>Fundamental measurement:</u> Travel times of refracted first-arrivals from source to receiver.

<u>Data analysis:</u> Forward modeling or tomographic inversion of travel time data.

<u>Software:</u> Geometrics® SeisImager software, installed in the PC lab (ESB 1006).

Overview

Refraction seismology provides information about seismic velocities in the subsurface, which provide information about composition, porosity, and water content. This method is particularly well suited to finding bedrock beneath thin sediments or weathered "saprolite." Of the methods you'll learn in this course, this one is probably the most effort-intensive, both in the field and in terms of the data analysis.

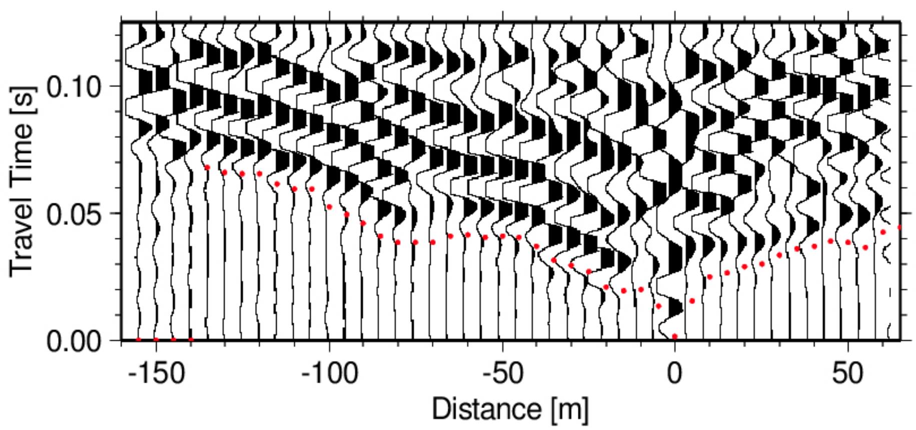
The basic chain of events in collecting and analyzing seismic refraction data is this:

1. Plan line location and decide on acquisition parameters (line length, geophone spacing, shot spacing).
2. Deploy geophone cable(s) and geophones. Connect hammer trigger cable to computer.
3. Start acquisition software (Seismodule Controller) on Toughbook PC and set parameters to match survey geometry.
4. Acquire line: hammer team swings hammer and recording team controls software. Meanwhile, survey team collects elevation data and records GPS positions of start/end of line (WGS-84 ellipsoid, please).
5. Copy data from laptop to USB memory stick before leaving field.

6. Read data into "picking" software (Pickwin) and pick first-arrival travel times.
7. Read travel time data into inversion software (Plotrefa) and conduct travel time inversion to produce velocity model.

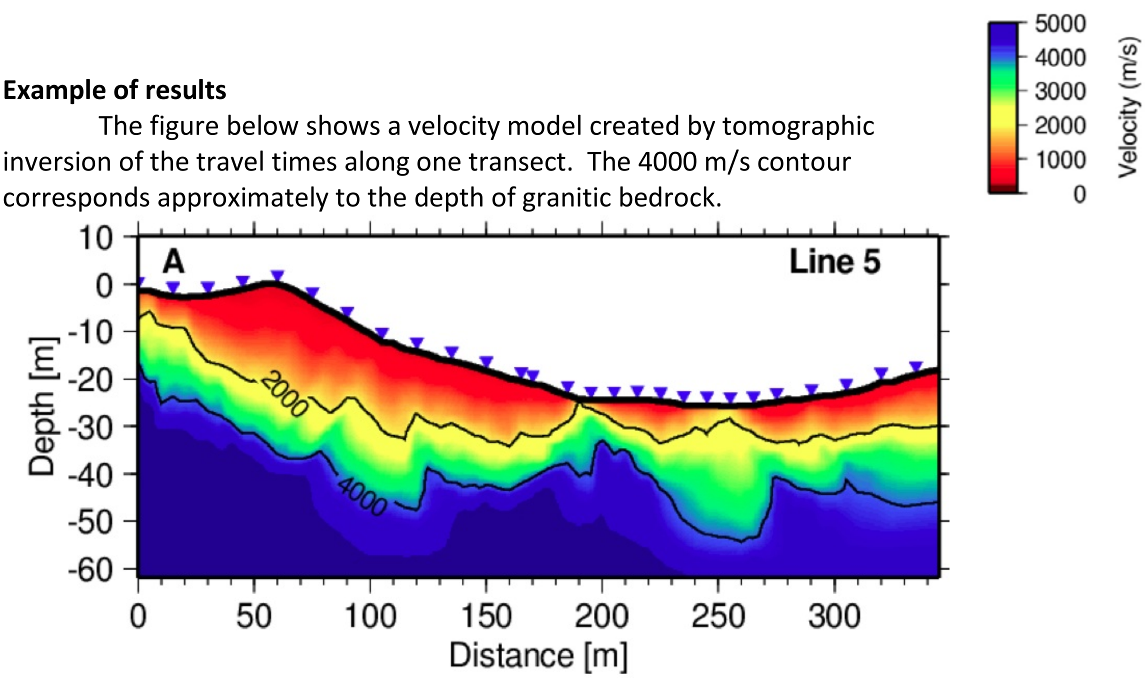
Data example

The figure below shows an example of seismic data produced by this method. Each wiggle trace is the seismogram recorded at one geophone location. The source (hammer) is located at x=0 m. The red dots show the travel times of the first (refracted) arrival. Note that travel times increase away from the source – greater distances require longer travel times. The slope of the arrival lines (dx/dt) is approximately the velocity of the subsurface. You will collect many such "shot gathers" on a single transect (typically 12-20, depending on the selected shot interval).



Example of results

The figure below shows a velocity model created by tomographic inversion of the travel times along one transect. The 4000 m/s contour corresponds approximately to the depth of granitic bedrock.



Appendix D

South Platte River Watershed
Level I Study

Summary and Details of Small Water and Study Projects

Appendix D: Summary and Details of Small Water and Study Projects

Appendix D.1

Table D.1: South Platte River Watershed Study Small Water Projects

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
1	Laramie	12-63-3.1	Grace Valley Stock & Wildlife Project	Well New	Grace Valley Farm LLC	Dale Martin	SESW 3 T12N R63W	41.0316 N	104.4191 W
2	Laramie	12-67-5.1	Duck Creek Section 5 New Stock Reservoir	New Stock Reservoir	Duck Creek Grazing Association	Jerry Sidwell	SWSE 5 T12N R67W	41.0305 N	104.9125 W
3	Laramie	12-67-7.1	Duck Creek Section 7 New Stock Reservoir	New Stock Reservoir	Duck Creek Grazing Association	Jerry Sidwell	SENE 14 T12N R67W	41.0240 N	104.9256 W
4	Laramie	12-68-4.1	Duck Creek Section 4 Well & Stock Water System	Well New	Duck Creek Grazing Association	Jerry Sidwell	SENE 4 T12N R68W	41.0372 N	105.0122 W
5	Laramie	12-68-11.1	Duck Creek Section 11 Spring Development	Spring Rehab	Duck Creek Grazing Association	Jerry Sidwell	SESE 11 T12N R67W	41.0161 N	104.9667 W
6	Laramie	12-68-13.1	Duck Creek Brush Creek Well Solar	Solar New	Duck Creek Grazing Association	Jerry Sidwell	NENE 13 T12N R68W	41.0144 N	104.9481 W
7	Laramie	13-67-33.1	Duck Creek Section 33 Well	Well New	Duck Creek Grazing Association	Jerry Sidwell	NWSW 33 T13N R67W	41.0530 N	104.9020 W
8	Laramie	12-70-2.1	Shiverdecker Section 2.1 Stock Reservoir	New Stock Reservoir	Shiverdecker	Jean Shiverdecker	SWSW 2 T12N R70W	41.0328 N	105.2061 W
9	Laramie	12-70-2.2	Shiverdecker House Spring	Spring Rehab	Shiverdecker	Jean Shiverdecker	NESW 2 T12N R70W	41.0355 N	105.2038 W
10	Laramie	12-70-2.3	Shiverdecker North Project Hosack # 3 and #4 Ditches	Spring Rehab	Shiverdecker	Jean Shiverdecker	SWNE 2 T12N R70W	41.0389 N	105.1992 W
11	Laramie	12-70-11.1	Sand Creek Section 11 New Stock Reservoir	New Stock Reservoir	Sand Creek Ranch	Robert Green	SESW 11 T12N R70W	41.0169 N	105.2026 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
12	Laramie	12-70-14.1	Sand Creek Ranch Stock Reservoir Rehab	Stock Reservoir Rehab	Sand Creek Ranch	Robert Green	SENW 14 T12N R70W	41.0113 N	105.2042 W
13	Laramie	12-70-14.2	Sand Creek Section 14 New Stock Reservoir	New Stock Reservoir	Sand Creek Ranch	Robert Green	SWSW 14 T12N R70W	41.0025 N	105.2094 W
14	Albany	12-71-18.1	Raisbeck Stock Reservoir	New Stock Reservoir	Merl Raisbeck	Merl Raisbeck	SESW 18 T12N R71W	41.0045 N	105.3975 W
15	Albany	12-71-19.1	Raisbeck Spring Development	New Spring	Merl Raisbeck	Merl Raisbeck	NENW 19 T12N, R71W	41.0012 N	105.3940 W
16	Laramie	13-61-30.1	Martin Stock & Wildlife Project	New Well, Solar Pumps and Tanks	David Martin	David Martin	NWSE 30 T13N, R61W	41.0634 N	104.2530 W
17	Laramie	13-63-1.1	Smith Section1 Stock Well & Tank	Well New, Pipeline & Tank	Cody Smith	Cody Smith	NWSW 1 T13N R63W	41.1214 N	104.3889 W
18	Laramie	13-63-7.1	Beaver Dam Ditch Rehabilitation	Irrigation Rehab	Red Baldy Ranch	Ed Ferguston	SESE 7 T13N, R63W	41.1043 N	104.4664 W
19	Laramie	13-63-9.1	Beaver Dam Ditch Pipeline	Irrigation Rehab	Red Baldy Ranch	Ed Ferguston	S 1/2 Sec 9 T13N R63W	41.1019 N	104.4394 W
20	Laramie	13-63-16.1	Evans State Section 16 Stock Water	Stock Well & Tank	State of Wyoming	Jeremy Evans	SESW 16 T13N R63W	41.0898 N	104.4389 W
21	Laramie	13-63-25.1	Smith Section 25 Stock Reservoir	Stock Reservoir	Gary Smith	Gary Smith	SESW 25 T13N R63W	41.0586 N	104.3817 W
22	Laramie	13-63-34.1	Smith Section 34 Stock Well & Tank	Well New, Pipeline & Tank	Cody Smith	Cody Smith	NWNW 34 T13N R63W	41.0550 N	104.4275 W
23	Laramie	13-64-6.1	Ullman #1 Reservoir Rehabilitation	Irrigation Rehab	Red Baldy Ranch	Ed Ferguston	SE NE 6 T13N R64W	41.1230 N	104.5896 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
24	Laramie	13-64-6.2	Ullman #1 and #2 Ditch Rehab	Irrigation Rehab	Red Baldy Ranch	Ed Ferguston	SE NE 6 T13N R64W	41.1230 N	104.5896 W
25	Laramie	13-65-2.1	Blue Ribbon Section 2 Ponds	New Reservoir	Blue Ribbon Estates	Will Edwards	Sec 2 T13N R65W	41.1250 N	104.6230 W
26	Laramie	13-65-2.2	Blue Ribbon Section 2 Environmental	Enviro	Blue Ribbon Estates	Will Edwards	Sec 2 T13N R65W	41.1277 N	10406333 W
27	Laramie	13-65-3.1	WHR No. 2 Reservoir Spillway Rehab	Irrigation Rehab	Red Baldy Ranch	Ed Ferguston	NENE 3 T13N R65W	41.1295 N	104.6374 W
28	Laramie	13-66-16.1	Sweetgrass	Enviro	Sweetgra ss	Larry Gallagher	NWNW 16 T13N R66W	41.1014 N	104.7879 W
29	Laramie	13-68-28.1	Belvoir Ranch Section 28 Well & Tanks	New Well, Solar Pumps and Tanks	City of Cheyenne	City of Cheyenne	SWNE 28 T13N, R68W	41.0667 N	105.0189 W
30	Laramie	12-69-9.1	Soapstone Section 9 Well & Stock Water	Well New, Tanks	Soapston e Grazing Associatio n	Mike Gallegos	SESW 9 T12N 69W	41.0167 N	105.1276 W
31	Laramie	13-69-26.1	Soapstone Goose Camp Well & Stock Water	Well, Solar Pump, Tanks	Soapston e Grazing Associatio n	Mike Gallegos	SWSE 26 T13N R69W	41.0616 N	105.0842 W
32	Laramie	13-69-34.1	Soapstone Flattery Windmill Replacement	New Well, Solar Pumps and Tanks	Soapston e Grazing Associatio n	Mike Gallegos	SESE 34 T13N R69W	41.0478 N	105.0979 W
33	Albany	13-72-36.1	Bath State Spring Development	Spring Develop	Bath Family LTD	Nancy Bath	SENW 36 T13N R72W	41.0547 N	105.4167 W
34	Albany	13-72-36.2	Bath State Stock Reservoir	New Stock Reservoir	Bath Family LTD	Nancy Bath	SENW 36 T13N R72W	41.0542 N	105.4152 W
35	Laramie	14-61-20.1	Bowman Wildlife Habitat	Enviro	Dale Bowman	Dale Bowman	SENW 20 T14N R61W	41.1659 N	104.2300 W
36	Laramie	14-63-14.1	Mead Irrigation	New Irrigation Res	Western Skys Ranch	Les Mead	SWSW 14 T15N R63W	41.2600 N	104.4033 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
37	Laramie	14-64-10.1	McWilliams Sec 10 Pump	New Solar Pump	Chris McWilliams	Chris McWilliams	SESW 10 T14N R64W	41.1880 N	104.5331 W
38	Laramie	14-64-16.1	McWilliams State Sec 16 Stockwater	New Solar Pump and Tank	Chris McWilliams and State of Wyoming	Chris McWilliams	NWSE 16 T16N R64W	41.1802 N	104.5503 W
39	Laramie	14-68-8.1	Polo Ranch Sections 8, 9, and 10 Stock Water	New stock well, pipeline and tanks	Polo Ranch	Brian Harvey	NENE 8 T14 N R68W	41.2013 N	105.0052 W
40	Laramie	14-68-13.1	Polo Ranch Bell Ditch and Home Ditch Head Gates	Irrigation Rehab	Polo Ranch	Brian Harvey	SWNW 13 T14N R68W	41.1847 N	104.9613 W
41	Laramie	14-68-15.1	Polo Ranch Section 15 Stock Pipelines and Tanks	New pipeline and stock tanks	Polo Ranch	Brian Harvey	SENW 15 T14N R68W	41.1827 N	104.9927 W
42	Laramie	14-68-15.2	Polo Ranch Section 15 Road Crossing and Erosion Control	Enviro	Polo Ranch	Brian Harvey	SESE 15 T14N R68W	41.1787 N	104.9877 W
43	Laramie	14-68-23.1	Polo Ranch Section 23 Stock Water Project	New pipeline and stock tanks	Polo Ranch	Brian Harvey	SESE 23 T14N R68W	41.1617 N	104.9637 W
44	Laramie	14-70-22.1	Jawbone Gulch Bramford Ditch Rehab	Irrigation Rehab	Jawbone Gulch Ranch	Guy Landers	NWSE 22 T14N R70W	41.1670 N	105.2204 W
45	Laramie	14-70-22.2	Jawbone Gulch Bramford #1 & #2 Ditch Rehab	Irrigation Rehab	Jawbone Gulch Ranch	Guy Landers	NWSW 22 T14N R70W	41.1650 N	105.2272 W
46	Laramie	15-60-20.1	R&K Farms Stock Pipeline & Tank	Stock pipeline and tanks	R&K Farms, Inc	Travis Freeburg	SWNE 20 T15N R60W	41.2556 N	104.1050 W
47	Laramie	15-60-20.2	R&K Farms Stock Well & Tank	New Well, Solar Pumps and Tanks	R&K Farms, Inc	Travis Freeburg	SWNW 20 T15N R60W	41.2517 N	104.1169 W
48	Laramie	15-62-5.1	Kathleen Lyon Stock & Wildlife Water	New Well, Solar Pumps and Tanks	Kathleen Lyon	Kathleen Lyon	SENW 5 T15N R62W	41.2976 N	104.3431 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
49	Laramie	15-62-7.1	Gary Lyon Stock & Wildlife Water	New Well, Solar Pumps and Tanks	Gary Lyon	Gary Lyon	NWSW 7 T15N R62W	41.2803 N	104.3675 W
50	Laramie	15-62-8.1	Larry Lyon Stock Water	Stock Water	Larry Lyon	Larry Lyon	NWSE 8 T15N R62W	41.2805 N	104.3388 W
51	Laramie	15-63-20.1	Keenan Stock Water	Stock Well and Tank	William Keenan	William Keenan	SESE 20 T15N R63W	41.2455 N	104.4464 W
52	Laramie	15-65-4.1	Hallock Section 4 Stock Water	Stock Well and Tank	Rosalie Hallock	Laurel Paul	NESW 4 T15N R65W	41.2950 N	104.6644 W
53	Laramie	15-68-18.1	Dudash Section 18 Stock Water Pipeline	Pipelines and Tanks	Nick Dudash	Nick Dudash	SWSW 18 T15N R68W	41.2707 N	105.0831 W
54	Laramie	15-70-3.1	Lorenz Ranch North 3/4 Spring	Spring Develop and Tank	Lorenz Ranch	Tom Twiford	SWNW 3 T15N R70W	41.2997 N	105.2286 W
55	Laramie	15-70-4.1	Lorenz Section 4 Spring Development	Spring Develop and Tank	Lorenz Ranch	Tom Twiford	SWSE 4 T15N R70W	41.2920 N	105.2389 W
56	Laramie	15-70-13.1	Lorenz Section 13 Well & Tank	Well, Solar Pump, Tanks	Lorenz Ranch	Tom Twiford	NESW 13 T15N R70W	41.2642 N	105.1850 W
57	Laramie	15-70-23.1	Lorenz Sect 23 Spring Development, Pipeline and Tank	Spring Development, Pipeline and Tank	Lorenz Ranch	Tom Twiford	SESW 23 T15N R70W	41.2557 N	105.2036 W
58	Laramie	15-70-25.1	Lorenz Ranch Hill Horse Spring Pipeline	Spring Development, Pipeline and Tank	Lorenz Ranch	Tom Twiford	NENE 25 T15N R70W	41.2486 N	105.1821 W
59	Laramie	15-70-35.1	North Crow Creek Wetlands	Enviro	City of Cheyenne	Jeff Geyer	E 1/2 35 T15N R70W	41.2235 N	105.1957 W
60	Laramie	16-61-1.1	Albin - Bushnell Draw Stock Reservoir	New SR New Stock Reservoir	Debra Childress	Jim Lerwick	SW SE 1 T16N R61W	41.3756 N	104.1458 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
61	Laramie	17-60-31.1	Ablin - Forester Mills Creek Stock Reservoir	New Stock Reservoir	David Forester	Jim Lerwick	NW NE 31 T17N R60W	41.4036 N	104.1182 W
62	Laramie	17-60-32.1	Ablin - Hanson Mills Stock Reservoir	New Stock Reservoir	Diedre & Dennis Hanson	Jim Lerwick	SE NE 32 T17N R60W	41.3995 N	104.0941 W
63	Laramie	17-60-34.1	Albin - Bella Farms Stock Reservoir	New Stock Reservoir	Bellla Farms	Jim Lerwick	SE NE 34 T17N R60W	41.3967 N	104.0544 W
64	Laramie	16-63-29.1	Spatz Stockwater	New Well, Solar Pumps and Tanks	Craig Spatz	Craig Spatz	SW NE 29 T16N R63W	41.3252 N	104.4632 W
65	Laramie	16-65-1.1	Berry Ranch Windmill Section 1	Convert Windmill to Solar Pump	Berry Ranch, LLC	Jeff Berry	SESW 1, T16N, R65W	41.3767 N	104.6084 W
66	Laramie	16-65-2.1	Berry Ranch Windmill Section 2	Convert Windmill to Solar Pump	Berry Ranch, LLC	Jeff Berry	SWSE 2 T16N, R65W	41.3769 N	104.6220 W
67	Laramie	16-65-22.1	Berry Ranch Windmill Section 22	Convert Windmill to Solar Pump	Berry Ranch, LLC	Jeff Berry	NWSW 22, T16N, R65W	41.3391 N	104.6508 W
68	Laramie	16-65-23.1	Berry Ranch Windmill Section 23	Convert Windmill to Solar Pump	Berry Ranch, LLC	Jeff Berry	NWSW 23, T16N, R65W	41.3389 N	104.6307 W
69	Laramie	16-65-23.2	Berry Ranch Section 23 Pipeline & Tanks	Pipelines and Tanks	Berry Ranch, LLC	Jeff Berry	NENE 23, T16N, R65W	41.3436 N	104.6194 W
70	Laramie	16-65-27.1	Berry Ranch Solar Conversion Section 27	Convert Windmill to Solar Pump	Berry Ranch, LLC	Jeff Berry	SWNE 27, T16N, R65W	41.3288 N	104.6399 W
71	Laramie	16-65-34.1	Kahler #2 Well Tank	Stock Tank, New	Paul Life Trust	Laurel Paul	SESE 34 T16N R65W	41.3061 N	104.6374 W
72	Laramie	16-65-34.2	Paul Ranch The Bam Bam Well Solar Pump & Tank	Solar New, Tank	Paul Life Trust	Laurel Paul	SWSW 34 T16N R65W	41.3061 N	104.6517 W
73	Laramie	16-65-34.3	Paul Ranch North Section 34 Stock Water	Well New	Paul Life Trust	Laurel Paul	NENE 34 T16N R65W	41.3167 N	104.6372 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
74	Laramie	16-65-35.1	Kleiman Section 35 Well & Stock Water	Well New & Stock Water	Alice Kleiman	Jim Cochran	NWSE 35 T16N, R65W	41.3099 N	104.6245 W
75	Laramie	15-68-1.1	Hollingsworth South Pipelines & Tanks	Stock pipelines and tanks	Lindsey Hollingsworth	TJ Hollingsworth	SENE 1 T15N, R68W	41.2987 N	104.9538 W
76	Laramie	16-67-5.1	Hollingsworth North Stock Water	New Stock Well, pipelines and tanks	Lindsey Hollingsworth	TJ Hollingsworth	SESE 5 T16N R67W	41.3805 N	104.9075 W
77	Laramie	16-67-19.1	Hollingsworth Erosion Protection	Environ	Lindsey Hollingsworth	TJ Hollingsworth	SENE 19 T16N R67W	41.3436 N	104.9306 W
78	Laramie	16-67-30.1	Hollingsworth Middle Pipelines & Tanks	Stock pipelines and tanks	Lindsey Hollingsworth	TJ Hollingsworth	SENW 30 T16N R67W	41.3290 N	104.9345 W
79	Laramie	16-67-8.1	LF Enterprises Section 8 Stock Water	Stock water	LF Enterprises, LLC	Frank Falen	SWSE 8, T16N, R67W	41.3696 N	104.9190 W
80	Laramie	16-67-8.2	LF Enterprises Section 8 Irrigation Well	New Irrigation Well, Not in Control Area	LF Enterprises, LLC	Frank Falen	SESE 8, T16N, R67W	41.3658 N	104.9096 W
81	Laramie	16-67-21.1	Falen #2 Stock Reservoir	Stock Reservoir	LF Enterprises, LLC	Frank Falen	SWSE 21, T16N, R67W	41.3360 N	104.8920 W
82	Laramie	16-67-28.1	Baccei Section 28 Stockwater System	Stock Well and Pipeline	Barry Baccei	Frank Falen	NWSW 28, T16N, R67W	41.3251 N	104.9034 W
83	Laramie	15-68-6.1	Vercelli Section 6 Pipeline & Tank	Tank, Pipeline	Vercelli, Michelle, ET al	Chris Vercelli	NWNE 6 T15N R68W	41.3041 N	105.0493 W
84	Laramie	16-68-19.1	Vercelli Section 19 Stock Water	New Stock Well, Pipeline and Tank	Vercelli, Michelle, ET al	Chris Vercelli	NENE 19 T16N R68W	41.3491 N	105.0397 W
85	Laramie	16-69-34.1	Vercelli Section 34 Well & Stock Water	New Stock Well, Pipeline and Tanks	Vercelli, Michelle, ET al	Chris Vercelli	NESW 34 T16N R69W	41.3129 N	105.1099 W
86	Laramie	16-69-191	Y Cross Section 19 Pipelines & Tanks	Pipelines and Tanks	Y CROSS	Tyler Kimzey	SENE 19, T16N, R69W	41.3427 N	105.1592 W

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
87	Laramie	16-69-30.1	Y Cross Section 30 Stock Well & Tank	Stock Well, Tank, Pipeline and Tanks	Y CROSS	Tyler Kimzey	NWSW 30 T16N, R69W	41.3259 N	105.1727 W
88	Laramie	16-70-24.1	Y Cross Islay Draw #1 Reservoir Rehab	Stock Reservoir Rehab	Y CROSS	Tyler Kimzey	SENE 24, T16N, R70W	41.3408 N	105.1857 W
89	Laramie	16-70-36.1	Y Cross Tabletop Reservoir Rehab	Reservoir and Irrigation System Rehab	Y CROSS	Tyler Kimzey	SWSE 36 T16N, R70W	41.3085 N	105.1826 W
90	Laramie	16-69-21.1	Islay North Pasture Stock Well & Tank	Stock Well and Tank	Islay Ranch	T.C. Berry	NWSE 21, T16N, R69W	41.3388 N	105.1408 W
91	Laramie	16-69-29.1	Islay Chadwick Reservoir #3	Reservoir Rehab	Islay Ranch	T.C. Berry	NENE 29, T16N, R69W	41.3318 N	105.1391 W
92	Laramie	16-69-29.2	Islay Chadwick #1 Ditch	Irrigation Rehab	Islay Ranch	T.C. Berry	SENE 29 T16N R69W	41.3310 N	105.1361 W
93	Laramie	16-69-32.1	Islay Ranch Road Pasture Spring	Spring Development and Tank - Road Pasture	Islay Ranch	T.C. Berry	NENE 32 T16N R69W	41.3191 N	105.1361 W
94	Laramie	17-63-27.1	Anderson Section 27 Well & Solar	Well Rehab	Dale Anderson	Dale Anderson	NESW 27 T17N R63W	41.4094 N	104.4150 W
95	Laramie	17-63-27.2	Anderson Section 27 Ditch	Irrigation Rehab	Dale Anderson	Dale Anderson	NWNE 27 T17N R63W	41.4181 N	104.4132 W
96	Laramie	17-63-28.1	Anderson Section 28 Contour Ditch	Irrigation	Dale Anderson	Dale Anderson	NWNW 28 T17N R63W	41.4186 N	104.4407 W

D.2 United States Forest Service Stock Water Projects

Table D.2 South Platte River Watershed Study USFS Stock Water Projects

#	County	Project #	Project Name	Project Type	Owner Name	Contact	Legal	Lat	Long
USFS-1	Albany	14-71-24.1	USFS-1	Spring Development	USFS	Jackie Roaque	24 T14N R71W	41.1728 N	105.2987 W
USFS-2	Albany	14-71-15.1	USFS-2	Spring Rehabilitation	USFS	Jackie Roaque	15 T14N R71W	41.1900 N	105.3460 W
USFS-3	Albany	15-71-31.1	USFS-3	Spring Rehabilitation	USFS	Jackie Roaque	31 T15N R71W	41.2234 N	105.3876 W
USFS-4	Albany	15-72-24.1	USFS-4	Spring Rehabilitation	USFS	Jackie Roaque	24 T15N R72W	41.2600 N	105.4174 W
USFS-5	Albany	15-71-31.1	USFS-5	Spring Rehabilitation	USFS	Jackie Roaque	31 T15N R71W	41.2320 N	105.4013 W
USFS-6	Albany	15-71-35.1	USFS-6	Spring Rehabilitation	USFS	Jackie Roaque	35 T15N R71W	41.2219 N	105.3192 W
USFS-7	Albany	15-71-35.2	USFS-7	Spring Rehabilitation	USFS	Jackie Roaque	35 T15N R71W	41.2330 N	105.3154 W
USFS-8	Albany	15-71-13.1	USFS-8	Spring Rehabilitation	USFS	Jackie Roaque	13 T15N R71W	41.2685 N	105.3043 W
USFS-9	Albany	15-71-2.1	USFS-9	Spring Rehabilitation	USFS	Jackie Roaque	2 T15N R71W	41.2977 N	105.3107 W
USFS-10	Albany	15-72-14.1	USFS-10	Spring Rehabilitation	USFS	Jackie Roaque	14 T15N R72W	41.2645 N	105.4316 W
USFS-11	Albany	15-71-6.1	USFS-11	Spring Development	USFS	Jackie Roaque	6 T15N R71W	41.3000 N	105.3986 W

D.3 Other Projects

In addition to the Small Water Projects and the Forest Service Stock water projects described in the previous sections of this report, the “Other Projects” listed in this section of the report include projects that would be beneficial to the South Platte Watershed, but likely will not qualify as a Small Water project. These projects are generally more expensive than the $135,000 limit of the Small Water Project program. Maps showing the locations of these projects are presented at the end of this chapter of the report.

Mackley Reservoir and Ditches Project (12-63-13.1 and 12-62-18.1)

This project involves repair and rehabilitation of an irrigation system including the Mackley Reservoir, Permit No. 2037Res and the associated irrigation ditches. The reservoir is permitted to store 148 acre-feet and the Wyoming rights for the ditches total approximately 3.24 cfs. The reservoir and associated ditches have priority dates from the early 1900's.

This project is located on Crow Creek near the Colorado – Wyoming state line. The Mackley Reservoir dam has been washed out for some time, which raises concerns about the "soundness" or validity of the water rights. Abandonment of the water rights could be possible.

Repair or reconstruction of the Mackley dam back to its original configuration may not be feasible. However, the potential benefits of a project at the Mackley Reservoir site include wildlife habitat, water quality, and perhaps groundwater recharge, even if the original irrigation rights are not re-activated or used.

Crow Creek Groundwater Recharge Project (12-63-36.1)

A Crow Creek Groundwater Recharge project was described in a WWDC funded Level II Study completed by States West Water Resources in 1990.

This study is available on the WWDC project reports website at: http://library.wrds.uwyo.edu/wwdcrept/Crow_Creek/Crow_Creek-Flood_Control_and_Groundwater_Recharge_Project- Executive_Summary-1990.html.

This Level II study described the potential to use flood water in Crow Creek for artificial recharge of groundwater in the Carpenter, Wyoming area. Conceptual designs of recharge projects were developed in this study. Check dams in Crow Creek, pipelines, and ditches were some of the options considered in this study and cost estimates for these ideas were developed. These cost estimates ranged from approximately $150,000 to $986,000. Using the US Bureau of Labor Statists inflation cost index or multiplier of 1.87 (27 years at an average inflation rate of approximately 2.35%) to inflate or adjust the costs estimates from the 1990 Study to 2017 results in cost estimates that range from approximately $280,000 to $1,850,000.

Although a Crow Creek Groundwater Recharge Project was not studied extensively during this Watershed study, the projects and concepts presented in the Level II study seem valid and would be beneficial to the Watershed.

Water availability will be a key consideration to determine if a Crow Creek – Carpenter area recharge project is feasible, practical, and/or beneficial. The 1990 Level II study estimated that approximately 600 acre-feet of water would be available for groundwater recharge. Since the 1990 study was completed, the USGS stream gage, Crow Creek at 19th Street has been operating and much more date concerning flows in Crow Creek are available. Based on the 19th Street stream gage and other supplemental or miscellaneous flow measurements and monitoring of Crow Creek near Carpenter, it appears that more water is available in Crow Creek than was estimated in the 1990 Level II report.

It is recommended that the feasibility of a Crow Creek – Carpenter groundwater recharge study be re-visited and studied again. This project could be done in conjunction with some sort of a Mackley Reservoir project, as described above.

Swan Ranch – Clear Creek Reservoirs Project (13-67-15.1)

The City of Cheyenne owns two reservoirs located on Clear Creek, just south of I-80 in Section 15, T13N, R67W. The accompanying map shows the locations of these reservoirs. The larger reservoir, Swan Ranch Reservoir, Permit No. 942RES is permitted to store 247 acre-feet. The smaller reservoir, the Clear Creek Reservoir, Permit No. 1741RES is permitted to store 69 acre-feet.

The conditions of these reservoirs, their benefits, potential risks and/or hazards should be evaluated. Repair, rehabilitation or breaching and abandonment of these reservoirs may be warranted. During this Watershed study Dino-Nobel expressed interest in additional fire flow storage and water supply. These reservoirs could store water for fire-fighting, as well as wildlife habitat, recreational opportunities, and flood control benefits.

Also, Clear Creek joins Crow Creek downstream of the point of diversion for the senior City of Cheyenne – BOPU water right and may not be subject to regulation or administration for this right. Additional study of the Clear Creek Reservoirs is recommended.

Table D.3: South Platte River Watershed Study Project By Type Summary

Report Number	County	Project Number	Project Name	New	Rehab	Small Reservoir	Water Well	Solar Platforms	Pipeline	Tank	Spring Development	Wetland	Environmental	Irrigation	Windmill
1	Laramie	12-63-3.1	Grace Valley Stock & Wildlife Project	X		X	X		X	X					
2	Laramie	12-67-5.1	Duck Creek Section 5 New Stock Reservoir	X							X		X		
3	Laramie	12-67-7.1	Duck Creek Section 7 New Stock Reservior	X		X									
4	Laramie	12-68-4.1	Duck Creek Section 4 Well & Stock Water System	X			X	X	X	X					
5	Laramie	12-68-11.1	Duck Creek Section 11 Spring Development		X						X				
6	Laramie	12-68-13.1	Duck Creek Brush Creek Well Solar		X			X							
7	Laramie	13-67-33.1	Duck Creek Section 33 Well	X			X	X	X	X					
8	Laramie	12-70-2.1	Shiverdecker Section 2.1 Stock Reservoir	X		X				X					
9	Laramie	12-70-2.2	Shiverdecker House Spring		X						X		X		
10	Laramie	12-70-2.3	Shiverdecker North Project Hosack # 3 and #4 Ditches		X					X	X		X	X	
11	Laramie	12-70-11.1	Sand Creek Section 11 New Stock Reservoir	X		X									
12	Laramie	12-70-14.1	Sand Creek Ranch Stock Reservoir Rehab		X	X									
13	Laramie	12-70-14.2	Sand Creek Section 14 New Stock Reservoir	X		X									
14	Albany	12-71-18.1	Raisbeck Stock Reservoir	X		X									
15	Albany	12-71-19.1	Raisbeck Spring Development	X							X				
16	Laramie	13-61-30.1	Martin Stock & Wildlife Project	X			X			X					
17	Laramie	13-63-1.1	Smith Section1 Stock Well & Tank	X			X			X					

Table D.3: South Platte River Watershed Study Project By Type Summary

Report Number	County	Project Number	Project Name	New	Rehab	Small Reservoir	Water Well	Solar Platforms	Pipeline	Tank	Spring Development	Wetland	Environmental	Irrigation	Windmill
18	Laramie	13-63-7.1	Beaver Dam Ditch Rehabilitation		X									X	
19	Laramie	13-63-9.1	Beaver Dam Ditch Pipeline		X									X	
20	Laramie	13-63-16.1	Evans State Section 16 Stock Water		X			X		X					
21	Laramie	13-63-25.1	Smith Section 25 Stock Reservoir	X		X							X		
22	Laramie	13-63-34.1	Smith Section 34 Stock Well & Tank	X			X			X					
23	Laramie	13-64-6.1	Ullman #1 Reservoir Rehabilitation		X	X									
24	Laramie	13-64-6.2	Ullman #1 and #2 Ditch Rehabilitation		X									X	
25	Laramie	13-65-2.1	Blue Ribbon Section 2 Ponds	X		X									
26	Laramie	13-65-2.2	Blue Ribbon Section 2 Environmental		X								X		
27	Laramie	13-65-3.1	WHR No. 2 Reservoir Spillway Rehab		X									X	
28	Laramie	13-66-16.1	Sweetgrass	X								X	X		
29	Laramie	13-68-28.1	Belvoir Ranch Section 28 Well & Tanks	X			X	X		X					
30	Laramie	12-69-9.1	Soapstone Section 9 Well & Stock Water	X			X	X	X	X					
31	Laramie	13-69-26.1	Soapstone Goose Camp Well & Stock Water		X		X	X		X					
32	Laramie	13-69-34.1	Soapstone Flattery Windmill Replacement	X			X	X	X	X					
33	Albany	13-72-36.1	Bath State Spring Development	X						X	X				
34	Albany	13-72-36.2	Bath State Stock Reservoir	X		X									

Table D.3: South Platte River Watershed Study Project By Type Summary

Report Number	County	Project Number	Project Name	New	Rehab	Small Reservoir	Water Well	Solar Platforms	Pipeline	Tank	Spring Development	Wetland	Environmental	Irrigation	Windmill
35	Laramie	14-61-20.1	Bowman Wildlife Habitat	X									X		
36	Laramie	14-63-14.1	Mead Irrigation	X		X									
37	Laramie	14-64-10.1	McWilliams Sec 10 Pump	X				X							
38	Laramie	14-64-16.1	McWilliams State Sec 16 Stockwater	X				X		X					
39	Laramie	14-68-8.1	Polo Ranch Sections 8, 9, and 10 Stock Water	X			X	X	X						
40	Laramie	14-68-13.1	Polo Ranch Bell Ditch and Home Ditch Head Gates		X									X	
41	Laramie	14-68-15.1	Polo Ranch Section 15 Stock Pipelines and Tanks	X			X	X	X	X					
42	Laramie	14-68-15.2	Polo Ranch Section 15 Road Crossing and Erosion Control		X								X		
43	Laramie	14-68-23.1	Polo Ranch Section 23 Stock Water Project	X					X	X					
44	Laramie	14-70-22.1	Jawbone Gulch Bramford Ditch Rehab		X								X		
45	Laramie	14-70-22.2	Jawbone Gulch Bramford #1 & #2 Ditch Rehab		X								X		
46	Laramie	15-60-20.1	R&K Farms Stock Pipeline & Tank	X					X	X					
47	Laramie	15-60-20.2	R&K Farms Stock Well & Tank	X			X	X		X					
48	Laramie	15-62-5.1	Kathleen Lyon Stock & Wildlife Water	X			X	X	X	X			X		
49	Laramie	15-62-7.1	Gary Lyon Stock & Wildlife Water	X			X	X	X	X			X		
50	Laramie	15-62-8.1	Larry Lyon Stock Water	X			X	X		X					
51	Laramie	15-63-20.1	Keenan Stock Water	X			X	X	X	X					

Table D.3: South Platte River Watershed Study Project By Type Summary

Report Number	County	Project Number	Project Name	New	Rehab	Small Reservoir	Water Well	Solar Platforms	Pipeline	Tank	Spring Development	Wetland	Environmental	Irrigation	Windmill
52	Laramie	15-65-4.1	Hallock Section 4 Stock Water	X				X		X					
53	Laramie	15-68-18.1	Dudash Section 18 Stock Water Pipeline	X					X						
54	Laramie	15-70-3.1	Lorenz Ranch North 3/4 Spring	X						X	X				
55	Laramie	15-70-4.1	Lorenz Section 4 Spring Development	X						X	X				
56	Laramie	15-70-13.1	Lorenz Section 13 Well & Tank	X			X			X					
57	Laramie	15-70-23.1	Lorenz Sect 23 Spring Development, Pipeline and Tank	X						X	X				
58	Laramie	15-70-25.1	Lorenz Ranch Hill Horse Spring Pipeline	X						X	X				
59	Laramie	15-70-35.1	North Crow Creek Wetlands		X								X		
60	Laramie	16-61-1.1	Albin - Bushnell Draw Stock Reservoir	X		X									
61	Laramie	17-60-31.1	Albin - Forester Mills Creek Stock Reservoir	X		X									
62	Laramie	17-60-32.1	Albin - Hanson Mills Stock Reservoir	X		X									
63	Laramie	17-60-34.1	Albin - Bella Farms Stock Reservoir	X		X									
64	Laramie	16-63-29.1	Spatz Stockwater	X			X		X	X					
65	Laramie	16-65-1.1	Berry Ranch Windmill Section 1	X				X							
66	Laramie	16-65-2.1	Berry Ranch Windmill Section 2	X				X							
67	Laramie	16-65-22.1	Berry Ranch Windmill Section 22	X				X							
68	Laramie	16-65-23.1	Berry Ranch Windmill Section 23	X				X							

Table D.3: South Platte River Watershed Study Project By Type Summary

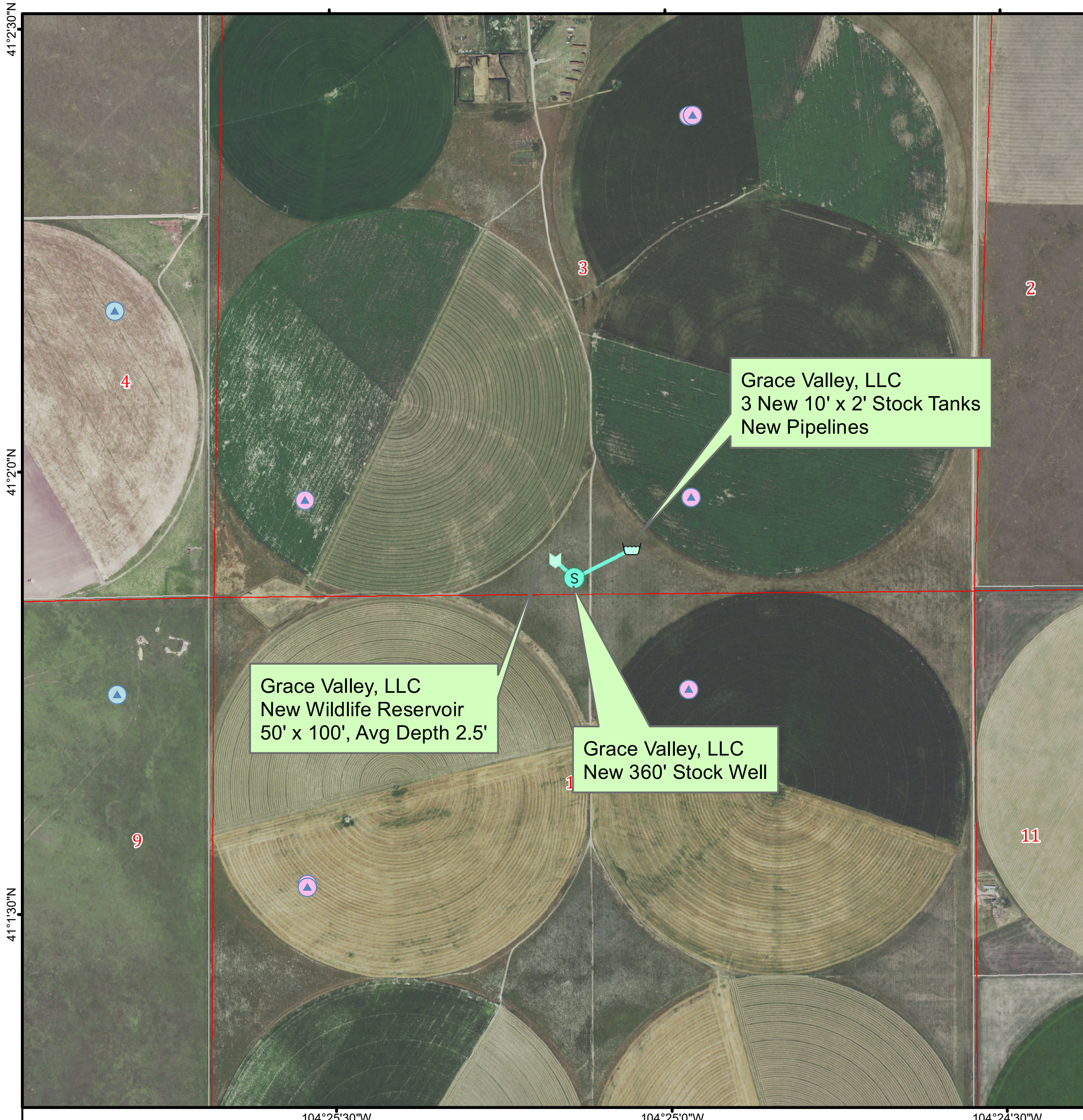
Report Number	County	Project Number	Project Name	New	Rehab	Small Reservoir	Water Well	Solar Platforms	Pipeline	Tank	Spring Development	Wetland	Environmental	Irrigation	Windmill
69	Laramie	16-65-23.2	Berry Ranch Section 23 Pipeline & Tanks	X				X	X	X					
70	Laramie	16-65-27.1	Berry Ranch Solar Conversion Section 27	X				X		X					
71	Laramie	16-65-34.1	Kahler #2 Well Tank		X					X					
72	Laramie	16-65-34.2	Paul Ranch The Bam Bam Well Solar Pump & Tank		X			X		X					
73	Laramie	16-65-34.3	Paul Ranch North Section 34 Stock Water	X			X	X		X					
74	Laramie	16-65-35.1	Kleiman Section 35 Well & Stock Water	X			X	X	X	X					
75	Laramie	15-68-1.1	Hollingsworth South Pipelines & Tanks	X					X	X					
76	Laramie	16-67-5.1	Hollingsworth North Stock Water	X			X		X	X					
77	Laramie	16-67-19.1	Hollingsworth Erosion Protection		X								X		
78	Laramie	16-67-30.1	Hollingsworth Middle Pipelines & Tanks	X					X	X					
79	Laramie	16-67-8.1	LF Enterprises Section 8 Stock Water	X						X					
80	Laramie	16-67-8.2	LF Enterprises Section 8 Irrigation Well	X			X							X	
81	Laramie	16-67-21.1	Falen #2 Stock Reservoir	X		X									
82	Laramie	16-67-28.1	Baccei Section 28 Stockwater System	X			X	X							
83	Laramie	15-68-6.1	Vercelli Section 6 Pipeline & Tank	X						X					
84	Laramie	16-68-19.1	Vercelli Section 19 Stock Water	X			X	X	X	X					
85	Laramie	16-69-34.1	Vercelli Section 34 Well & Stock Water	X			X	X	X	X					

Table D.3: South Platte River Watershed Study Project By Type Summary

Report Number	County	Project Number	Project Name	New	Rehab	Small Reservoir	Water Well	Solar Platforms	Pipeline	Tank	Spring Development	Wetland	Environmental	Irrigation	Windmill
86	Laramie	16-69-19.1	Y Cross Section 19 Pipelines & Tanks	X					X	X					
87	Laramie	16-69-30.1	Y Cross Section 30 Stock Well & Tank	X			X		X	X					
88	Laramie	16-70-24.1	Y Cross Islay Draw #1 Reservoir Rehab		X	X									
89	Laramie	16-70-36.1	Y Cross Tabletop Reservoir Rehab		X	X									
90	Laramie	16-69-21.1	Islay North Pasture Stock Well & Tank	X			X	X		X					
91	Laramie	16-69-29.1	Islay Chadwick Reservoir #3 Rehab		X	X									
92	Laramie	16-69-29.2	Islay Chadwick #1 Ditch Rehab	X										X	
93	Laramie	16-69-32.1	Islay Ranch Road Pasture Spring	X			X	X		X	X				
94	Laramie	17-63-27.1	Anderson Section 27 Well & Solar	X			X	X		X					
95	Laramie	17-63-27.2	Anderson Section 27 Ditch Rehab		X									X	
96	Laramie	17-63-28.1	Anderson Section 28 Contour Ditch Rehab		X									X	
			Totals	70	26	20	30	33	23	48	11	1	14	10	0

Table D.3: South Platte River Watershed Study Project By Type Summary

Report Number	County	Project Number	Project Name	New	Rehab	Small Reservoir	Water Well	Solar Platforms	Pipeline	Tank	Spring Development	Wetland	Environmental	Irrigation	Windmill
USFS Stock Water Projects															
USFS-1	Albany	14-71-24.1	USFS-1	X					X	X	X				
USFS-2	Albany	14-71-15.1	USFS-2		X				X	X	X				
USFS-3	Albany	15-71-31.1	USFS-3		X				X	X	X				
USFS-4	Albany	15-72-24.1	USFS-4		X				X	X	X				
USFS-5	Albany	15-71-31.1	USFS-5		X				X	X	X				
USFS-6	Albany	15-71-35.1	USFS-6		X				X	X	X				
USFS-7	Albany	15-71-35.2	USFS-7		X				X	X	X				
USFS-8	Albany	15-71-13.1	USFS-8		X				X	X	X				
USFS-9	Albany	15-71-2.1	USFS-9		X				X	X	X				
USFS-10	Albany	15-72-14.1	USFS-10		X				X	X	X				
USFS-11	Albany	15-71-6.1	USFS-11	X					X	X	X				
			Totals	2	9	0	0	0	11	11	11	0	0	0	0
Other Projects															
1	Laramie	12-63-13.1	Mackley Reservoir		X									X	
2	Laramie	13-63-36.1	Carpenter Area Groundwater Recharge Project		X										
3	Laramie	13-67-15-1	Swan Ranch Reservoir												
			Totals	0	2	0	0	0	0	0	0	0	0	1	0



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

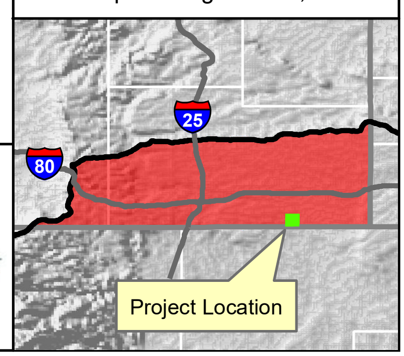
N

Feet

0 500 1,000

1 in = 1,000 Feet

Township & Range: T12N, R63W



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Project 12-63-3.1:Grace Valley, Stock Well, Tank and Wildlife Reservoir

Document Name: Martin_12-63-3.1
Date Saved: 7/5/2017

SPRWS PROJECT NUMBER: 12-63-3.1
New Well, Solar Pump, Pipeline, Tank, and Wildlife Reservoir
SE ¼ SW ¼ Sec. 3 T12N R63W
Site Visit Date: Oct. 11, 2016

PROJECT NAME: Grace Valley Stock Well, Tank and Wildlife Reservoir
New water right permit required

___Grace Valley, LLC___________________________ (Applicant – Name of Entity)

Dale Martin_________________ (Contact Address)

PO Box 391______________________________________

Carpenter, WY 82054 _

Laramie___ ______________(307) 630-3142 _______MartinFarm@rtconnect.net

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		X		41.0316	104.4195
Well		X		41.0318	104.4190
Solar Platforms		X			
Pipeline		X			
Tank		X		41.0318	104.4176
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	63W	3	SESW and SWSE

Project Description:

This project involves construction of a new stock watering and wildlife water system, including new well; solar pump, panels and associated equipment; a stock tank approximately 500’ east of the well; a pipeline to the tank and miscellaneous valves.

The project also involves construction of a small wildlife watering reservoir, approximately 0.25 to 0.5 AF in capacity. The reservoir would be approximately 50’ x 100’ at the top and 2.5’ average depth. A shallow pit would be constructed and the material excavated from the pit would be used to construct a short embankment around the pit. The slopes of the pit and embankment will be flat (5:1 to 8:1) to promote res-seeding, minimize maintenance, and encourage use by wildlife. The area around the reservoir would be re-planted to create habitat and encourage wildlife use. Due to the sandy nature of the soils, the reservoir pit will need to be lined to minimize seepage. Bentonite soil enhancement would be a cost effective lining method. The reservoir would be fenced with wildlife friendly fencing, but to prevent use by cattle.

Specifically, this project will include:

- A 300' deep stock well. This new well will need a new permit.
- A solar pump, with solar panels, controller, 1250 gallon cistern.
- Two 8' diameter by 2' deep stock tanks to be installed at the end of the pipeline.
- 660' of 2" dia. pipeline.
- Miscellaneous valves and floats.
- Construction of a wildlife reservoir. Preliminary design costs assume a 50'x100' reservoir at the high waterline, approximately 2.5' average depth (0.25 to 0.4 AF capacity). Max depth of the reservoir would be 4 – 5'. The reservoir would need to be lined or a soil-bentonite mix would be installed to minimize seepage. The area would be planted to create habitat and encourage wildlife use and the reservoir area would be fenced.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Grace Valley, LLC

Who owns the land that the project is to be built on? Grace Valley, LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
The project will provide stock water for approximately 2 sections and the wildlife reservoir will provide habitat and drinking water for a large area.

What is the total estimated project cost? $60,000

SPRWS Project Cost Estimate

SPRWS Project No. **12-63-3.1**

Project Name Grace Valley Farm Stock and Wildlife Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,725.00	$ 4,725.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	300	$ 40.00	$ 12,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	3	$ 2,900.00	$ 8,700.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	600	$ 3.50	$ 2,100.00
7	Miscellaneous Valves and piping at tank(s)	Ea	3	$ 500.00	$ 1,500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10a	Wildlife Reservoir Pit	LS	1.00	$ 10,000.00	$ 10,000.00
10	Site Revegetation and reclamation	Acre	1.50	$ 1,250.00	$ 1,875.00

Sub-Total Estimated Component Costs	$ 51,975.00
Contingency - 15%	$ 7,796.25
Budget for Project with Contingency	**$ 59,771.25**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

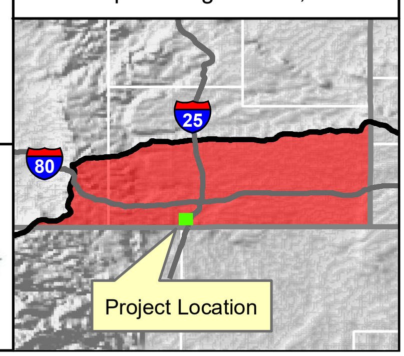
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T12N, R67W



Project 12-67-5.1: Duck Creek Grazing Association, New Stock Reservoir

Document Name: DuckCreek_12-67-5.1
Date Saved: 9/6/2017

SPRWS PROJECT NUMBER: 12-67-5.1

Duck Creek Grazing Association Section 5 Stock Reservoir

SW ¼ SE ¼ Sec. 5 T12N R67W
Site Visit Date: 10/14/2016

PROJECT NAME: Duck Creek Grazing Association Section 5 Stock Reservoir and Railroad Spring #8 Rehabilitation

Duck Creek Grazing Association (Applicant – Name of Entity)

Jerry Sidwell (Contact)

4481 Road 203 Carpenter, WY 82054

Laramie 970-381-4701 sidwellbrothers@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		x	☐	41.0305 N	104.9125W
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		☐	☐		
Spring Development		☐	x	41.0305 N	104.9125W
Wetland		☐	☐		
Environmental		☐	x	41.0305 N	104.9125W
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	67W	5	SW ¼ SE ¼

Project Description:

This project involves the construction of a small dam and stock reservoir by constructing an approximately 10' high x200' long dam. Currently, the railroad maintenance road ends near the south end of the proposed dam. Construction of a dam near at this site could improve access along the railroad by allowing one to drive across the dam.

This site is located near the Railroad Spring Tank # 8, WY SEO Permit No. 123251. Construction of the reservoir and rehabilitation of the existing 20' stock tank and pipeline from the spring to the tank would provide a water source for the area, other than the spring. Fencing of the spring and the riparian area could be done, after the reservoir was constructed and the tank was repaired.

The reservoir would be constructed just upstream of the railroad embankment and the reservoir needs to be properly designed and constructed to protect the railroad.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).
_____LCCD____

Who is the owner of the project? ______Duck Creek Grazing Association___________________

Who owns the land that the project is to be built on? _______Duck Creek Grazing Association__

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? ____________________________________

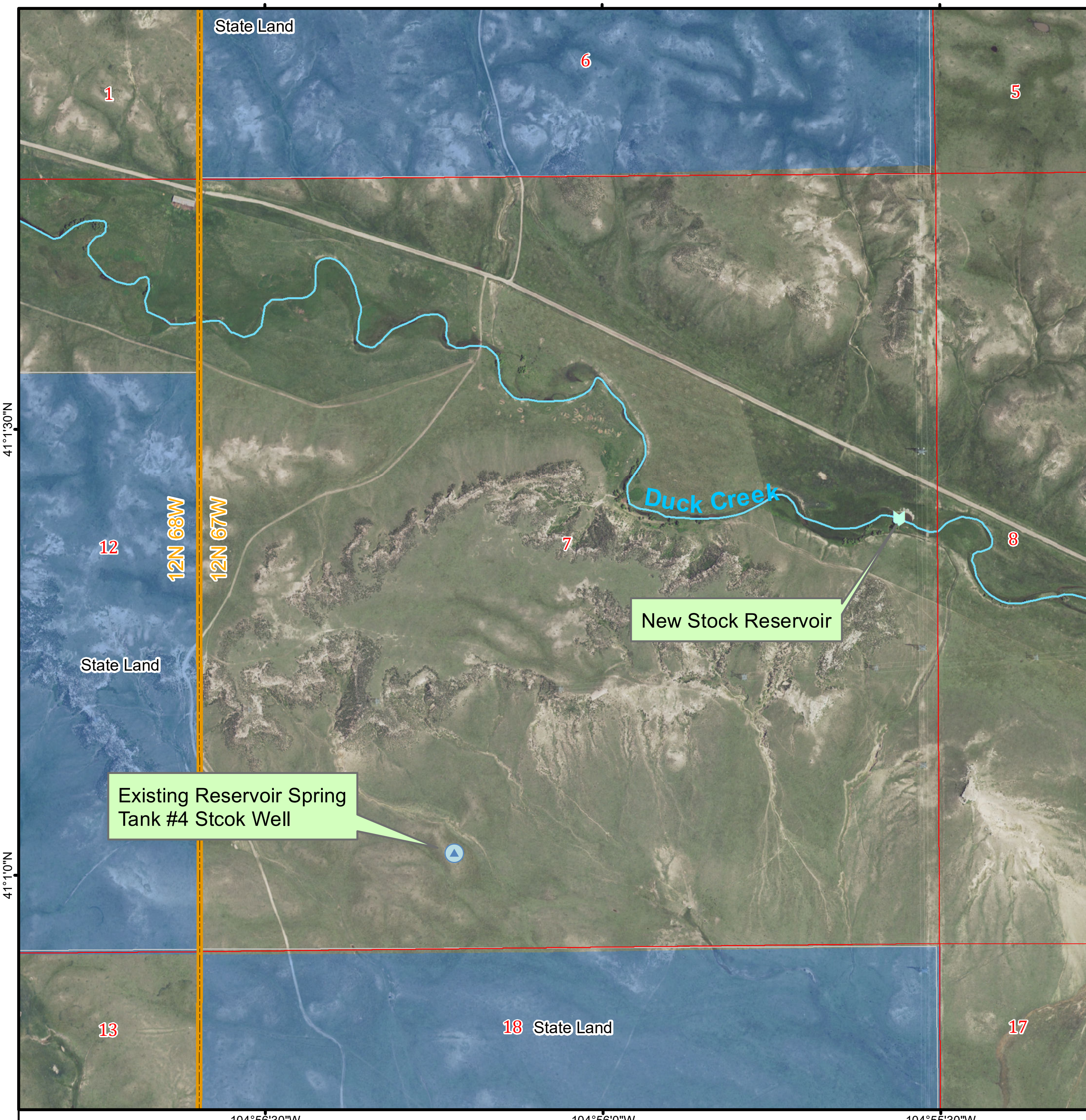
What is the total estimated project cost? _______$70,000_____________________________________

Photographs: Duck Creek Grazing Association Section 5 Stock Reservoir
SW ¼ SE ¼ Sec. 5 T12N R67W

View of the site from the south.

Photo shows the stock tank near the reservoir site.

Photo shows the spring upstream of the reservoir location.



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

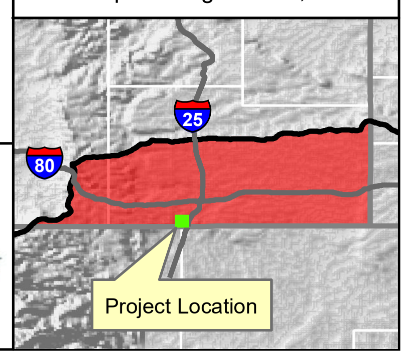
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T12N, R67W



Project 12-67-7.1: Duck Creek Grazing Association, New Stock Reservoir

Document Name: DuckCreek_12-67-7.1
Date Saved: 9/6/2017

SPRWS PROJECT NUMBER: 12-67-7.1

Duck Creek Grazing Association Section 7 Stock Reservoir

SE ¼ NE ¼ Sec. 7 T12N R67W
Site Visit Date: 10/14/2016

PROJECT NAME: Duck Creek Grazing Association Section 7 Stock Reservoir
New Project – Needs permitting

Duck Creek Grazing Association (Applicant – Name of Entity)

Jerry Sidwell (Contact)

4481 Road 203 Carpenter, WY 82054

Laramie 970-381-4701 sidwellbrothers@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		X	☐	41.024 N	104.9256W
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		☐	☐		
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	67W	7	SE ¼ NE ¼

Project Description:

This project involves the construction of a stock reservoir located near Duck Creek and along the Spottswood Supply Ditch, WY SEO Permit No. 8943.0D. A permit will need to be obtained for the stock reservoir and perhaps an enlargement of the ditch to fill the reservoir would be needed.

Currently there is a small natural pond at this location. The Duck Creek Grazing Association would like to create additional storage at this location by constructing an approximately 10’ tall by 250’ long dam. Excavation could increase storage within the natural pond.

As an alternative to this site, perhaps a stock reservoir could be constructed approximately 1000' downstream in Section 8. Restrictions for this location would involve the location of a nearby gas pipeline and overhead power lines.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).
LCCD

Who is the owner of the project? Duck Creek Grazing Association

Who owns the land that the project is to be built on? Duck Creek Grazing Association

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project?

Additional stock water would be beneficial to all of the pasture in the north half of Section 7; therefore at least 320 acres would benefit from this project. Also the reservoir could provide wildlife benefits.

What is the total estimated project cost? $52,000

Photograph of Duck Creek Grazing Association New Section 7 Stock Reservoir

Existing Pond

SE ¼ NE ¼ Sec. 7 T12N R67W

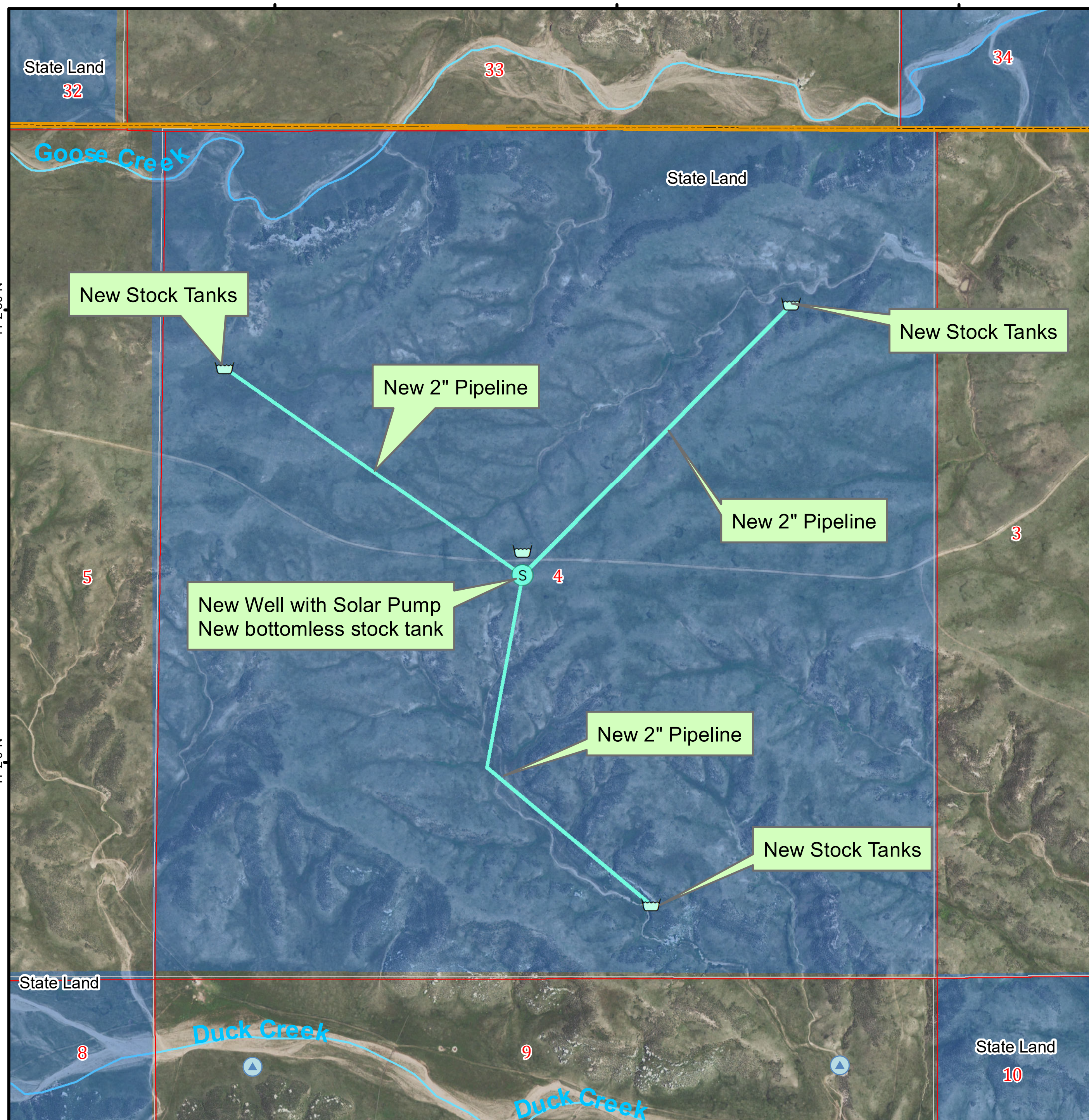
Work Items and Quantities
Duck Creek Grazing
Section 7 Stock Reservoir

SPRWS Project No. **12-67-7.1**

Project Name Duck Creek Section 7 Stock Reservoir

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization	LS	1	$ 5,000.00	$ 5,000.00
2	Strip, Stockpile, and Replace Topsoil	CY	500	$ 5.00	$ 2,500.00
3	Excavation and Placement Embankment Fill	CY	1,500	$ 4.50	$ 6,750.00
4	Special backfill around pipes. Compaction around and min. 2' over pipes.	CY	200	$ 12.00	$ 2,400.00
5	Riprap - 8" nominal sized rock - 12" thick	CY	125	$ 125.00	$ 15,625.00
6	Filter fabric under riprap	SY	0	$ 4.00	$ -
7	Principal Spillway	LS	1	$ 3,500.00	$ 3,500.00
8	8" low level outlet pipe	LF	90	$ 40.00	$ 3,600.00
9	8" gate valve and valve box	LS	1	$ 1,750.00	$ 1,750.00
10	Site Revegetation and reclamation	Acre	1	$ 1,250.00	$ 937.50
11	Miscellaneous work - road and fencing	LS	1	$ 2,500.00	$ 2,500.00

Sub-Total Estimated Component Costs	$	44,562.50
Contingency - 15%	$	6,684.38
Opinion of Probable Costs	**$**	**51,246.88**



Existing	Proposed
SEO Existing Stock Well	Stock Reservoir
SEO Existing Irrigation Well	Spring
Existing Permitted Stock Reservoir	Headgate
Existing Stock Tank	Well with AC Pump System
Township and Range	Well with Solar Pump System
PLSS Sections	Stock Tanks
Parcel Boundary	Pipeline
	Sprinkler System
	Environmental Project

N

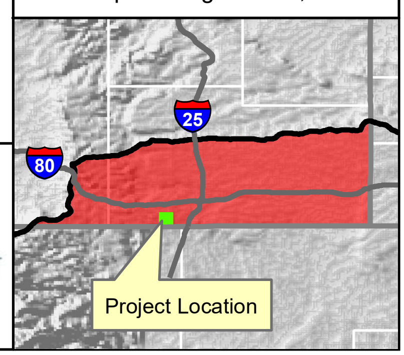
Feet
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T12N, R68W



Project 12-68-4.1: Duck Creek Grazing Association, New Well Stock Tanks and Pipelines

Document Name: DuckCreek_12-68-4.1
Date Saved: 9/7/2017

SPRWS PROJECT NUMBER: 12-68-4.1

New Well, Solar Pump, Panels and Tanks

NE ¼ SE ¼ Section 4, T12N R68W
Site Visit Date: 10/14/2016

PROJECT NAME: Duck Creek Grazing Association New Section 4 Well
And Stock Water System
No existing water rights, this is a new project.

Duck Creek Grazing Association (Applicant – Name of Entity)

Jerry Sidwell (Contact)

4481 Road 203 Carpenter, WY 82054

Laramie 970-381-4701 sidwellbrothers@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		x	☐	41.0372 N	105.0122W
Solar Platform		x	☐	41.0372 N	105.0122W
Tank		x		41.0372 N	105.0122W
Pipeline		x	☐		
Tank in NE ¼		x	☐	41.0418 N	105.0041W
Tank in NW ¼		x	☐	41.0406 N	105.0179W
Tank in SE ¼		x	☐	41.0307 N	105.0075W
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	68W	4	NE ¼ SE 1/4

Project Description:

This project involves the construction of a new well located in the SE ¼ NE ¼ of Section 4, T12N, R68W and stock water pipeline system. Section 4 is a State Section. There is no water in this section and the pasture currently is under grazed.

The well would serve as a primary water source for a stock water pipeline system, consisting of four tanks and associated pipelines. A solar pump and panels would be needed to pump water from the well, as there is no accessible power source.

Public Benefit:

____
____

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).
____LCCD____
____

Who is the owner of the project? ______Duck Creek Grazing Association__________________

Who owns the land that the project is to be built on? _______State of Wyoming

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
_______All 640 acres in Section 4 plus land in adjacent sections.______________________________
____

What is the total estimated project cost? ___$108,500____

Photographs: Location for the Duck Creek Grazing Association new Section 4 well.
NE ¼ SE ¼ Sec. 4 T12N R68W

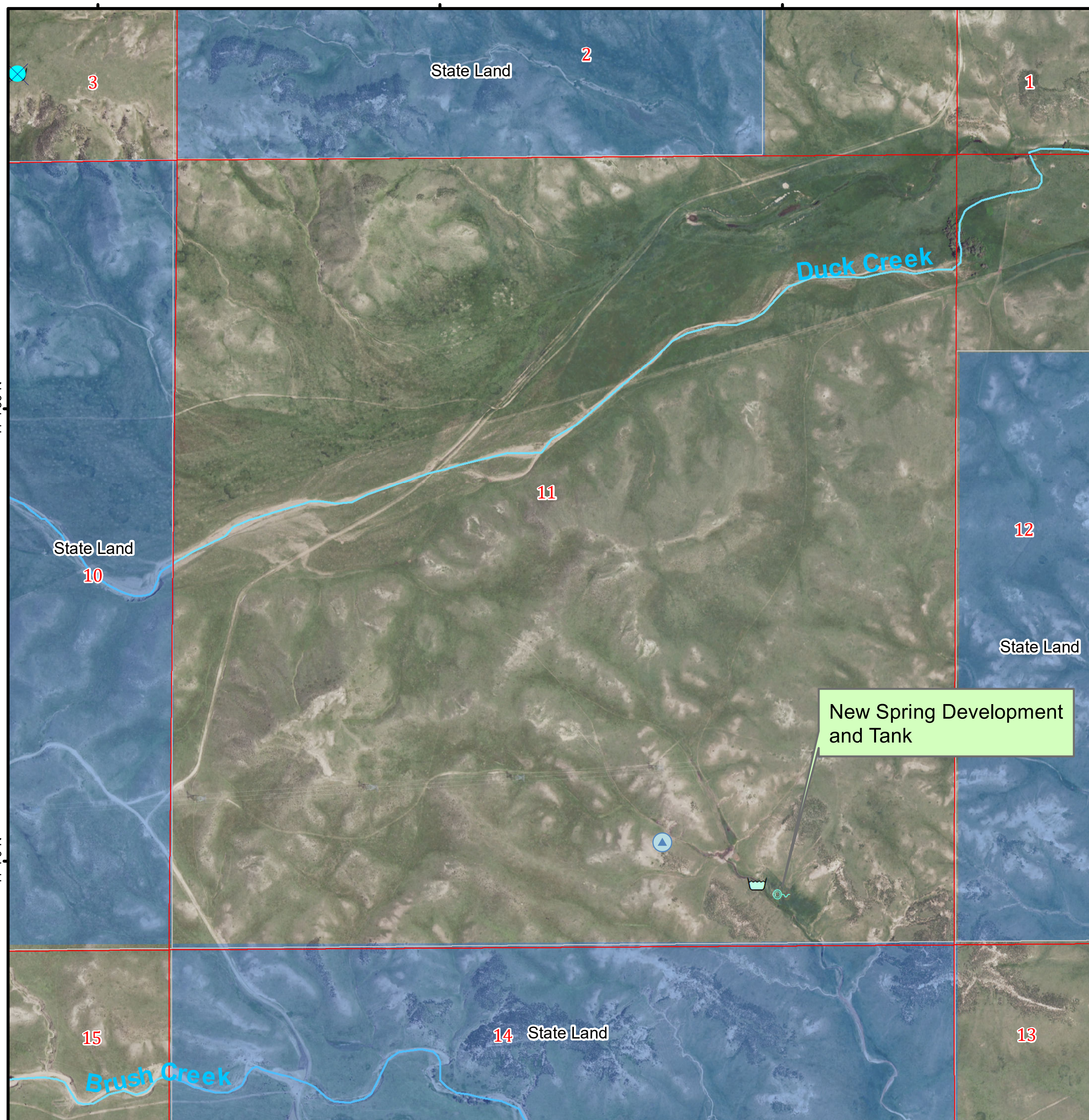
SPRWS Project Cost Estimate

SPRWS Project No. **12-68-4.1**

Project Name Duck Creek Section 4 Well and Stock Water System

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 8,575.00	$ 8,575.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
2a	Spring Development	LS		$ 3,800.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS	1	$ 14,500.00	$ 14,500.00
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	6	$ 2,900.00	$ 17,400.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	6,000	$ 3.50	$ 21,000.00
7	Miscellaneous Valves and piping at tank(s)	Ea	4	$ 500.00	$ 2,000.00
8	3 Wire Fence with wood posts	LF	200	$ 5.00	$ 1,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	1.00	$ 1,250.00	$ 1,250.00

Sub-Total Estimated Component Costs	$ 94,325.00
Contingency - 15%	$ 14,148.75
Budget for Project with Contingency	**$ 108,473.75**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

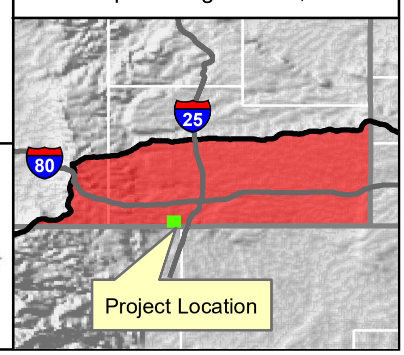
Feet
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T12N, R68W



Project 12-68-11.1: Duck Creek Grazing Association, Spring Rehabilitation and New Tank

Document Name: DuckCreek_12-68-11.1
Date Saved: 9/6/2017

SPRWS PROJECT NUMBER: 12-68-11.1

Duck Creek Grazing Association Section 11 Spring Development

SE ¼ SE ¼ Sec. 11 T12N R68W
Site Visit Date: 10/14/2016

PROJECT NAME: Duck Creek Grazing Association Section 11 Spring Development

Duck Creek Grazing Association (Applicant – Name of Entity)

Jerry Sidwell (Contact)

4481 Road 203 Carpenter, WY 82054

Laramie	970-381-4701	sidwellbrothers@gmail.com
(County)	(Phone)	(Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		☐	☐		
Spring Development		☐	x	41.01611N	104.96667W
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	68W	11	SE ¼ SE ¼

Project Description:

This project involves the development of a spring located in the SE ¼ SE ¼ Section 11, T12N R68W. Currently, the riparian area around the spring is eroded and damaged due to the presence of livestock, which has caused damage to the riparian area.

The development of the spring, fencing it, and installing a stock tank located out of the riparian area will provide relief for the riparian area.

Public Benefit:

____
____

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).
_____LCCD____
____

Who is the owner of the project? ______Duck Creek Grazing Association___________

Who owns the land that the project is to be built on? _______Duck Creek Grazing Association

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
The entire pasture in the SE ¼ of Section 11 and northeast ¼ of Section 14, which is a State section will benefit from the additional water source. There will be water quality benefits and benefits to the riparian area.

What is the total estimated project cost? ______$27,000_________________________________

Photographs: Duck Creek Grazing Association Section 11 Spring Development
SE ¼ SE ¼ Sec. 11 T12N R67W

Photo shows the spring in the SE 1/4 SE ¼ Section 11, T12N, R68W

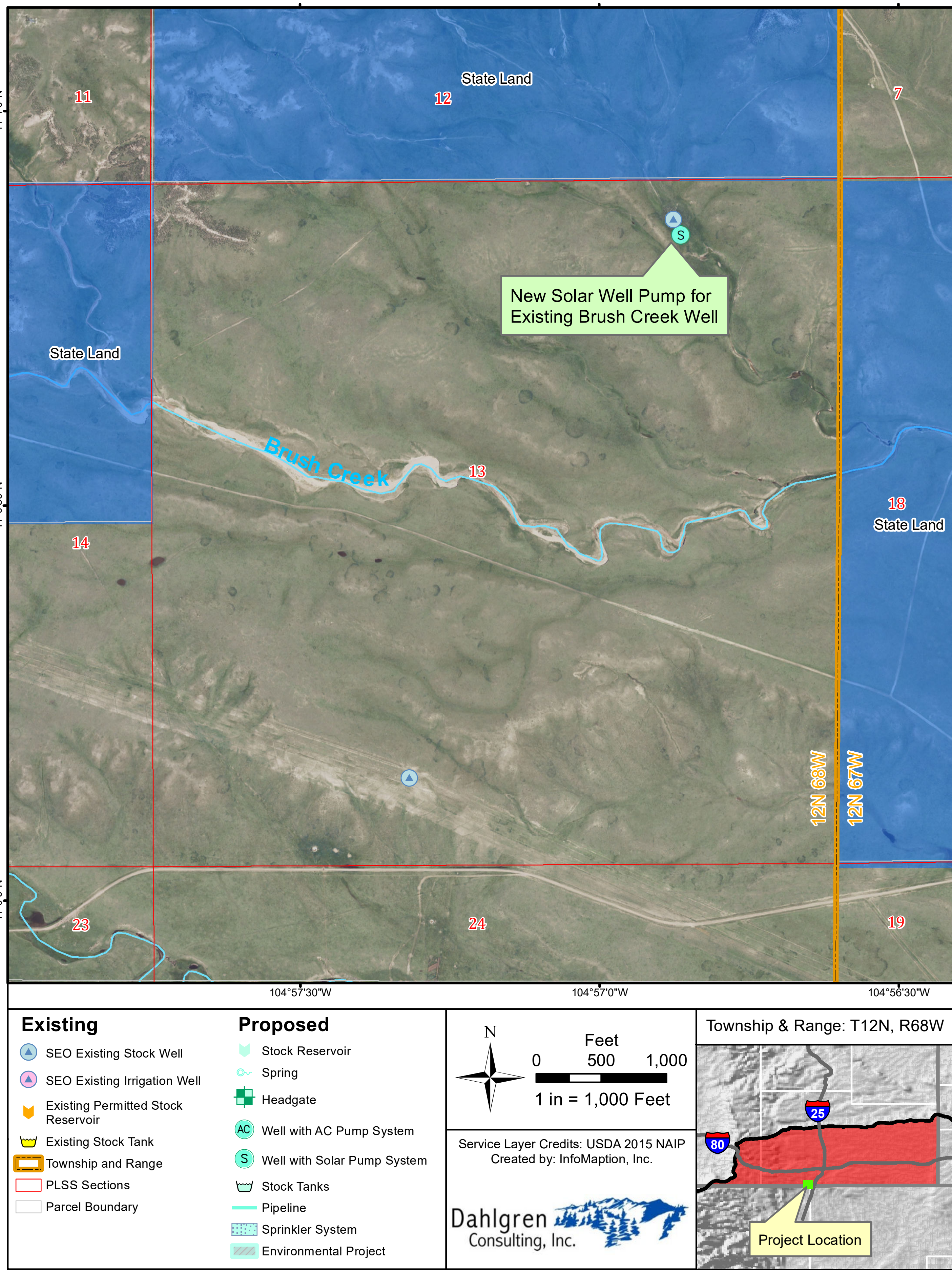
SPRWS Project Cost Estimate

SPRWS Project No. **12-68-11.1**

Project Name Duck Creek Section 11 Spring and Tank

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,132.50	$ 2,132.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS	1	$ 3,800.00	$ 3,800.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	400	$ 4.50	$ 1,800.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	400	$ 5.00	$ 2,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$ 23,457.50
Contingency - 15%	$ 3,518.63
Budget for Project with Contingency	**$ 26,976.13**



Project 12-68-13.1: Duck Creek Grazing Association, New Solar Well Pump

Document Name: DuckCreek_12-68-13.1
Date Saved: 9/7/2017

SPRWS PROJECT NUMBER: 12-68-13.1

Add Solar Pump and Panels for existing
Brush Creek Well WY SEO Permit UW119967

NE ¼ NE ¼ Sec. 13 T12N R68W
Site Visit Date: 10/14/2016

PROJECT NAME: Duck Creek Grazing Association
Solar Pump and Platform for Brush Creek Well

___Duck Creek Grazing Association____________________________ (Applicant – Name of Entity)

_____Jerry Sidwell________________________________ (Contact)

_____4481 Road 203____ _____ _______Carpenter, WY 82054__

_Laramie___ _______970-381-4701__ _______sidwellbrothers@gmail.com____

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		☐	☐		
Solar Platforms		☐	X	41.01444N	104.94805W
Pipeline		☐	☐		
Tank		☐	☐		
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	68W	13	NE ¼ NE ¼

Project Description:

This project involves the installation of a solar pump and panels into the existing Brush Creek Well, Permit UW 119967. This well is currently powered by a generator to run a submersible electric pump. This requires a ranch hand to repeatedly check the well, fill the generator with gas and to operate in order to pump water to an existing bottomless tank.

The well was drilled in 2000 and according to the Statement of Completion (SOC) the well is 100' deep, cased with 5" PVC and screened with 32 slot PVC pipe. The reported yield is 10 gpm and the static water level is reported to be 42' BGS. Pump test data was reported on the SOC with the well yielding 10 gpm with 28' of draw down after 2 hours.

The existing bottomless tank is reported by the owner to be in good condition.

Public Benefit:

____

____

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).
_____LCCD________________________________

____

Who is the owner of the project? ______Duck Creek Grazing Association__________________

Who owns the land that the project is to be built on? _______Duck Creek Grazing Association__

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
_______All of the NE ¼ of Section 13, at least 160 acres.____________________________

____

What is the total estimated project cost? _______$16,000_______________________________

Photograph showing the existing bottomless tank near the Brush Creek Well.

SPRWS Project Cost Estimate

SPRWS Project No. **12-68-13.1**

Project Name Duck Creek Brush Creek Well Solar Pump

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,267.50	$ 1,267.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 3,800.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	200	$ 4.50	$ 900.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	160	$ 5.00	$ 800.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre		$ 1,250.00	$ -

Sub-Total Estimated Component Costs	$ 13,942.50
Contingency - 15%	$ 2,091.38
Budget for Project with Contingency	**$ 16,033.88**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

0 500 1,000

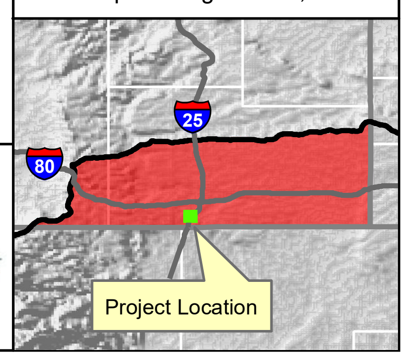
1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP

Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T13N, R67W



Project 13-67-33.1: Duck Creek Grazing Association, New Well, Solar Pump and Stock Tank

Document Name: DuckCreek_13-67-33.1
Date Saved: 9/7/2017

SPRWS PROJECT NUMBER: 13-67-33.1

New Well, Solar Pump, Panels and Tanks

NW ¼ SW ¼ Sec. 33 T13N R67W
Site Visit Date: 10/14/2016

PROJECT NAME: Duck Creek Grazing Association
New Section 33 Well and Solar Pump

Duck Creek Grazing Association (Applicant – Name of Entity)

Jerry Sidwell (Contact)

4481 Road 203 Carpenter, WY 82054

Laramie 970-381-4701 sidwellbrothers@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		x	☐	41.0530 N	104.9020W
Solar Platforms		x	☐	41.0530 N	104.9020W
Pipeline		x	☐	41.0530 N	104.9020W
Tank		x	☐	41.0530 N	104.9020W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	67W	33	NW ¼ SW ¼

Project Description:

This project involves the construction of a new well located in the NW ¼ SW ¼ of Section 33, T13N, R67W. The well would serve as a primary water source for stock watering in an area that is currently under grazed due to no water in the pasture.

There are also areas in the NW ¼ of Section 33 that also do not have water. But it is difficult access from one area to the other, because of the railroad. There may be the potential to extend a pipeline from the new well to another stock tank located in the NW ¼ of the section, but there will need to be negotiations with the railroad to construct a pipeline. Therefore a second well may need to be drilled on the opposite side of the tracks instead of a pipeline.

- The well would potentially service two (2) stock watering tanks that would be located in the pasture.
- Associated pipelines would be installed to convey water to the stock tanks.
- A solar platform would be needed to pump water from the well, as there is no accessible power source

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

LCCD

Who is the owner of the project? Duck Creek Grazing Association

Who owns the land that the project is to be built on? Duck Creek Grazing Association

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? All of the west ½ of Section 33 would benefit from the additional stock water.

What is the total estimated project cost? $52,000

Pasture in Section 33, T13N, R67W near the new well location.

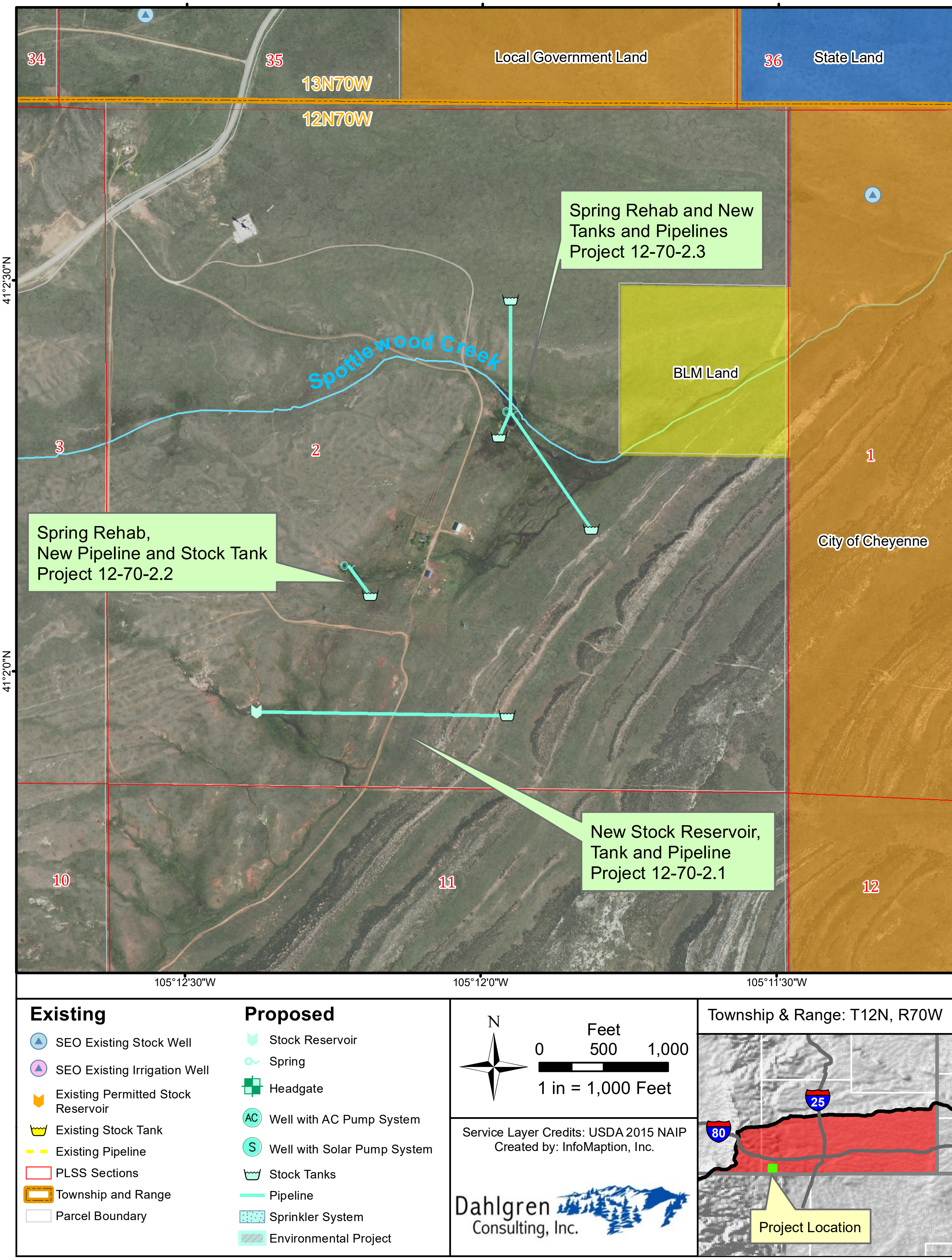
SPRWS Project Cost Estimate

SPRWS Project No. **13-67-33.1**

Project Name Duck Creek Section 33 Well

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,098.75	$ 4,098.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
2a	Spring Development	LS		$ 3,800.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	200	$ 4.50	$ 900.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	160	$ 5.00	$ 800.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 45,086.25
Contingency - 15%	$ 6,762.94
Budget for Project with Contingency	**$ 51,849.19**



Project 12-70-2.1/2.2/2.3: Shiverdecker, Spring Rehab & New Stock Tanks/Pipelines/Stock Reservoir

Document Name: Shiverdecker_12-70-2.1-2.2-2.3
Date Saved: 7/5/2017

SPRWS PROJECT NUMBER: 12-70-2.1

SW ¼ SW ¼ Sec. 2 T12N R70W

Site Visit Date: 9/22/2016

PROJECT NAME: Shiverdecker Section 2.1 Stock Reservoir, stock water pipeline and tank This is the site of the diversion dam for the Hosack No. 5 Ditch, permit no. 10650.

___Shiverdecker Ranch______________________________________ (Applicant – Name of Entity)

____Jean Shiverdecker ____________________________ (Contact)

__________________________ _______Granite Springs, WY_________82059__

_Laramie___ _____307-212-1874 jeanshiverdecker@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		x	☐	41.0328 N	105.2061W
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		x	☐	41.0313N	105.2025W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Stock Reservoir site

Township	Range	Section	Quarter-Quarter
12N	70W	2	SW ¼ SW ¼

Project Description:

This project involves two components; construction of a stock reservoir and construction of a stock water pipeline and stock tank. The stock reservoir will be located downstream of a spring.

The stock reservoir will require construction of a dam, which will be approximately 275' long and a maximum of approximately 15' high. The capacity of the reservoir will be approximately 3.5 AF. The dam will require approximately 3400 CY of embankment, spillway and outlet pipe. The stock water pipeline will be extended from the dam outlet toward the east and a stock tank will be constructed at the end of the pipeline. The pipeline will be approximately 2000' long. Preliminary cost estimates for both components of the project are included with this project description.

There is an existing adjudicated water right for the Hosack No. 5 Ditch, Permit No. 10650, at the proposed stock reservoir. This permit allows irrigation of 8 acres. Construction of the stock reservoir and dam has an additional benefit of restoring the diversion dam for the Hosack No. 5 Ditch.

Public Benefit:

____

____

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

_____Laramie County Conservation District____

____

Who is the owner of the project? ______Jean Shiverdecker_________________

Who owns the land that the project is to be built on? _______Jean Shiverdecker___________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? __8 acres of adjudicated irrigation rights could be re-activated by this project. Also approximately 160 acres is the southern part of Section 2 would benefit from the additional stock water.

What is the total estimated project cost? ____The preliminary estimated costs for reservoir, stock water pipeline and tank is $75,600. The cost break down for the components is shown on the enclosed cost estimate.

Photographs: Shiverdecker Stock Reservoir 12-70-2.1
Location: 41.0328N, 105.2061W, SW ¼ SW ¼ Sec 2 T12N R70W

Proposed dam site.

Photo shows area downstream of dam. Traces of the old irrigation ditch are visible on the ground.

Work Items and Preliminary Quantities
SPRWS Small Water Project

SPRWS Project No. **12-70-2.1**

Shiverdecker 2.1 Stock Reservoir Preliminary Costs

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization	LS	1	$ 5,000.00	$ 5,000.00
2	Strip, Stockpile, and Replace Topsoil	CY	575	$ 5.00	$ 2,875.00
3	Excavation and Placement Embankment Fill	CY	3,400	$ 6.50	$ 22,100.00
4	Special backfill around pipes. Compaction around and min. 2' over pipes.	CY	200	$ 12.00	$ 2,400.00
5	Riprap - 8" nominal sized rock - 12" thick	CY	100	$ 125.00	$ 12,500.00
6	Filter fabric under riprap	SY	300	$ 4.00	$ 1,200.00
7	8" low level outlet pipe	LF	100	$ 40.00	$ 4,000.00
8	8" gate valve and valve box	LS	1	$ 1,750.00	$ 1,750.00
9	Site Revegetation and reclamation	Acre	2	$ 1,250.00	$ 2,500.00
10	Miscellaneous work - road and fencing	LS	1	$ 2,000.00	$ 2,000.00

Sub-Total Estimated Component Costs	$	56,325.00
Contingency - 15%	$	8,448.75
Opinion of Probable Costs for Stock Reservoir	**$**	**64,773.75**

Shiverdecker 2.1 Stock water pipeline and tank cost estimate

	1100 gallon 10' diameter tire tank	Ea	1	$ 2,900.00	$ 2,900.00
	2" Class 200 HDPE pipeline installed at 4'	LF	2,000	$ 3.00	$ 6,000.00
	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00

Sub-Total Estimated Component Costs	$	9,400.00
Contingency - 15%	$	1,410.00
Opinion of Probable Costs for Stock water pipeline and tank	**$**	**10,810.00**
Total Costs for Stock Reservoir and stock water pipeline	**$**	**75,583.75**

SPRWS PROJECT NUMBER: 12-70-2.2
NE ¼ SW ¼ Sec. 2 T12N R70W
Site Visit Date: 9/22/2016

PROJECT NAME: Shiverdecker House Spring Project

Shiverdecker Ranch (Applicant – Name of Entity)

Jean Shiverdecker (Contact)

Granite Springs, WY 82059

Laramie 307-212-1874 jeanshiverdecker@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tanks		1	☐		
Spring Development		☐	x	41.0355N	105.2038W
Wetland		☐	☐		
Environmental		☐	x	41.0355N	105.2038W
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	70W	2	NE ¼ SW ¼

Project Description:

This project involves rehabilitation of a spring; construction of a stock water pipeline and tank; fencing around the spring; and improvements to a drainage ditch, which also could improve drainage and mitigate flooding.

The spring is the source of drinking water for the home, because there is no house well. Currently, livestock graze around the spring, which raises concerns about the domestic water quality. Flow from the spring causes nuisance flooding of the road and around the barn.

The primary rehabilitation efforts at this spring will include fencing around the spring to improve water quality and protect the wetlands and riparian areas. Since the spring will be fenced off, construction of a spring box, stock water pipeline and stock tank should be done to provide an alternative water source and encourage dispersal of the cattle from the riparian areas around the spring to other parts of the pasture.

Construction of a ditch and culvert below the spring could mitigate the flooding and restore drainage.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Jean Shiverdecker

Who owns the land that the project is to be built on? Jean Shiverdecker

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

This project would construct an alternative stock water and wildlife watering facility, improve grazing conditions, provide water quality improvements, and improve the condition of the wetlands and riparian area.

What is the total estimated project cost? $18,750

Photographs: Shiverdecker House Spring
Location: 41.0355N, 105.2038W, NE ¼ SW ¼ Sec 2 T12N R70W

Photo shows the spring with cattle grazing upstream of the spring and in the riparian area.

SPRWS Project Cost Estimate

SPRWS Project No. **12-70-2.2**

Project Name Shiverdecker House Spring Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,492.50	$ 1,492.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS	1	$ 3,800.00	$ 3,800.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	1	$ 2,900.00	$ 2,900.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	500	$ 3.00	$ 1,500.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	1,000	$ 5.00	$ 5,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	16,417.50
Contingency - 15%	$	2,462.63
Budget for Project with Contingency	**$**	**18,880.13**

SPRWS PROJECT NUMBER: 12-70-2.3

SW ¼ NE ¼ Sec. 2 T12N R70W

Site Visit Date: 9/22/2016

PROJECT NAME: Shiverdecker North Project

Hosack No. 3and No. 4Ditches, WY SEO Permit Nos. 8770 and 8771

___Shiverdecker Ranch___________________________ (Applicant – Name of Entity)

_____Jean Shiverdecker___________________________ (Contact)

__________________________ _______Granite Springs, WY _________82059__

_Laramie___ _____________307-212-1874__ _______jeanshiverdecker@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tanks		3	☐		
Spring Development		☐	x	41.0389N	105.1992W
Wetland		☐	☐		
Environmental		☐	x	41.0389N	105.1992W
Irrigation		☐	x	41.0389N	105.1992W
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	70W	2	SW ¼ NE ¼

Project Description:

This project involves rehabilitation of two spring fed ponds, related to the Hosack Ditch No. 3, WY SEO Permit No. 8770 and the Hosack Ditch No. 4, WY SEO Permit No. 8771. Both permits are adjudicated for irrigation. 30.5 acres and 11 acres are adjudicated from the Hosack No. 3 and No. 4 Ditches, respectively. The ponds likely were associated with the diversion dams for these small ditches.

Currently, the north pond is fenced and wetlands and riparian areas have developed around this pond. The wetlands and riparian areas are in good shape. Also, there are fish in the north pond. The south pond is unfenced and cattle have tromped around the pond and caused deteriorated conditions. There is erosion on the pond dikes, the wetlands are in poor shape, and the irrigation system has been destroyed. These conditions have resulted in poor water quality.

This project will involve fencing of the south pond, replacement of the outlet pipes and headgates, and cleaning and re-grading the ditches to restore the irrigation system.

Also stock water pipelines and tanks will be constructed:

- One stock tank will be installed near the south pond to replace the south pond as a water source, since the pond will be fenced. A short pipeline from the ponds will supply this tank.
- A second longer pipeline and stock tank can be installed approximately 2000' east of the ponds to provide water to the east side of the pasture. This pipeline and tank would be fed by gravity from the ponds.
- A third pipeline and stock tank would be installed to the north of the ponds. This pipeline would require a pump to convey the water uphill to the north pasture location.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

____Laramie County Conservation District

Who is the owner of the project? Jean Shiverdecker

Who owns the land that the project is to be built on? Jean Shiverdecker

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

41.5 acres of irrigation would be restored by rehabilitation of the ditches. Also, 160 acres in the NE ¼ of Section 2 would benefit from the improved stock water facilities. Finally, the erosion and deterioration of the riparian area and wetlands around the south pond would be improved.

What is the total estimated project cost? $50,250

Photographs: Shiverdecker North Project
Location: 41.033056N, 105.2006W, SW ¼ NE ¼ Sec 2 T12N R70W

North or Upper Pond, which is fenced.

South or Lower Pond, which is not fenced.

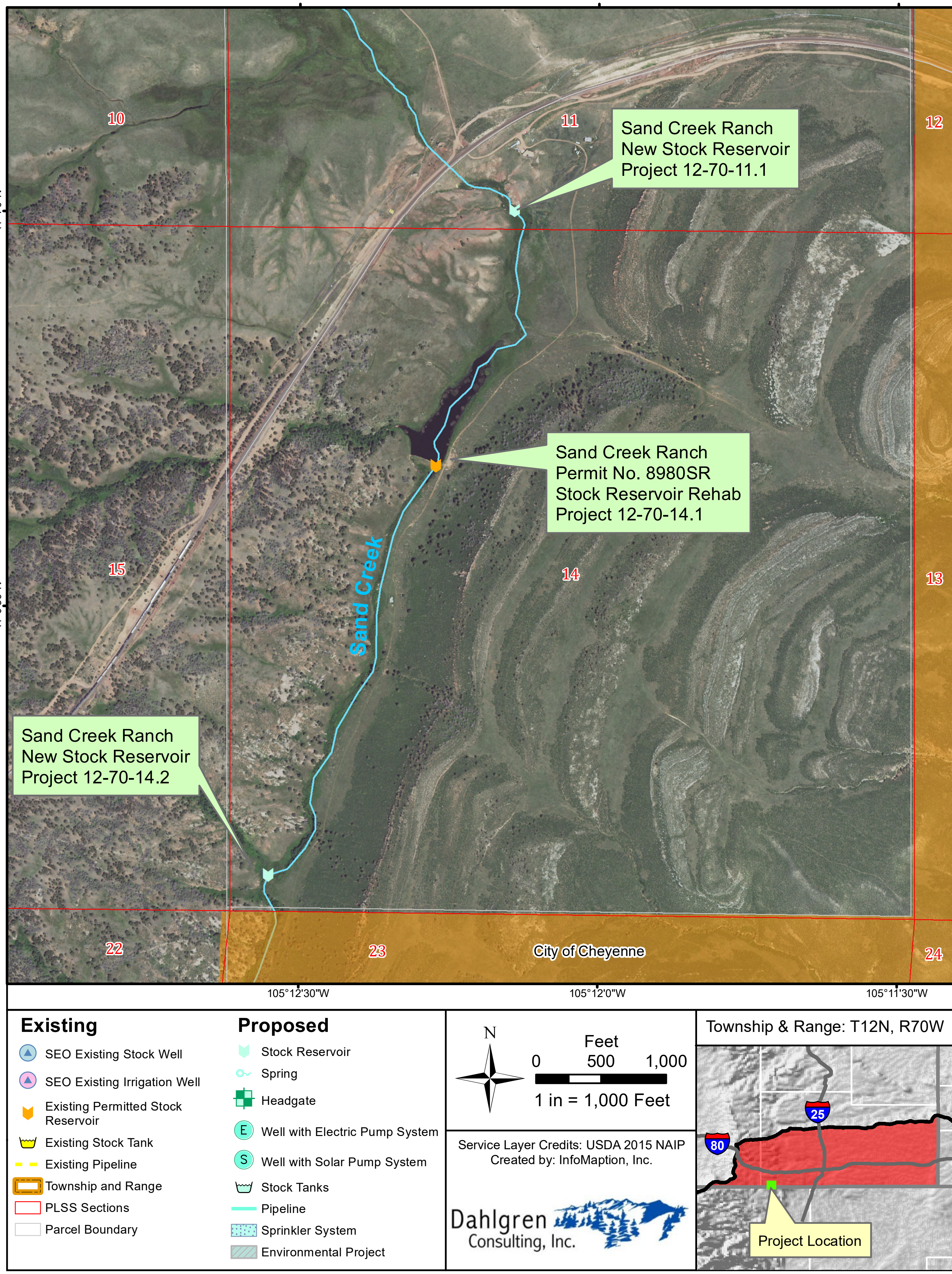
SPRWS Project Cost Estimate

SPRWS Project No. **12-70-2.3**

Project Name Shiverdecker North Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 3,970.00	$ 3,970.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS	1	$ 3,800.00	$ 3,800.00
3	Solar Pump System - less than 250' TDH	LS	1	$ 9,650.00	$ 9,650.00
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	3	$ 2,900.00	$ 8,700.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	2,400	$ 3.00	$ 7,200.00
7	Miscellaneous Valves and piping at tank(s)	Ea	3	$ 500.00	$ 1,500.00
8	3 Wire Fence with wood posts	LF	400	$ 5.00	$ 2,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Miscellaneous work on outlets and ditches	LS	1.00	$ 5,000.00	$ 5,000.00
11	Site Revegetation and reclamation	Acre	1.00	$ 1,250.00	$ 1,250.00

Sub-Total Estimated Component Costs	$ 43,670.00
Contingency - 15%	$ 6,550.50
Budget for Project with Contingency	**$ 50,220.50**



Projects 12-70-11.1, 12-70-14.1 & 12-70-14.2:
Sand Creek Ranch, New Stock Reservoirs & Rehab

Document Name: Green_12-70-11.1-14.1-14.2
Date Saved: 9/7/2017

SPRWS PROJECT NUMBER: 12-70-11.1
New Stock Reservoir
SE ¼ SW ¼ Sec. 11 T12N R70W
Site Visit Date: 9/22/2016

PROJECT NAME: Sand Creek Ranch Section 11 Stock Reservoir, aka Stock Reservoir # 3
No Water Right—New Project

Sand Creek Ranch (Applicant – Name of Entity)

Robert Green (Contact)

279 ROAD 102 Granite Springs, WY 82059

Laramie

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		x	☐	41.0169N	105.2026W
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		☐	☐		
Spring Development		☐	☐		
Wetland		☐			
Environmental		☐			
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	70W	11	SE ¼ SW ¼

Project Description:

This project involves the construction of a small dam for a stock reservoir on Sand Creek Ranch. The project will meet the criteria of a small water project, with a dam height of no more than 20’ and total storage of less than 20 acre-feet.

This project will involve construction of an earth dam, riprap, principal spillway, spillway, and outlet pipe. The dam will be approximately 160’ long and a maximum of approximately 15’ tall. The dam will be constructed on Sand Creek in a small canyon and flow in the creek will supply the reservoir. This location is approximately ¼ mile upstream from the existing Sand Creek Ranch Stock Reservoir, Permit 8980 SR.

The primary effort at this stock reservoir location involves the placement and construction of an earth dam. A 24" drop inlet pipe flowing into a 18" outlet pipe will serve as the principal spillway and maintain flow to minimize water from flowing through the emergency spillway.

- The preliminary estimate of the earth fill required is approximately 2000 cubic yards.
- The dam height will be approximately 15', allowing for 5' of freeboard, means that 10' of water will be stored against the dam.
- Preliminary estimates of the storage capacity of the dam will be approximately 3.5 acre-feet.
- This dam is downstream of the UPRR embankment and more detailed surveying will be required to complete the design of this structure. The dam and reservoir may need to be relocated further downstream to prevent stored water from backing up to the railroad embankment and into the culvert beneath the embankment.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

____

____

Who is the owner of the project? ______Robert Green______________

Who owns the land that the project is to be built on? _______Robert Green________________

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? ____________________________________

____

What is the total estimated project cost? ______$72,000_______________________________________

____

Photographs: Proposed Sand Creek Ranch Stock Reservoir # 3
Location: 41.01611N, 105.20167W, SE ¼ SW ¼ Sec 11 T12N R70W
September 22, 2016

Proposed dam site looking upstream (generally west). The UPRR embankment is visible in the background.

Photo shows the dam site looking downstream.

Work Items and Preliminary Quantities for a Stock Reservoir

Sand Creek Ranch New Stock Reservoir 12-70-11.1 Preliminary Cost Estimate

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization	LS	1	$ 5,000.00	$ 5,000.00
2	Strip, Stockpile, and Replace Topsoil	CY	325	$ 5.00	$ 1,625.00
3	Excavation and Placement Embankment Fill	CY	2,500	$ 6.50	$ 16,250.00
4	Special backfill around pipes. Compaction around and min. 2' over pipes.	CY	200	$ 12.00	$ 2,400.00
5	Riprap - 8" nominal sized rock - 12" thick	CY	125	$ 125.00	$ 15,625.00
6	Filter fabric under riprap	SY	450	$ 4.00	$ 1,800.00
7	Principal Spillway 36" diameter riser and inlet with Trash Rack and Anti-vortex baffle	LS	1	$ 5,000.00	$ 5,000.00
8	18" discharge pipe	LF	100	$ 40.00	$ 4,000.00
9	8" low level outlet pipe	LF	120	$ 40.00	$ 4,800.00
10	8" gate valve and valve box	LS	1	$ 1,750.00	$ 1,750.00
11	Site Revegetation and reclamation	Acre	2	$ 1,250.00	$ 2,500.00
12	Miscellaneous work - road and fencing	LS	1	$ 2,000.00	$ 2,000.00

Sub-Total Estimated Component Costs	$	62,750.00
Contingency - 15%	$	9,412.50
Opinion of Probable Costs	**$**	**72,162.50**

SPRWS PROJECT NUMBER: 12-70-14.1
Stock Reservoir Rehab – Erosion in the Emergency Spillway
SE ¼ NW ¼ Sec. 14 T12N R70W
Site Visit Date: 9/22/2016

PROJECT NAME: Sand Creek Ranch Stock Reservoir Rehabilitation
WY SEO Permit No. 8980 SR

Sand Creek Ranch (Applicant – Name of Entity)

Robert Green (Contact)

279 ROAD 102 Granite Springs, WY 82059

Laramie

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	x	41.0113 N	105.2042W
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		☐	☐		
Spring Development		☐	☐		
Wetland		☐			
Environmental		☐			
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	70W	14	SE ¼ NW ¼

Project Description:

This project involves rehabilitation of the existing Sand Creek Stock Reservoir, WY SEO Permit No. 8980 SR. This reservoir is adjudicated for 12.8 AF.

The primary rehabilitation effort at this stock reservoir involves the emergency spillway. There are two primary concerns with the emergency spillway:

- A concrete structure was constructed at the inlet or control section of the spillway. Water flowing through the spillway has undercut the concrete and water is running beneath the crest structure. The concrete section needs to be enlarged and/or extended further upstream and a deeper cut-off wall needs to be constructed to prevent the water from flowing beneath the concrete crest structure.
- There is erosion in the exit channel of the emergency spillway. The exit channel of the emergency spillway is steep and an approximately 120' long by 16' wide area of the exit channel has eroded. This area needs stabilization, by re-grading, placing riprap, filter fabric or filter material, and/or construction of grade control/check structures. Stabilization of the eroded area may take both riprap and grade control structures.
- Also, resizing of drop inlet of the principal spillway and re-configuring the crest of the principal spillway pipe would increase the flow through the principal spillway and reduce flow through the emergency spillway.

Other improvements to the dam and reservoir that could be considered during this project include placing additional riprap on the face of the dam; grading the dam so that there are no low spots and a minimum of 5' of freeboard is re-established; placing riprap at the downstream end of the discharge pipe, and rehabilitation of the gate hand wheel and control pipe so that the gate is more easily operated.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

____

____

____

Who is the owner of the project? ______Sand Creek Ranch________________

Who owns the land that the project is to be built on? ________Sand Creek Ranch__________________

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? ______________________________________

____

____

What is the total estimated project cost? ________$45,000____________________________________

Photographs: Sand Creek Ranch Stock Reservoir
WY SEO Permit Number 8980 S.R.
Location: 41.01139 N, 105.20417 W. SE ¼ NW ¼ Sec. 14 T12N R70W

Drop Inlet of Principal Spillway

Downstream end of the 24” Outlet pipe

Concrete crest at emergency spillway

Top of Dam

Erosion in Emergency Spillway

Erosion in Emergency Spillway

SPRWS PROJECT NUMBER: 12-70-14.2
Sand Creek Ranch Stock Reservoir #2 – New Stock Reservoir
SW ¼ SW ¼ Sec. 14 T12N R70W
Site Visit Date: 9/22/2016

PROJECT NAME: Sand Creek Ranch New Section 14 Stock Reservoir, aka Stock Reservoir # 2. New Project, needs permitting.

Sand Creek Ranch (Applicant – Name of Entity)

Robert Green (Contact)

279 ROAD 102 Granite Springs, WY 82059

Laramie

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		x	☐	41.0025N	105.2094W
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		☐	☐		
Spring Development		☐	☐		
Wetland		☐			
Environmental		☐			
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	70W	14	SW ¼ SW ¼

Project Description:

This project involves the construction of a dam and stock reservoir on Sand Creek Ranch. The project will meet the criteria of a small water project, with a dam height of no more than 20' and total storage of less than 20 acre-feet. The dam and stock reservoir will be constructed on Sand Creek.

This project will involve construction of an earth dam, riprap, principal spillway, spillway, and outlet pipe. The dam will be approximately 240' long and a maximum of 20' high.

- A 36" drop inlet pipe configured into a 24" outlet pipe will serve as the principal spillway and maintain flow to minimize water from flowing through the emergency spillway.
- A low level outlet with gate will be required. The diameter of the outlet pipe will be 8".
- The preliminary estimate is that the dam will require approximately 5000 cubic yards of compacted earth fill.
- The water height at the dam will be 15', which allows 5' of freeboard.
- Preliminary estimates of the storage capacity of the dam will be approximately 10 acre feet, which is slightly smaller than the existing Sand Creek Ranch Reservoir, permit 8980 S.R.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Robert Green

Who owns the land that the project is to be built on? Robert Green

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project?

What is the total estimated project cost? $115,000

Photographs: Proposed Sand Creek Ranch Stock Reservoir # 2
Location: 41.01139N, 105.20417W. SE ¼ NW ¼ Sec. 14 T12N R70W
September 22, 2016

Creek at proposed dam site. Looking upstream (north).

Dam site looking east along approximate centerline of dam.

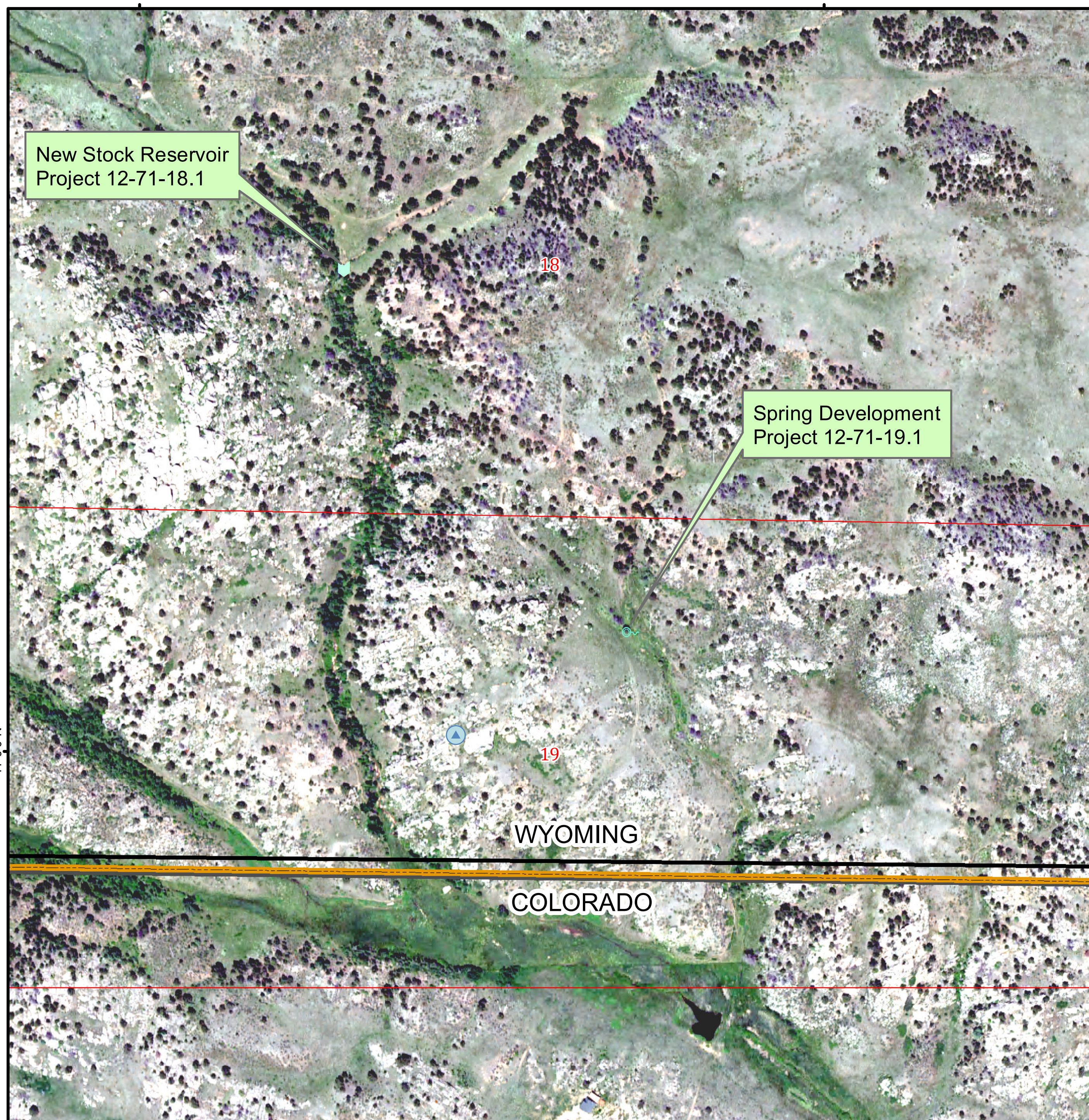
Dam site looking west.

Work Items and Quantities
Sand Creek Stock Reservoir #2
SW ¼ SW ¼ Sec. 14 T12N R70W
Nov 2016

Bid Item	Description	Unit	Quantity	Unit Price	Item Total	Percent of Work
1	Mobilization	LS	1	$ 5,000.00	$ 5,000.00	4.95%
2	Strip, Stockpile, and Replace Topsoil	CY	650	$ 5.00	$ 3,250.00	3.21%
3	Excavation and Placement Embankment Fill	CY	5,500	$ 6.50	$ 35,750.00	35.36%
4	Special backfill around pipes. Compaction around and min. 2' over pipes.	CY	200	$ 12.00	$ 2,400.00	2.37%
5	Riprap - 8" nominal sized rock - 12" thick	CY	225	$ 125.00	$ 28,125.00	27.82%
6	Filter fabric under riprap	SY	850	$ 4.00	$ 3,400.00	3.36%
7	Principal Spillway 36" diameter riser and inlet with Trash Rack and Anti-vortex baffle	LS	1	$ 5,000.00	$ 5,000.00	4.95%
8	18" discharge pipe	LF	135	$ 40.00	$ 5,400.00	5.34%
9	8" low level outlet pipe	LF	135	$ 40.00	$ 5,400.00	5.34%
10	8" gate valve and valve box	LS	1	$ 1,750.00	$ 1,750.00	1.73%
11	Site Revegetation and reclamation	Acre	3	$ 1,250.00	$ 3,125.00	3.09%
12	Miscellaneous work - road and fencing	LS	1	$ 2,500.00	$ 2,500.00	2.47%

w/o mobilization
$ 96,100.00

Sub-Total Estimated Component Costs	$	101,100.00
Contingency - 15%	$	15,165.00
Opinion of Probable Costs	**$**	**116,265.00**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- PLSS Sections
- Township and Range
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

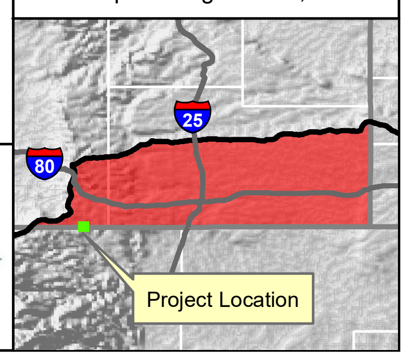
0 250 500

1 in = 500 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T12N, R71W



Document Name: Raisbeck_12-71-18.1 19.1
Date Saved: 11/29/2017

Project 12-71-18.1 and 19.1: Raisbeck Stock Reservoir and Spring Development

SPRWS PROJECT NUMBER: 12-71-18.1

New Spring Development
SE¼ SW¼ Sec 18 T12N R71W
Site Visit Date: Nov. 21, 2017

PROJECT NAME: Raisbeck Section 18 Stock Reservoir

Merl Raisbeck (Applicant – Name of Entity)

Same (Contact)

2852 Riverside

Laramie, WY 82070

Albany 307-761-1671 raisbeck@uwyo.edu

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		X		41.045N	105.3975W
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	71W	18	SESW

Project Description:

This project will involve construction of a new small stock reservoir on an ephemeral draw, tributary to Mud Creek, tributary to Dale Creek. This project is near the Colorado-Wyoming state line.

This project will provide the water storage and potential wildlife habitat benefits associated with a small reservoir. In addition, this reservoir will help mitigate erosion and head cutting that is occurring in the draw upstream (north and east) of the dam and reservoir site.

- The dam will be approximately 20’ tall and 120’ long.
- The reservoir will store approximately 12 – 15 AF.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie Rivers Conservation District;____

____

Who is the owner of the project? ______Merl Raisbeck

Who owns the land that the project is to be built on? _______Merl Raisbeck_______________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________

All 360 acres of the pasture owned by Merl Raisbeck will benefit from the stock water storage. Also, other pastures that are owned by other landowners, but grazed as a unit will benefit from this new water source. In addition, the reservoir will help control and check the erosion that is occurring upstream of the reservoir site.

What is the total estimated project cost? ____

$53,000 without contingency, engineering, or permitting costs. Additional surveying and design effort is required prior to submitting the stock reservoir application to the State Engineer’s Office and before submitting an application for Small Water Project funding.

The Corps of Engineers should be contacted concerning 404 permitting for this reservoir.

Work Items and Quantities
SPRWS Project
12_71_18.1 Raisbeck SR costs

SPRWS Project No. **12-71-18.1**

Project Name Raisbeck Stock Reservoir

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization	LS	1	$ 5,000.00	$ 5,000.00
2	Strip, Stockpile, and Replace Topsoil	CY	325	$ 5.00	$ 1,625.00
3	Excavation and Placement Embankment Fill	CY	2,500	$ 4.50	$ 11,250.00
4	Special backfill around pipes. Compaction around and min. 2' over pipes.	CY	200	$ 12.00	$ 2,400.00
5	Riprap - 8" nominal sized rock - 12" thick	CY	125	$ 75.00	$ 9,375.00
6	Filter fabric under riprap	SY	350	$ 4.00	$ 1,400.00
7	Principal Spillway 36" diameter riser and inlet with Trash Rack and Anti-vortex baffle	LS	1	$ 5,000.00	$ 5,000.00
8	18" discharge pipe	LF	135	$ 40.00	$ 5,400.00
9	8" low level outlet pipe	LF	120	$ 40.00	$ 4,800.00
10	8" gate valve and valve box	LS	1	$ 1,750.00	$ 1,750.00
11	Site Revegetation and reclamation	Acre	2	$ 1,250.00	$ 2,500.00
12	Miscellaneous work - road and fencing	LS	1	$ 2,500.00	$ 2,500.00

Sub-Total Estimated Component Costs	$ 53,000.00
Contingency - 15%	$ 7,950.00
Opinion of Probable Costs	**$ 60,950.00**

Raisbeck Stock Reservoir
Project # 12-71-18.1
Prelimin Dam Quantity Estimates

Height of Dam	20 ft	Water Depth at Dam=	15 ft		
Length of Dam	120 ft	Area of Pond =	3 acres		
Crest Elevation	100 ft	Vol of Pond =	15 AF *		
Crest Width	12 ft	*Assume Pond Vol = Depth at Dam divided by 3 multiplied by Area			
US Slope	3.25 to one				
DS slope	2.5 to one	Reservoir Efficiency =	166 CY/AF Stored		
CP #1	100				
HI	100				

Sta	Rod Reading	Grd Elevation	Dam Ht at Sta	X-S Area	Incremental Vol at Sta CF	Dam Width US toe to DS Toe	Volume to Strip Assume 1' depth to strip (CF)	Upstream Face Length (ft)	Riprap Quantity (CF) Assume 12" thick and entire US Face (CF)	Riprap Quantity (CF) Assume only Riprap 10' of US Face
0	0.00	100.0	0.0	0.0	0	12.0	0	0.0	0	
50	7.00	93.0	7.0	224.9	5,622	52.3	1,606	23.8	595	500
75	20.00	80.0	20.0	1390.0	20,186	127.0	2,241	68.0	1,148	250
100	7.00	93.0	7.0	224.9	20,186	52.3	2,241	23.8	1,148	250
120	0	100.0	0.0	0.0	2,249	12.0	643	0.0	238	200
200	0	100.0	0.0	0.0	0	12.0	960	0.0	0	800
240	0	100.0	0.0	0.0	0	12.0	480	0.0	0	400
			Total Vol CF		48,243		8,170		3,128	2400
			Total Vol CY		**1,787**		**303**		**116**	**89**
								Area of filter (SY)	347.59	266.67

Core Trench
Assume 8' wide by 3' deep with 1.5:1 side slopes — 1.4 CY per LF
Length of Core Trench (ft) 120 — 168 CY

Special Backfill Quantities
Special backfill around outlet and prinipal spillway pipes, 1:1 slope

Base of trench (ft)	Height of Trench (ft)	Cross Sectional Area (ft)	Dam Width US toe to DS Toe (ft)	Compacted Fill Quantity	
4	4	32	127.0	4064	CF
				151	CY

Assume 10% for compaction and settlement
Total Volume of Special Backfill **166 CY**

	Neat Line Volume	Volume Increased 10%
Volume of Embankment	**1,787 CY**	**1,965 CY**
Volume of Stripping	**303 CY**	**333 CY**
Volume of Core Trench	**168 CY**	**185 CY**
Total Volume	**2,257 CY**	**2,483 CY**

Photographs:

Raisbeck Stock Reservoir dam site. Photo is looking across the proposed dam site from the left abutment and spillway location toward the right abutment of the dam (from the northeast toward the southwest).

Photo shows the draw with the erosion. This draw flows into the proposed reservoir from the north and east. Construction of the dam and reservoir will help to stabilize erosion in this draw.

SPRWS PROJECT NUMBER: 12-71-19.1
New Spring Development
NE¼ NW¼ Sec 19 T12N R71W
Site Visit Date: Nov. 21, 2017

PROJECT NAME: Raisbeck Section 19 Spring Development

Merl Raisbeck (Applicant – Name of Entity)

Same (Contact)

2852 Riverside

Laramie, WY 82070

Albany 307-761-1671 raisbeck@uwyo.edu

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development		X		41.0012N	105.3938W
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
12N	71W	19	NENW

Project Description:

This project will involve a spring development, pipeline, and tank, and then installing a fence around the spring. During the site visit on Nov. 21, 2017, a wet spot with a small flow of water was observed at this location. Refer to the photos. Developing this spring seems feasible.

Specifically, this project will include:

- A spring development with perforated pipe, gravel, and spring box.
- 400' of 2" pipe downhill (east) from the spring box to the tanks.
- A new 10'dia. by 2' deep tire tank.
- Construct 400' of fence with gate around the spring.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie Rivers Conservation District;

____

Who is the owner of the project? Merl Raisbeck

Who owns the land that the project is to be built on? Merl Raisbeck

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

All 360 acres of the pasture owned by Merl Raisbeck will benefit from this spring development. Also, other pastured that are owned by other landowners, but grazed as a unit will benefit from this new water source.

What is the total estimated project cost?

$14,000 without contingency, engineering, or permitting costs. A new water right permit for the spring will be required. Limited additional design is necessary for this project and this project could be "shovel ready" with minimal effort.

Photographs:

Raisbeck Spring Development site. Arrow points to the approximate location of the spring.

Photo shows a close up of the spring, looking generally northwest or up the draw. The collection system and spring box would be installed in this location and the pipeline and tank would be installed in the direction opposite of the way the photo is looking.

SPRWS Project Cost Estimate

SPRWS Project No. **12-71-19.1**

Project Name Raisbeck Section 19 Spring Development

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,272.50	$ 1,272.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS	1	$ 3,800.00	$ 3,800.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	1	$ 2,900.00	$ 2,900.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	400	$ 4.50	$ 1,800.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	400	$ 5.00	$ 2,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	13,997.50
Contingency - 15%	$	2,099.63
Budget for Project with Contingency	**$**	**16,097.13**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

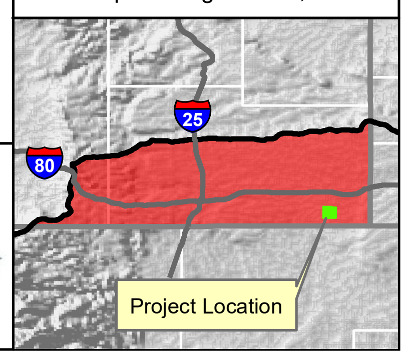
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T13N, R61W



Project 13-61-30.1: David martin, Stock Well, Pump, Tanks and Wildlife Habitat

Document Name: Martin_13-61-30.1
Date Saved: 9/6/2017

SPRWS PROJECT NUMBER: 13-61-30.1

David Martin new stock well, pump and tank

NW¼ SW ¼ Sec. 33 T13N R61W

Site Visit Date: Oct. 11, 2016

Project Name: David Martin Stock and wildlife water project

___David Martin_____________________________ (Applicant – Name of Entity)

_____David Martin_______________________________ (Contact)

_____437 County Road 154____ _______Carpenter WY__

_Laramie___ _______307-701-1772__ _______davpen93@msn.com___

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		X	☐	41.0634	104.2530 W
Solar Platforms			☐		
Pipeline		☐	☐		
Tanks		X	☐	41.0634	104.2530 W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	61W	30	NW¼ SE ¼

Project Description:

This project involves drilling a new well in the NWSW of Section 30, T13N, R61W. The pump will be an electrical submersible, and two tanks will be installed near the well. This project will provide stock water and support wildlife habitat.

As an alternative to a new well, perhaps a pipeline could be run from the existing domestic well, which is the Claude #1 Well, UW 7108. A pump test should be conducted on the existing well to determine the yield and drawdown and determine if the existing well can support the new uses.

Public Benefit:

____
____

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

____
_____LCCD____
____

Who is the owner of the project? ______David Martin______________

Who owns the land that the project is to be built on? _______David Martin__

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ___________________________________
____
____

What is the total estimated project cost? __________$36,800_________________________________

Photographs: None available

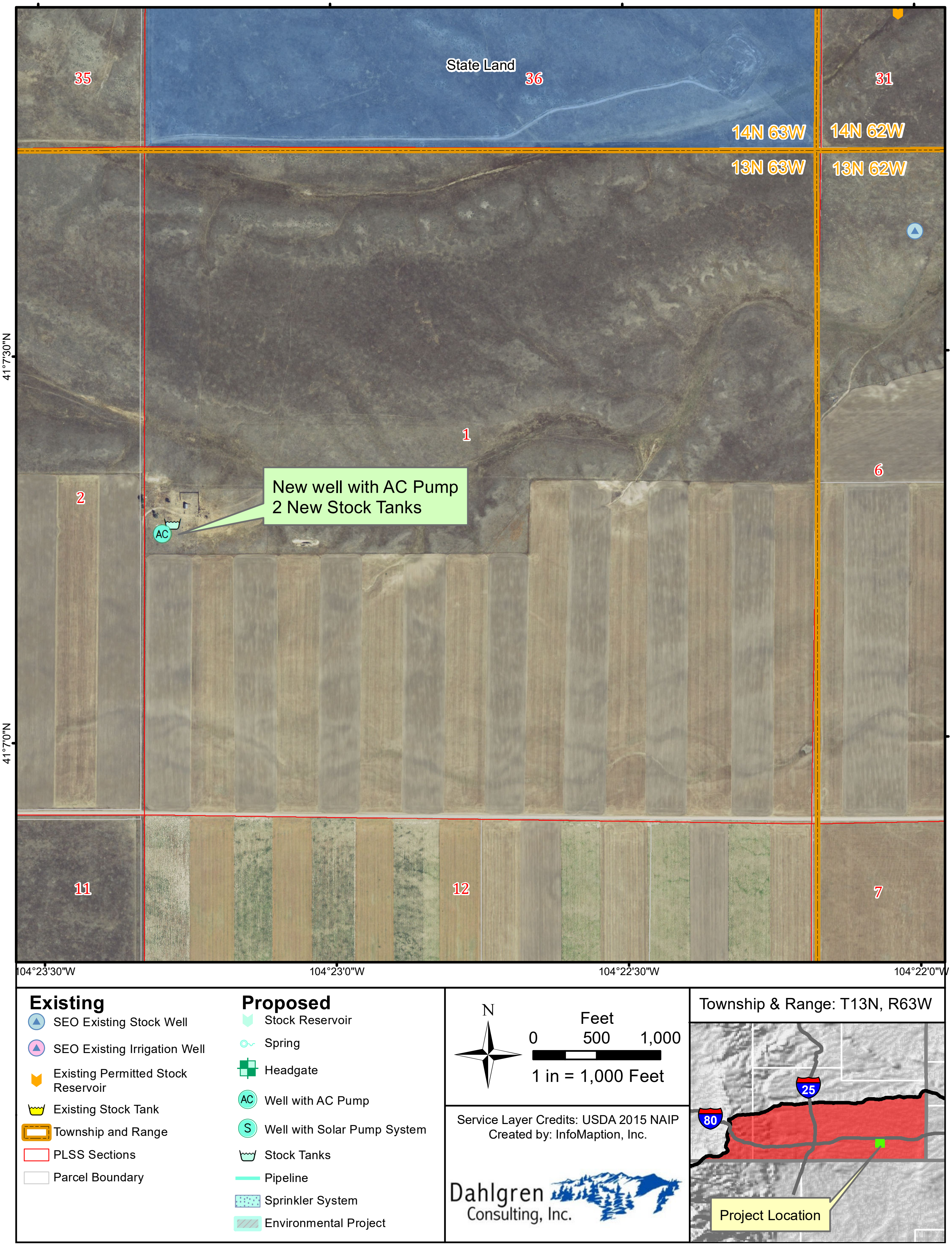
SPRWS Project Cost Estimate

SPRWS Project No. **13-61-30.1**

Project Name David Martin Stock and Wildlife water project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,910.00	$ 2,910.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	340	$ 40.00	$ 13,600.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	2	$ 2,900.00	$ 5,800.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	250	$ 3.50	$ 875.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$ 32,010.00
Contingency - 15%	$ 4,801.50
Budget for Project with Contingency	**$ 36,811.50**



Project 13-63-1.1: Cody Smith, New Well, Electric AC Pump and Tank

Document Name: CSmith_13-63-1.1
Date Saved: 9/7/2017

SPRWS PROJECT NUMBER: 13-63-1.1

NW ¼ SW ¼ Sec. 1, T13N R63W
Site Visit Date: Nov. 10, 2016

PROJECT NAME: Smith Section 1 Stock Well and Tank Project
Need new well permit

Cody Smith (Applicant – Name of Entity)

Cody Smith (Contact)

291 County Road 152 Carpenter, WY 82054

Laramie 307-630-6816

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		X	☐	41.1214 N	104.3889 W
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		X	☐	41.1214 N	104.3889 W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	63W	1	NW ¼ SW ¼

Project Description:

This project involves construction of new stock well, new submersible electric pump and installation of two 10’ diameter tire tanks near the well.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

LCCD

Who is the owner of the project? Cody Smith

Who owns the land that the project is to be built on? Carol Bradley

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?
All 640 acres in Section 1, T13N, R63W would benefit from this project. There is no stock water source in this pasture.

What is the total estimated project cost? $34,000

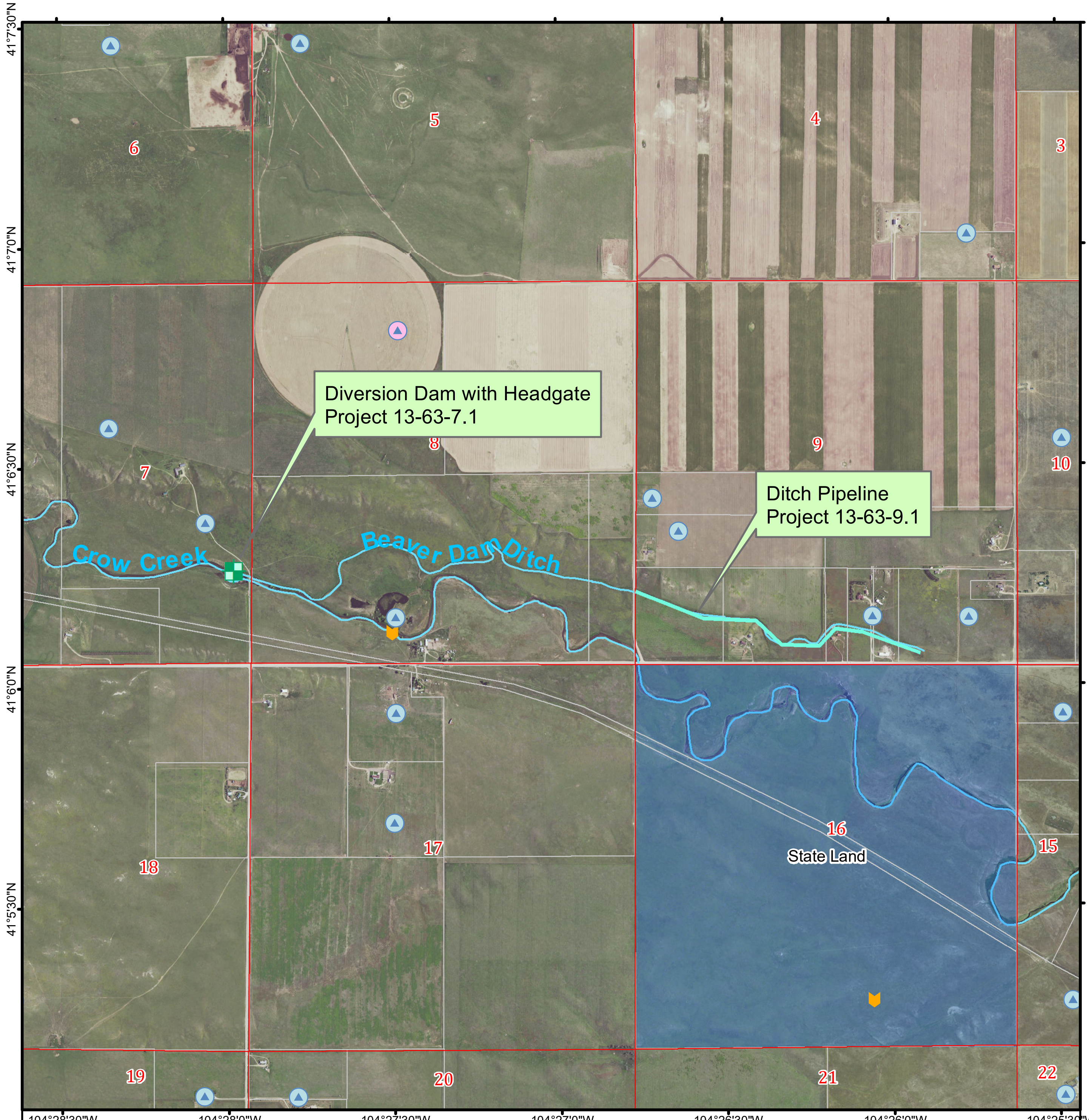
SPRWS Project Cost Estimate

SPRWS Project No. **13-63-1.1**

Project Name Cody Smith Section 1 Stock Well and Tank Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,687.50	$ 2,687.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	300	$ 40.00	$ 12,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	2	$ 2,900.00	$ 5,800.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	150	$ 5.00	$ 750.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	29,562.50
Contingency - 15%	$	4,434.38
Budget for Project with Contingency	**$**	**33,996.88**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

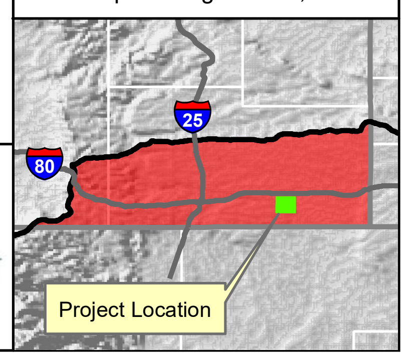
N

Feet

0 940 1,880

1 in = 2,000 Feet

Township & Range: T13N, R63W



Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Project 13-63-7.1 and 9.1: Beaver Dam Ditch Diversion and Pipeline

Document Name: Beaver Dam Ditch_13-63-7.1 and 9.1
Date Saved: 12/4/2017

SPRWS PROJECT NUMBER: 13-63-7.1

Beaver Dam Ditch Diversion Dam and Headgate Rehabilitation

SE ¼ SE ¼ Section 7, T13N R63W

Site Visit Date: March 10, 2017

PROJECT NAME: Beaver Dam Ditch Diversion Dam and Headgate Rehabilitation

Red Baldy Ranch, LLC ____________________ (Applicant – Name of Entity)

Ed Ferguson ____________ (Contact)

785 Road 140

Carpenter, WY 82054

Laramie (307) 630-2047 ____________________

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation			X	41.1043N	104.4664W
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	63W	7	SESE

Project Description:

Rehabilitation work is recommended for the existing diversion dam and headgate of the Beaver Dam Ditch. This water right is a territorial appropriation, Crow Creek Court Decree priority No. 41 for 10 cfs. This structure is a concrete diversion dam that diverts water into the ditch. This concrete dam is approximately 8 - 10’ tall. The head gate is on the north side of the creek and a parshall flume is located approximately 200 yards downstream of the head gate.

The owners recently have started repairs to the diversion dam. So the immediate or short term condition of the diversion dam will be improved by this work. However, the diversion dam does create a barrier to fish passage and the recent work will not address this issue. The dam could be rehabilitated to allow better and easier passage of fish. Also, the headgate and the parshall flume or measurement device need to be repaired or replaced.

The exact work to be done will need additional study and design efforts; therefore no detailed cost estimates were prepared for this project. The work funded through the Small Water Program will be less than the $135,000 limit. And in keeping with WWDC policy, the parshall flume or measurement device will not be funded with WWDC funds.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

____

Who is the owner of the project? Red Baldy Ranch, LLC

Who owns the land that the project is to be built on? Wyoming Construction Services, Inc.

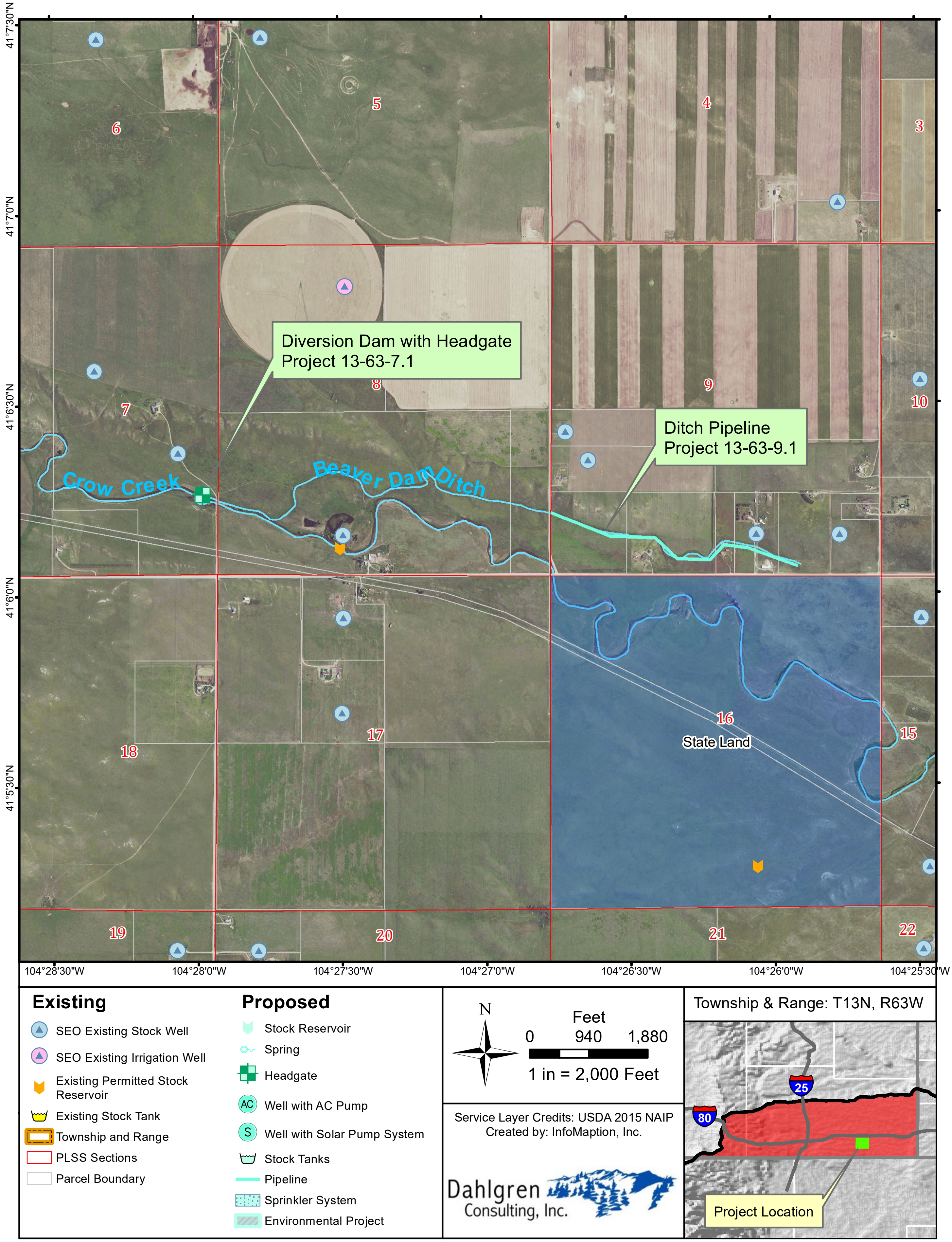
Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ______________________________
The land irrigated through the ditch will benefit from this project. Also, improving fish movement and removing the barrier caused by the dam would benefit a large reach of Crow Creek.

____

What is the total estimated project cost? Additional design work is required to develop final cost estimates for this project. Preliminary construction cost estimate without contingency, engineering or fees is approximately $100,000.



Project 13-63-7.1 and 9.1: Beaver Dam Ditch Diversion and Pipeline

Document Name: Beaver Dam Ditch_13-63-7.1 and 9.1
Date Saved: 12/4/2017

SPRWS PROJECT NUMBER: 13-63-9.1

Beaver Dam Ditch Pipeline

SW ¼ Section 9, T13N R63W

Site Visit Date: March 10, 2017

PROJECT NAME: Beaver Dam Ditch Pipeline

Red Baldy Ranch, LLC (Applicant – Name of Entity)

Ed Ferguson (Contact)

785 Road 140

Carpenter, WY 82054

Laramie (307) 630-2047

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation			X	41.1019N	104.4394W
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	63W	9	SW

Project Description:

This project will replace the open ditch with a pipeline. This work will reduce seepage in the ditch and improve efficiency of the system. A significant amount of the water diverted at the headgate and diversion dam does not reach the irrigated land.

Ultimately, approximately one mile of pipeline will be installed. The exact work to be done will need additional study and design efforts; therefore no detailed cost estimates were prepared for this project. The work funded through the Small Water Program will be less than the $135,000 limit.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

Who is the owner of the project? Red Baldy Ranch, LLC

Who owns the land that the project is to be built on?

The ditch flows through various landowners

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

The land irrigated through the ditch will benefit from this project. Also, improving the efficiency of this ditch could make more water available in the lower reaches of Crow Creek, because less water would be diverted from the creek to satisfy the irrigation right.

What is the total estimated project cost?

The estimated installed cost for 24" Class 80 – SDR -51 plastic irrigation pipe is $50/LF. The preliminary construction costs for installing one mile of pipe, with minor miscellaneous work including site reclamation and re-vegetation is approximately $300,000.

Additional work is required to complete the design for this project and to develop more detailed cost estimates.

SPRWS Project Cost Estimate

SPRWS Project No. **13-63-9.1**

Project Name Beaver Dam Ditch Pipeline

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 27,375.00	$ 27,375.00
2	Furnish and Install 24" Plastic Irrigation Pipe SDR 51 - Class 80	LF	5,280	$ 50.00	$ 264,000.00
3	Miscellaneous Valves	Ea	1	$ 3,500.00	$ 3,500.00
4	Site Revegetation and reclamation	Acre	5.00	$ 1,250.00	$ 6,250.00

Sub-Total Estimated Component Costs	$ 301,125.00
Contingency - 15%	$ 45,168.75
Budget for Project with Contingency	**$ 346,293.75**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

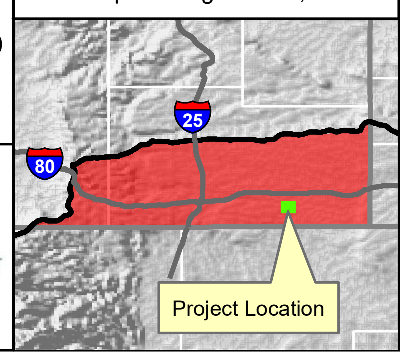
N

Feet
0 500 1,000
1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T13N, R63W



Project 13-63-16.1:Evans State Section 16 Solar Pump

Document Name: Evans 13-63-16.1
Date Saved: 12/5/2017

SPRWS PROJECT NUMBER: 13-63-16.1
New Solar Pump and Tank
SE ¼ SW ¼ Sec. 16 T13N R63W

PROJECT NAME: Evans State Section 16 Stock water project

Jeremy Evans and the State of Wyoming — Applicant – Name of Entity)

Jeff Geyer — Contact

Laramie County Conservation District
11221 Highway 30
Cheyenne, WY 82009

Laramie	307-772-2600	jgeyer@lccdnet.org
(County)	(Phone)	(Email)

This project is located on a School Section – Sec 16, T13N, R63W.

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms			X	41.0898N	104.4389W
Pipeline					
Tank at well		X		41.0898N	104.4389W
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	63W	16	SE SW

Project Description:

This project involves installation of a new solar pump system into an existing well. No permit was found for this well, so a well permit will be required. The solar pump will replace a windmill. Also, the project will include installation of a new bottomless tank near the well.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District. State of Wyoming – this is a school section.

____

Who is the owner of the project? ______State of Wyoming – Jeremy Evans

Who owns the land that the project is to be built on? _______State of Wyoming

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ______________________________________

This project will improve stock water for all over half of Sec 16, T13N, R63W. Also the stock well and tank will provide an alternative to livestock grazing and drinking in the riparian area along Crow Creek.

What is the total estimated project cost?

$26,275 without contingency, engineering or permitting costs.

SPRWS Project Cost Estimate

SPRWS Project No. **13-63-16.1**

Project Name Evans State Section 16 Stock water project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,388.75	$ 2,388.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 4.50	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$	26,276.25
Contingency - 15%	$	3,941.44
Budget for Project with Contingency	**$**	**30,217.69**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

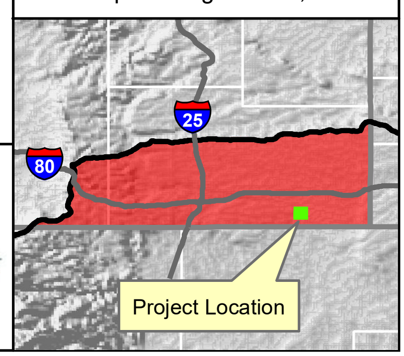
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T13N, R63W



Project 13-63-25.1: Gary Smith, New Recharge Reservoir

Document Name: GSmith_13-63-25.1
Date Saved: 9/7/2017

SPRWS PROJECT NUMBER: 13-63-25.1
SE ¼ SW ¼ Section 25, T13N R63W
Site Visit Date: Nov. 10, 2016

PROJECT NAME: Smith Section 25 Stock Reservoir Project
New project will need a new well permit

Gary Smith (Applicant – Name of Entity)

Gary Smith (Contact)

4696 Road 204 Carpenter, WY 82054

Laramie # for Cody Smith 307-630-6816

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		X	☐	41.0586 N	104.3817 W
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		☐	☐		
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		X	☐	41.0586 N	104.3817 W
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	63W	25	SE ¼ SW ¼

Project Description:

This project involves construction of an off-channel stock reservoir on the west side of Crow Creek. This project will provide storage for stock water and wildlife and could provide groundwater recharge benefits. A detailed survey and final design will need to be completed prior to submitting the application for this project. The State Engineer's recent decisions on Crow Creek water right applications likely will impact the ability to permit this project.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).
LCCD

Who is the owner of the project? Gary Smith

Who owns the land that the project is to be built on? Gary Smith Family Trust

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

This project will improve the stock water supply in the SW ¼ of Section 25. Also, there are wildlife benefits from this project. And there may be groundwater recharge benefits.

What is the total estimated project cost? $100,000, but additional design will be necessary to complete this project.

Photograph: Showing the reservoir site. Crow Creek is in the foreground of the photo.

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

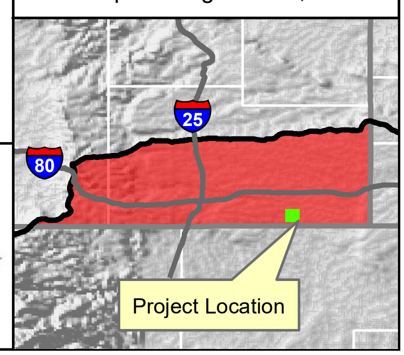
N

Feet
0 500 1,000
1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T13N, R63W



Project 13-63-34.1: Cody Smith, New Well, Pipeline and Tank

Document Name: CSmith_13-63-34.1
Date Saved: 9/7/2017

SPRWS PROJECT NUMBER: 13-63-34.1
NW ¼ NW ¼ Sec. 34 T13N R63W
Site Visit Date: Nov. 10, 2016

PROJECT NAME: Smith Section 34 Stock Well and Tank Project
Need new well permit

___Cody Smith___________________________ (Applicant – Name of Entity)

_____Cody Smith _________________________________ (Contact)

___291 County Road 152_____ ______________ _______Carpenter, WY _______82054__

_Laramie___ _____________307-630-6816__ ___________________________________

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		X	☐	41.0550 N	104.4275 W
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		X	☐	41.0550 N	104.4275 W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	63W	34	NW ¼ NW ¼

Project Description:

This project involves construction of new stock well, new submersible electric pump and installation of two 10’ diameter tire tanks near the well.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

LCCD

Who is the owner of the project? Cody Smith

Who owns the land that the project is to be built on? John Farmer

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

320 acres in the west ½ of Section 34, T13N, R63W would benefit from this project. There is no stock water source in this pasture.

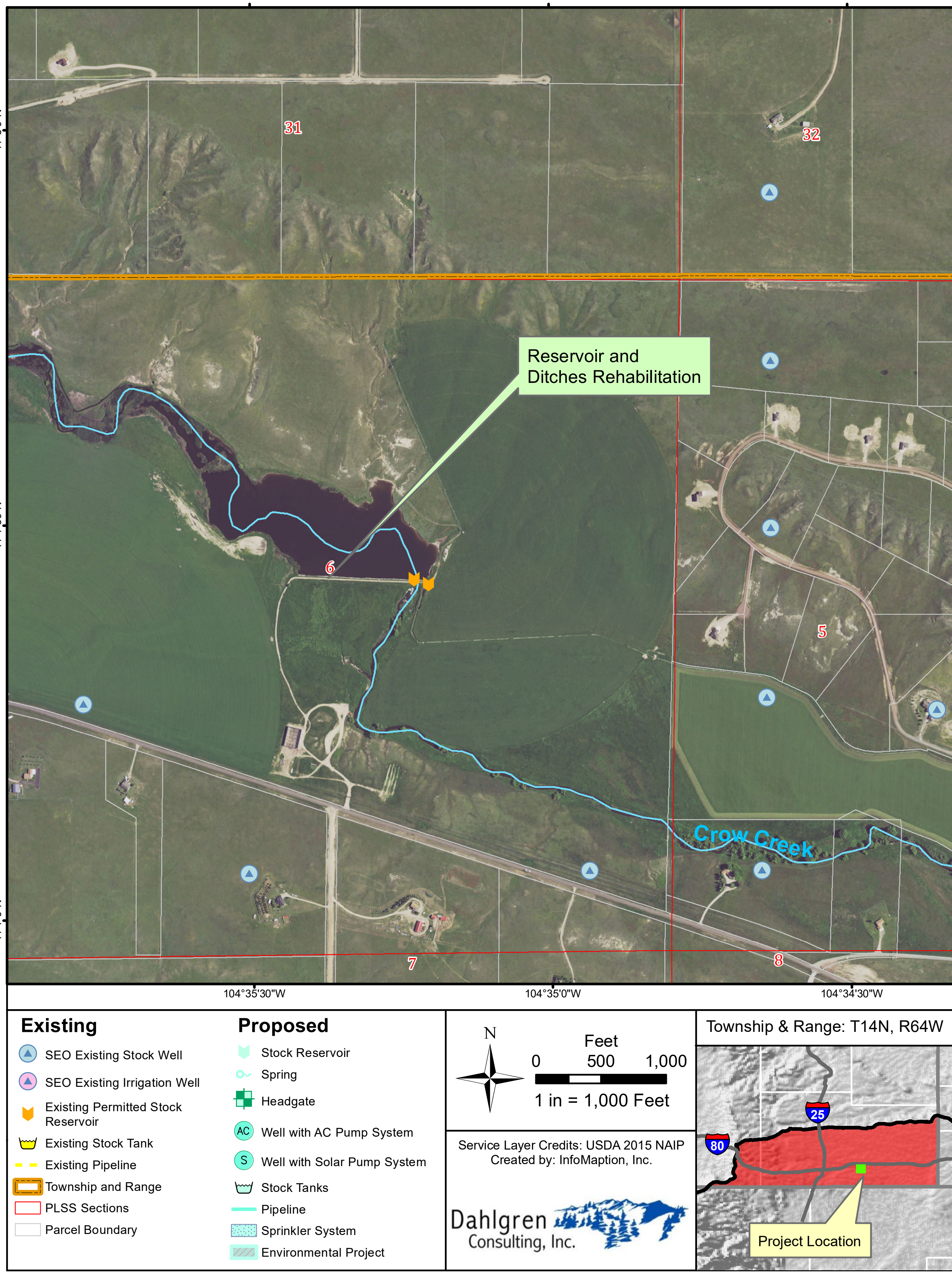
What is the total estimated project cost? $28,500

SPRWS Project Cost Estimate

SPRWS Project No.	**13-63-34.1**
Project Name	Smith Section 34 Stock Well and Tank Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,265.00	$ 2,265.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	200	$ 40.00	$ 8,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	2	$ 2,900.00	$ 5,800.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	150	$ 3.50	$ 525.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$ 24,915.00
Contingency - 15%	$ 3,737.25
Budget for Project with Contingency	**$ 28,652.25**



Project 13-64-6.1 and 6.2: Ullman Reservoir and Ditches Rehabilitation

Document Name: Ullman_13-64-6.1 and 6.2
Date Saved: 11/21/2017

SPRWS PROJECT NUMBERS: 13-64-6.1 and 6.2

Ullman No. 1 Reservoir Rehabilitation

And

Associated Ullman Ditches Rehabilitation

SE ¼ NE ¼ Section 6, T13N R64W

Site Visit Date: March 10, 2017

PROJECT NAME: Ullman No. 1 Reservoir Rehabilitation and Ullman Ditches Rehabilitation

Red Baldy Ranch, LLC (Applicant – Name of Entity)

Ed Ferguson (Contact)

785 Road 140

Carpenter, WY 82054

Laramie (307) 630-2047

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation – Reservoir Rehab			X	41.1230N	104.5896W
Irrigation – Ditches Rehabilitation			X	41.1230N	104.5896W
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	64W	6	SE NE

Project Description:

These projects involve repair and rehabilitation of the Ullman Reservoir, permit No. 7286 RES and rehabilitation of the pumps and headgates for the associated Ullman No. 1 and No. 2 Ditches, which are Territorial Appropriations. The Ullman Reservoir and the Ullman Ditches are adjudicated water rights. The reservoir stores approximately 164 AF, with an additional 124 AF of flood control storage. Combined, the Ullman Ditches divert 10.98 cfs. The dam acts as a diversion dam for the ditches and the water is conveyed from the dam, through a pipe and ditch to two pumps, which pump water and supply irrigation sprinklers. Turbulent fountains are installed before the pumps.

The dam and reservoir was constructed in 1970. All of the outlet pipes through the dam, including the principal spillway (drop inlet) and low level outlet pipe through the dam and 24" outlet pipe through the dam, which supplies water to the ditch pumps need repair and rehabilitation. Also, the ditch and pipelines to the pumps need rehabilitation.

The exact work to be done will need additional study and design efforts; therefore no detailed cost estimates were prepared for this project. However, it appears feasible to phase the work required at the Ullman Reservoir and/or ditches so that some of the projects could be included in the Small Water Project program.

Public Benefit:

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Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Red Baldy Ranch, LLC

Who owns the land that the project is to be built on? Red Baldy Ranch, LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ______________________________

The land irrigated through the ditches will benefit by the improvements to the irrigation supply system. Rehabilitation of the dam and reservoir would improve the condition of it and long term safety of the structure.

What is the total estimated project cost?

Additional design work is required to develop final cost estimates for these projects. Phases or parts of the overall rehabilitation project could be constructed and some of these phases could qualify as a Small Water project.

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

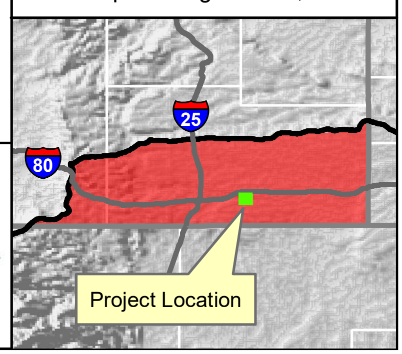
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T17N, R65W



Project 13-65-2.1 and 2.2: Blue Ribbon Estates
Erosion Control and Constructed Ponds

Document Name: Blue Ribbon Estates_13-65-2.1_2.2
Date Saved: 11/21/2017

SPRWS PROJECT NUMBER: 13-65-2.1 and 2.2

Blue Ribbon Section 2 Ponds and Environmental Projects Section 2, T1N, R66W

Site Visit Date: March 10, 2016

PROJECT NAME: Blue Ribbon Section 2 Ponds and Environmental Projects

Blue Ribbon Estates, LLC (Applicant – Name of Entity)

Will Edwards (Primary Contact)

506 Shoshone Ave (Contact Address)

Cheyenne, Wyoming 82009

Laramie 307-634-8800 will@edwards-development.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir	3	X		41.1250N	104.6230W
Well					
Solar Platforms					
Pipeline					
Tanks – 1 of 1					
Spring Development					
Wetland					
Environmental			X	41.1277N	104.6333/w
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	65W	2	

Project Description:

There are two projects described in this write-up, both located in Section 2, T13N, R65W on land owned by Blue Ribbon Estates, LLC. One project (13-65-2.1) involves construction of a small reservoir or reservoirs near Crow Creek. The other project (13-65-2.2) involves bank stabilization and erosion control along Crow Creek and a side channel.

We were originally contacted concerning a pond or ponds (small reservoirs) that would be constructed along Crow Creek to provide stock water, wildlife habitat, and potentially groundwater recharge. Three potential sites for ponds or small reservoirs, shown on the accompanying map, were identified. Additional design work is required before a Small Water Project application could be submitted. Conceptually, the design of these reservoirs would be similar to the Emmanuel Farms Reservoir, which was designed by the NRCS, which means there would be a small diversion dam and supply ditch. The water would flow through the reservoirs and return to Crow Creek. Also, these reservoirs potentially would be filled by seepage from the creek and from groundwater. Due to the recent State Engineer's Office opinions concerning Crow Creek water administration, it may be difficult to obtain permits for these reservoirs.

During the site visit and survey for the reservoirs, we observed erosion along Crow Creek and in an un-named side channel north of the main creek channel. The erosion in Crow Creek is located below the diversion dam and head gate for the WHR No. 2 Ditch, Permit No. 17170. The erosion in the side channel is located near where a gas line has been constructed. Also, water from the WHR No. 2 Reservoir principal spillway flows through this side channel.

The erosion control would provide environmental benefits by reducing sedimentation, potentially providing fish habitat, and would protect the gas line and the WHR No. 2 Ditch diversion dam and head gate. Although final design is necessary prior to submitting an application for a Small Water Project, preliminary costs for the erosion control efforts are $25,000 for the work at each site or a total of $50,000.

Public Benefit:

Project Participants:

Laramie County Conservation District,

Who is the owner of the project? Blue Ribbon Estates, LLC

Who owns the land that the project is to be built on? Blue Ribbon Estates, LLC

Which WWDC Watershed Study Boundary is this project within?

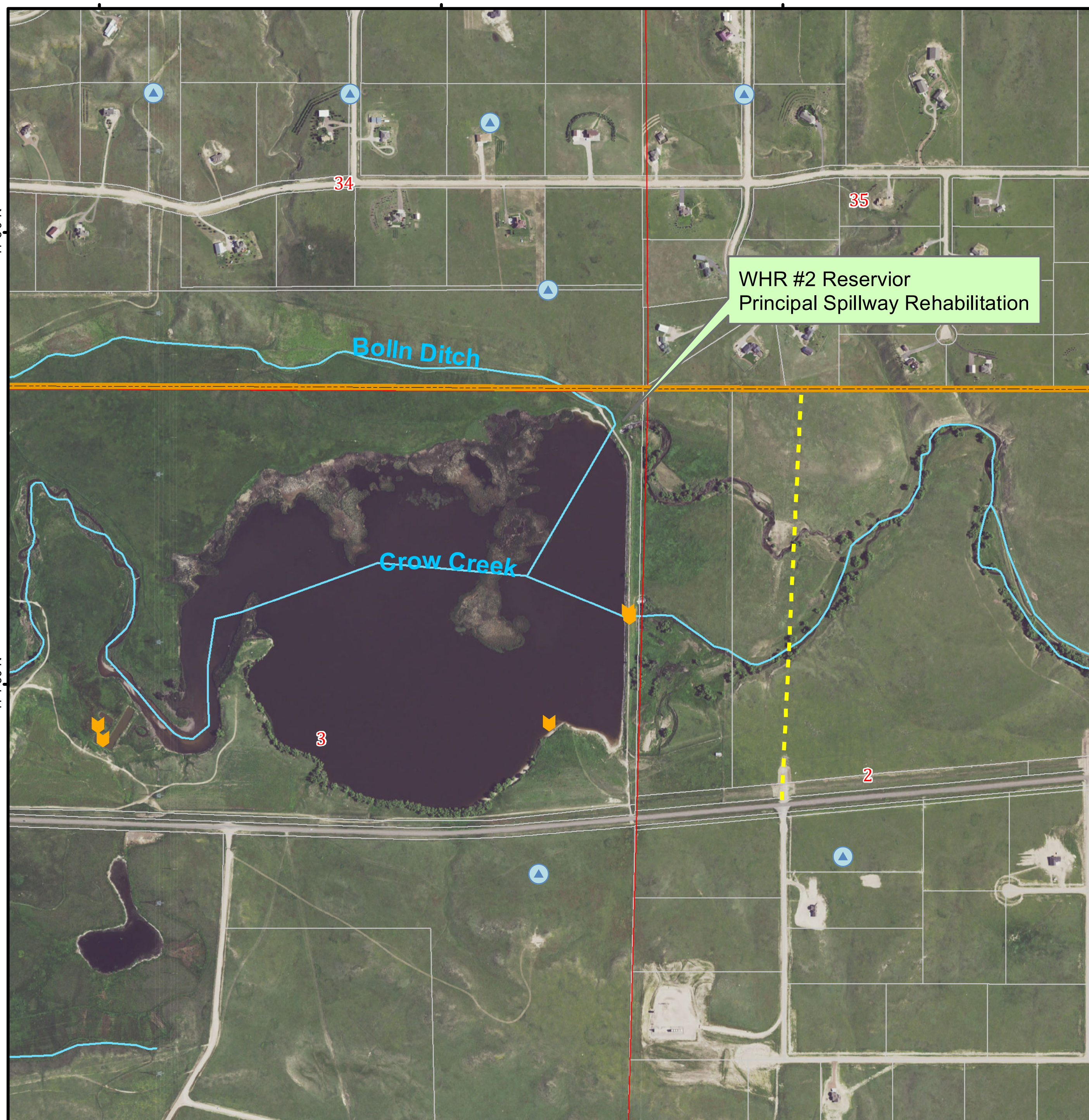
South Platte River Watershed

How many acres will be benefited by this project?

The erosion control efforts will benefit the WHR No. 2 ditch and the entire reach of Crow Creek in this area.

What is the total estimated project cost?

Additional engineering and cost estimates will be done before the final project application is submitted. The reservoir work funded through the Small Water Program is estimated to cost $135,000. The erosion control costs are estimated to be $25,000 for each site or $50,000 total.



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System

N

Feet

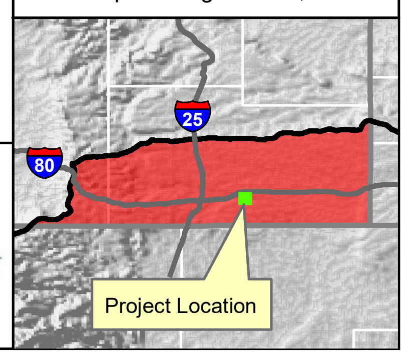
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T13N, R65W



Project 13-65-3.1: WHR #2 Reservoir Principal Spillway Rehabilitation

Document Name: WHR#2_13-65-3.1
Date Saved: 11/22/2017

SPRWS PROJECT NUMBERS: 13-65-3.1

WHR No. 2 Reservoir Spillway Rehabilitation

NE ¼ NE ¼ Section 3, T13N R65W
Site Visit Date: March 10, 2017

PROJECT NAME: WHR No. 2 Reservoir Spillway Rehabilitation

Red Baldy Ranch, LLC (Applicant – Name of Entity)

Ed Ferguson (Contact)

785 Road 140

Carpenter, WY 82054

Laramie (307) 630-2047

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation – Reservoir Rehab			X	41.1295N	104.6374W
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	65W	3	NE NE

Project Description:

This project involves repair and/or rehabilitation of the WHR #2 Reservoir principal spillway. The WHR #2 Reservoir has two water right permits, the original permit No. 4032 Res and enlargement permit, No. 4640 RES. In total, this reservoir stores approximately 877 acre-feet. The enlarged dam and reservoir was originally constructed in 1937 with a concrete principal spillway on the north end of the dam. The emergency spillway for the dam is located on the south end of the dam.

In 1981, the original concrete principal spillway failed and was reconstructed with a 10' diameter CMP drop inlet that discharges into an 8' diameter CMP discharge pipe. At this time, there are no known serious problems or concerns about the principal spillway.

However, the re-built principal spillway structure is over 35 years old and surficial or typical age related conditions have been observed. Repair and/or rehabilitation of the principal spillway structure would extend the life and the safety of the dam and reservoir. Also, the operation of the principal spillway could be improved during this project.

The exact work to be done will need additional study and design efforts; therefore no detailed cost estimates were prepared for this project. A thorough project to repair and rehabilitate the principal spillway would likely meet the funding limits of the Small Water Project program.

Public Benefit:

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Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Red Baldy Ranch, LLC

Who owns the land that the project is to be built on? Red Baldy Ranch, LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ________________________________

Rehabilitation of the principal spillway would improve the condition of it and assure the long term safety of the WHR #2 Reservoir, which would be important for the entire length of Crow Creek below the reservoir.

What is the total estimated project cost?

Additional design work is required to develop final cost estimates for these projects.

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

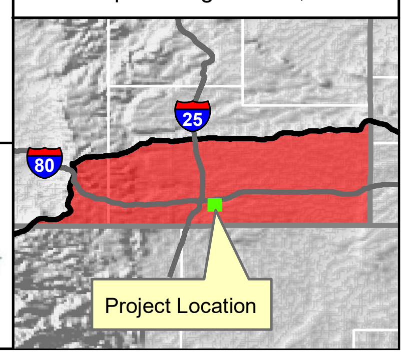
Feet
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T13N, R66W



Project 13-66-16.1: Sweetgrass Land Company LLC , Water Quality Pond and Wetland

Document Name: Sweetgrass_13-66-15.1
Date Saved: 10/26/2017

SPRWS PROJECT NUMBER: **13-66-16.1**

Sweetgrass Pond and Wetlands

NW ¼ NW ¼ Section 16, T15N, R66W

Site Visit Date: Sept 22, 2017

PROJECT NAME: Sweetgrass Pond and Wetlands

Sweetgrass Land Company, LLC (Applicant – Name of Entity)

1825 Campstool Road (Contact Address)

Cheyenne, Wyoming 82001

Laramie	307-630-3185	landoflum@aol.com
(County)	(Phone)	(Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tanks – 1 of 1					
Spring Development					
Wetland		X		41.1014	104.7879
Environmental		X		41.1014	104.7879
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

Legal Description

Township	Range	Section	Quarter-Quarter
15N	66W	16	NW NW

Project Description:

This project proposes the development a 1acre open water pond and constructed wetlands. The pond and wetlands will provide flood control, water quality, and wildlife habitat benefits. The proposed project is uniquely located to provide wildlife viewing and education opportunities to the surrounding area.

Laramie County Community College is located north of the site; south of this site, an 80-acre City of Cheyenne Regional Park is proposed; existing urban and sub-urban development is located to the west of the site; and east of the site is the future Sweetgrass development.

Public Benefit:

Project Participants:

Laramie County Conservation District, Sweetgrass Development, City of Cheyenne

Who is the owner of the project? Sweetgrass Land Company, LLC

Who owns the land that the project is to be built on? Sweetgrass Land Company, LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

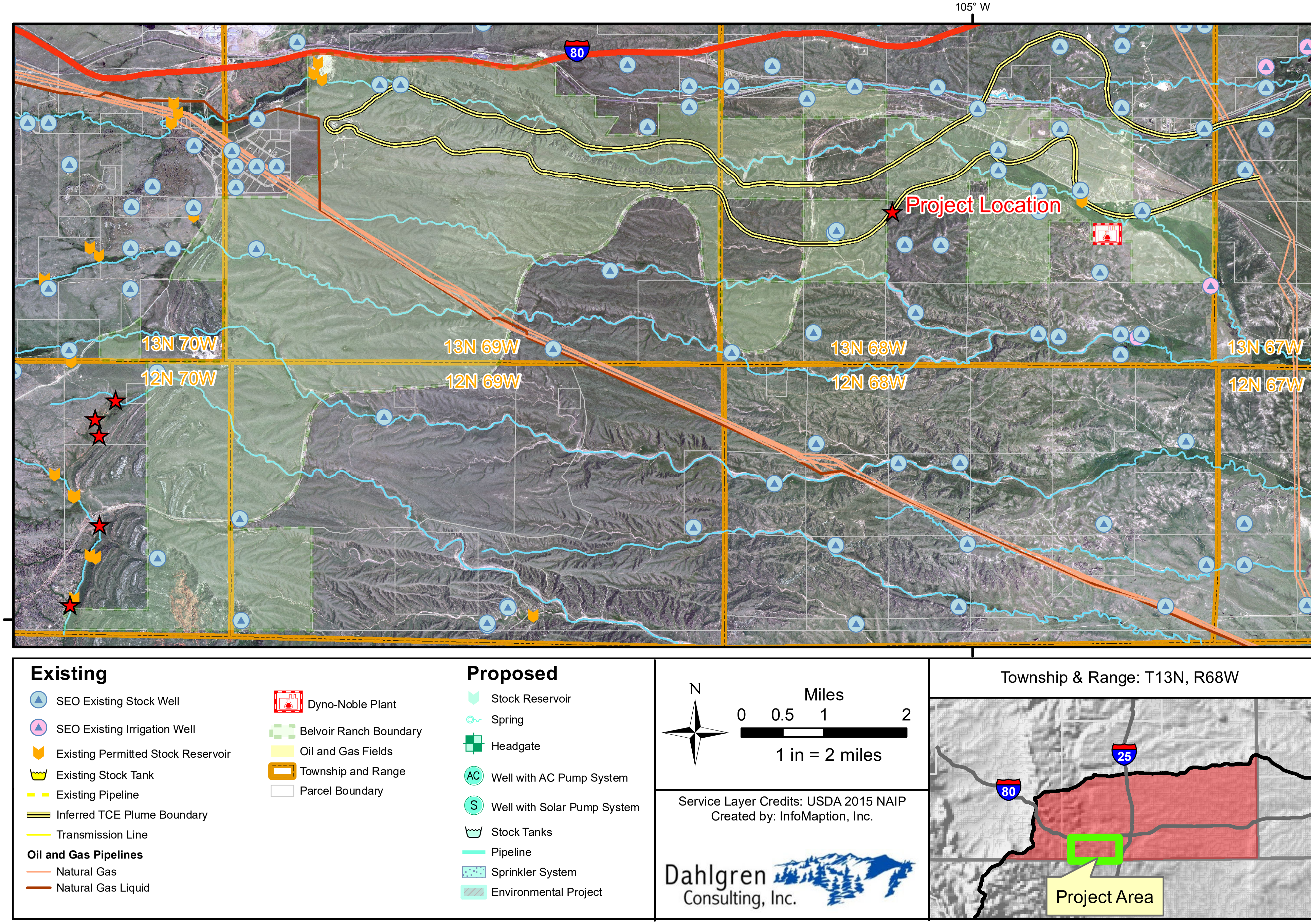
How many acres will be benefited by this project?

This project will provide control and water quality benefits for approximately 1920 acres. The wildlife habitat will provide additional benefits.

What is the total estimated project cost?

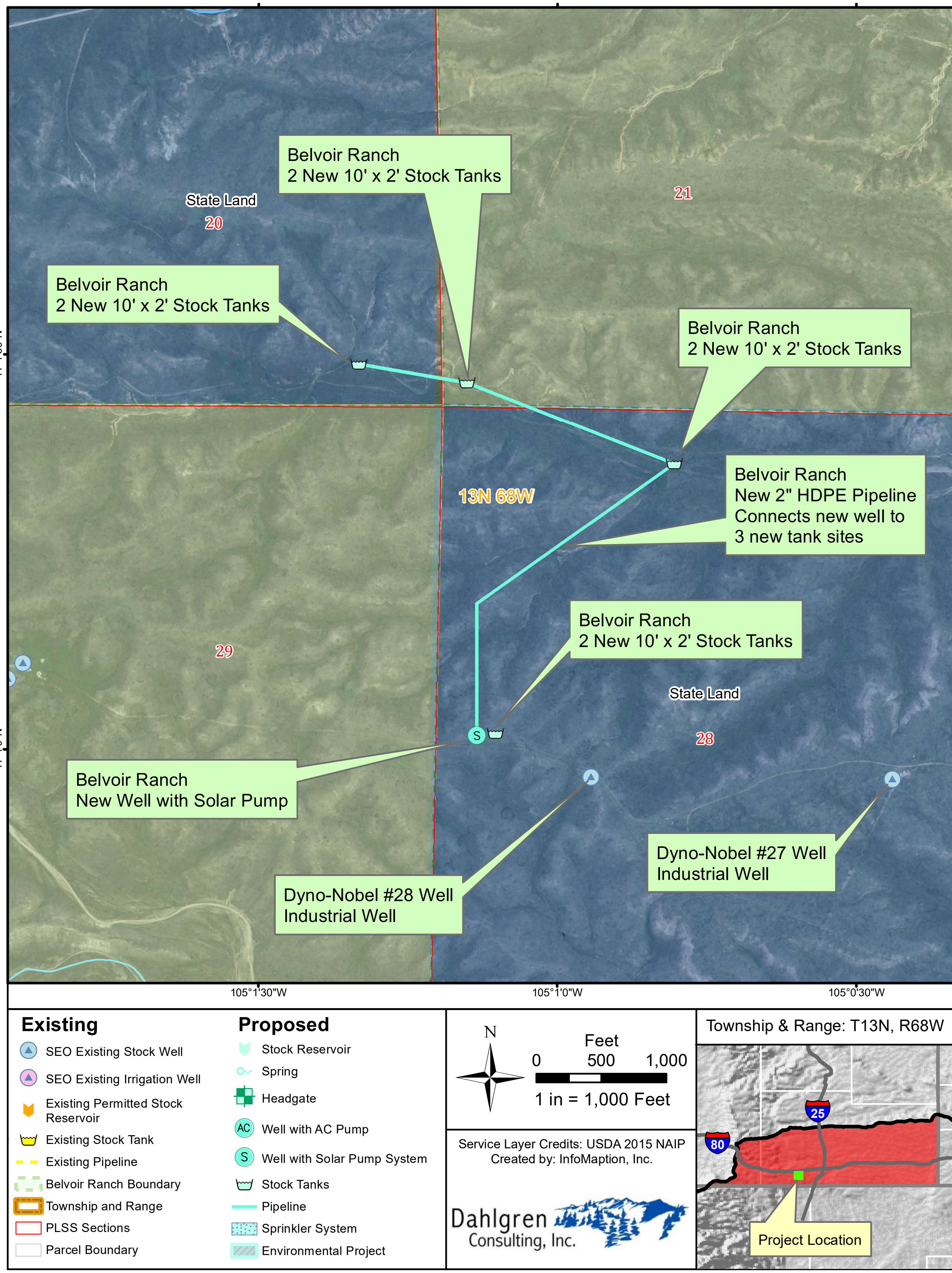
Additional engineering and cost estimates will be done before the final project application is submitted. The work funded through the Small Water Program is estimated to cost $135,000.

Photographs:



Belvoir Ranch Overview

Document Name: Belvoir_Ranch_Overview
Date Saved: 9/1/2017



Project 13-68-28.1: Belvoir Ranch Stock Water

Document Name: Belvoir_Ranch_13-68-28.1
Date Saved: 9/1/2017

SPRWS PROJECT NUMBER: 13-68-28.1
Stock Well and Stock Tank
Section 28, T13N, R68W
Site Visit Date: July 10, 2017

PROJECT NAME: Belvoir Ranch Well, Pump, Pipeline and Tanks

Belvoir Ranch – City of Cheyenne and the State of Wyoming ___ (Applicant – Name of Entity)

____ (Contact)

__________________________ __________________________________

_Laramie___ ____________________ __________________________________

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		x	☐	41.0667N	105.01889W
Solar Platforms		x	☐		
Pipeline		☐	☐		
Tanks - 1		x	☐	41.0667N	105.01889W
Tanks – 2		x		41.0715N	105.0130W
Tanks -3		x		41.0748N	105.0189W
Tanks - 4		x		41.0747N	105.0223W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	68W	28	SW ¼ NW ¼

Project Description:

This project involves the construction of a new stock well, currently proposed to be located in NW ¼ of Section 28, which is a School Section. There is 3 phase power near this location. Dyno-Nobel has two wells near the proposed well. The new well will be drilled, tanks installed near the well, a pipeline and tanks would be installed at three additional locations. The well site is near the top of a ridge. Three of the tank sites are located downhill from the well.

Specifically, the project will include:

- Drilling of a new well. The well will be approximately 400' deep.
- A new electrical pump would be installed in the well. Electric service would be provided from the existing powerline.
- Four sets of tanks would be installed. At each location – 2 10' diameter by 2' deep stock tanks would be installed. Miscellaneous valves and floats would be installed in the tanks.
- Approximately 4800' of pipeline would run from the well to the tanks.

Public Benefit:

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Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Belvoir Ranch – City of Cheyenne

Who owns the land that the project is to be built on? State of Wyoming

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? All 640 acres in Section 28, plus the Southwest part of Section 21 and the Southeast part of Section 20 will benefit from this project.

What is the total estimated project cost? $89,600

Photo shows the approximate location of the well and is looking north toward the tank locations.

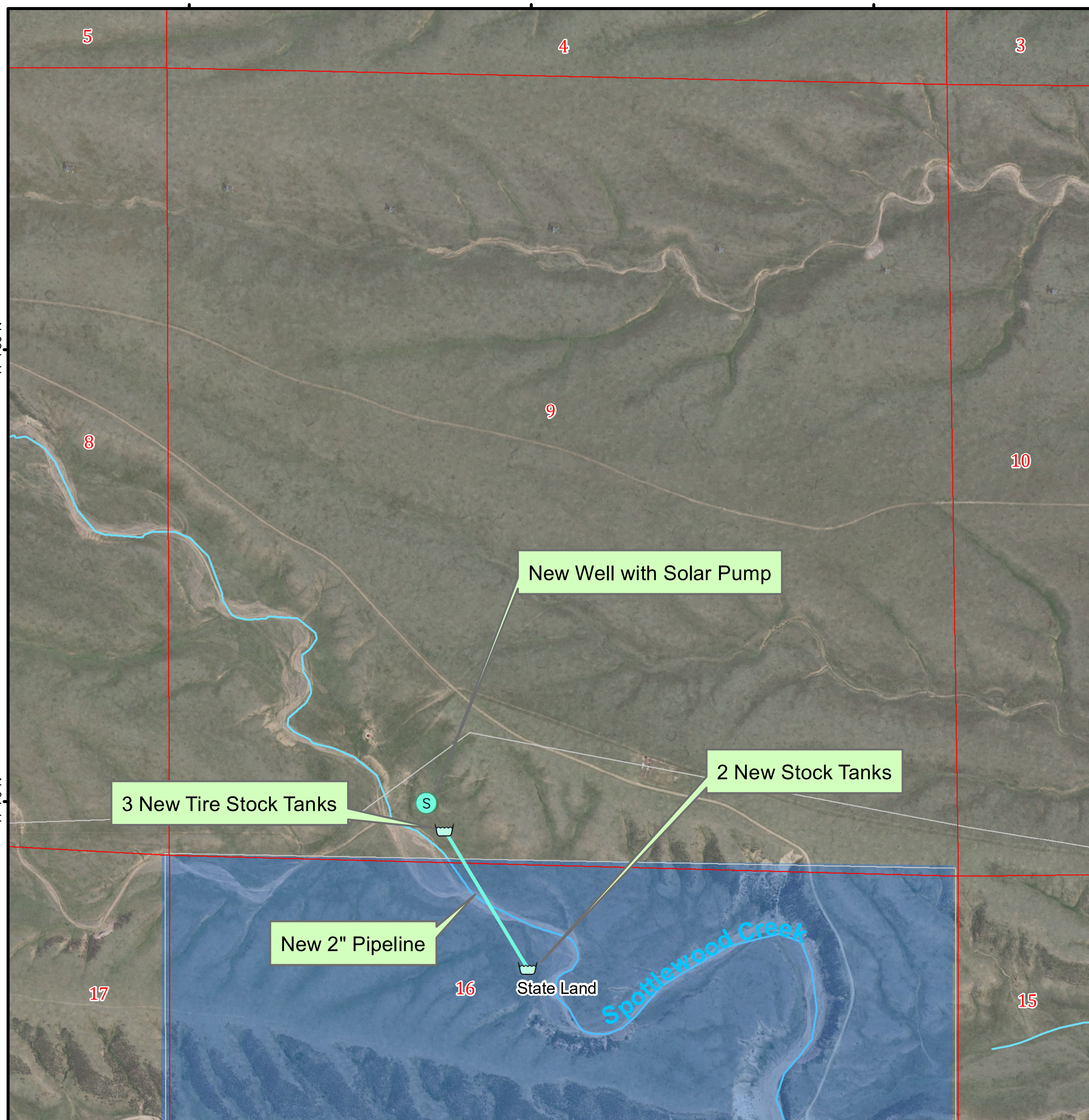
SPRWS Project Cost Estimate

SPRWS Project No. **13-68-28.1**

Project Name Belvoir Well, Pipeline, and Tanks

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 7,082.50	$ 7,082.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI	0.25	$ 20,000.00	$ 5,000.00
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	8	$ 2,900.00	$ 23,200.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	4,800	$ 3.50	$ 16,800.00
7	Miscellaneous Valves and piping at tank(s)	Ea	4	$ 500.00	$ 2,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$ 77,907.50
Contingency - 15%	$ 11,686.13
Budget for Project with Contingency	**$ 89,593.63**



Existing

- SEE Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

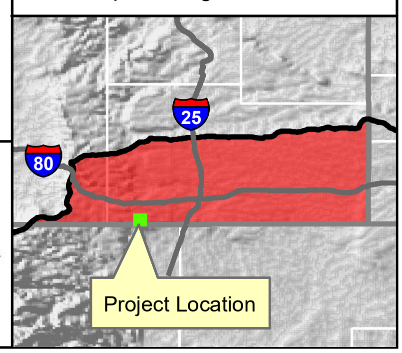
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T12N, R69W



Project 12-69-9.1: Soapstone Grazing Association, New Well and Tanks

Document Name: Soapstone_12-69-9.1
Date Saved: 9/7/2017

SPRWS PROJECT NUMBER: 12-69-9.1

Soapstone Section 9 Well and Stock Water project
SE ¼ SW ¼ Sec. 9 T12N R69W

PROJECT NAME: Soapstone Grazing Association Section 9 Well and Stock Water project

Soapstone Grazing Association (Applicant – Name of Entity)

Mike Gallegos (Contact)

118 S. Cribbon Cheyenne, WY 82007

Laramie 970-219-3884 rgallegos6@aol.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		X		41.0167N	105.1276W
Solar Platforms		X		41.0167N	105.1276W
Pipeline		X	☐		
Tanks at well		X	☐	41.0167N	105.1276W
2nd Tanks in Sec 16		X		41.0139N	105.1252W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	69W	9	SE ¼ SW ¼

Project Description:

This project involves the construction of a new well, solar pump, tanks and pipeline. The existing windmill, located on another landowner, is an un-reliable source of water. Also, no permit for this windmill was found.

The new well would be located on the Soapstone Grazing association property in Section 9, T12N,R69W. One set of tanks would be installed near the well and a second set of tanks could be located in Section 16, which is a State section, to the south of the well location.

Due to the remote location and difficult access a battery of tanks is proposed to store water at the well, because it will be difficult to construct a bottomless tank.

Specifically this project will involve:

- A new 400' deep well; a solar pump and solar platform; 3-10' diameter tire tanks at the well; a second set of tanks, consisting of 2 -10' diameter tanks would be constructed in Section 16 to the south of the well; approximately 1200' of pipeline; and miscellaneous valves.

Public Benefit:

____

____

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

____

____

Who is the owner of the project? ______Soapstone Grazing Association____________________

Who owns the land that the project is to be built on? _______Mike Gallegos_______________

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? _____________________________________
Most of the north ½ of Section 16, which is a State section could be improved by this project. Also, the pasture owned by Soapstone Grazing Association in the South part of Section 9 would receive water from this project.

What is the total estimated project cost? _____$61,250_____________________________________

Photograph shows the Section 9 Well location.

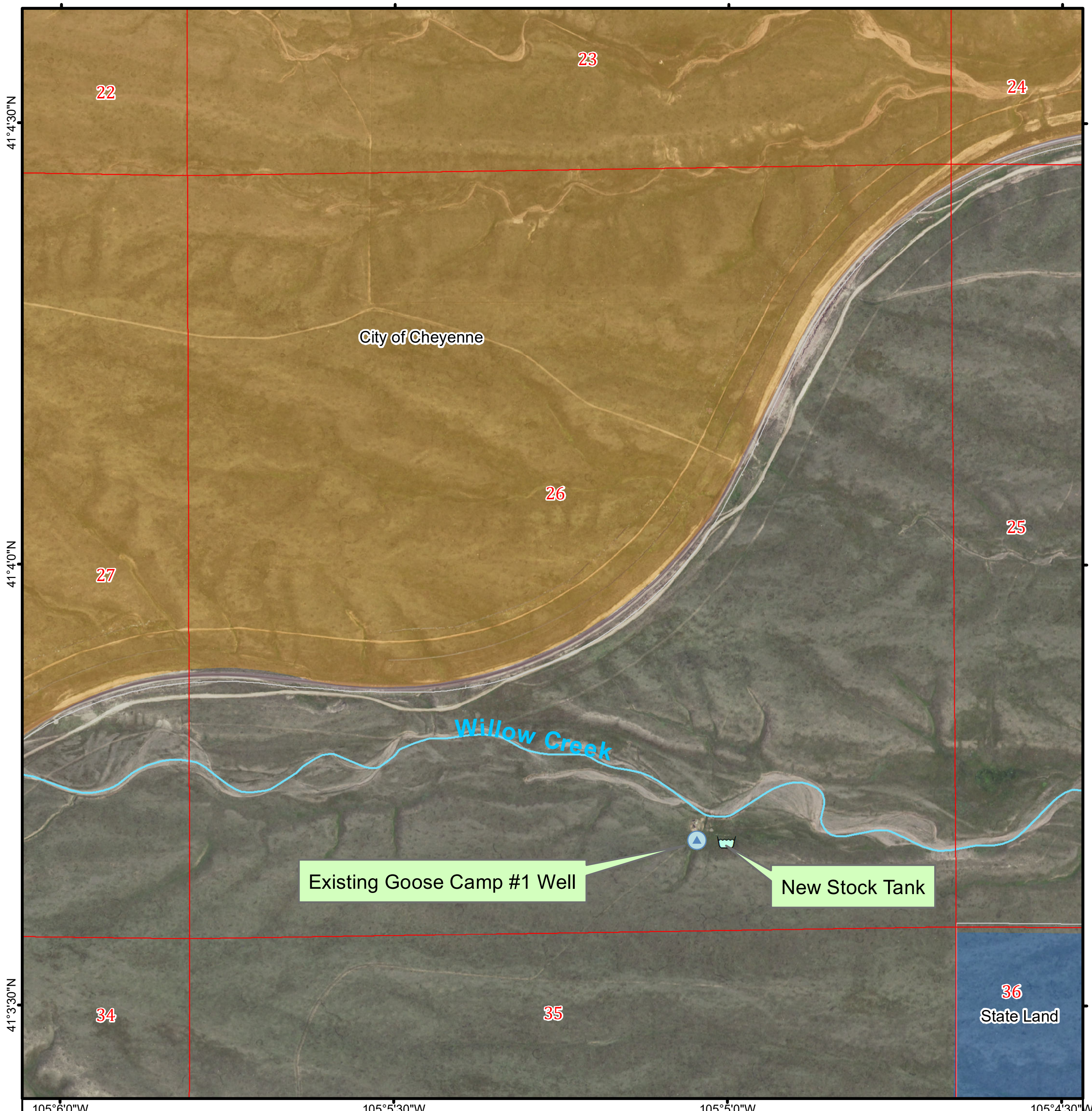
SPRWS Project Cost Estimate

SPRWS Project No. **12-69-9.1**

Project Name Soapstone Section 9 Well and Stockwater Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,840.00	$ 4,840.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	5	$ 2,900.00	$ 14,500.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	1,200	$ 3.50	$ 4,200.00
7	Miscellaneous Valves and piping at tank(s)	Ea	4	$ 500.00	$ 2,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	53,240.00
Contingency - 15%	$	7,986.00
Budget for Project with Contingency	**$**	**61,226.00**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

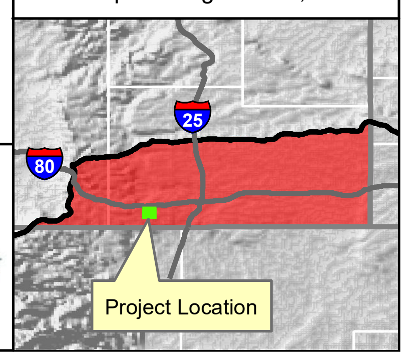
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T13N, R69W



Project 13-69-26.1: Soapstone Grazing Association, Goose Pasture Project

Document Name: Soapstone_13-69-26.1
Date Saved: 9/6/2017

SPRWS PROJECT NUMBER: 13-69-26.1

Goose Camp Well and Stock Water Project

SW ¼ SE ¼ Sec. 26 T13N R69W

PROJECT NAME: Goose Camp Well and Stock Water Project

Soapstone Grazing Association (Applicant – Name of Entity)

Mike Gallegos (Contact)

118 S. Cribbon Cheyenne, WY 82007

Laramie	970-219-3884	rgallegos6@aol.com
(County)	(Phone)	(Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		☐	x	41.0616N	105.0842W
Solar Platforms		x	☐	41.0616N	105.0842W
Pipeline		☐	☐		
Tank		☐	x	41.0616N	105.0842W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	69W	26	SW ¼ SE ¼

Project Description:

This project involves work at the existing Goose Camp No. 1 Well, SEO permit No. 196466. At a minimum, the project will involve installing a solar pump, panels, and tanks at this well. The reported yield of this well is 10 gpm. The existing pump is being run with a portable generator.

The project could involve drilling a new well and installing a pump in the new well. Or a new solar pump could be installed in the existing well. The budget for this project assumes a new well and that the old well will be plugged and abandoned.

There is an existing tire tank at this location and three additional tanks and associated pipelines are proposed for this site.

Due to the location of this well, it may be prudent to test the well for TCE prior to proceeding with a project at this site. Also, the yield of the well should be confirmed.

Specifically, the budget for this project assumes:

- A new 400' deep stock well.
- The existing well will be plugged and abandoned.
- A new solar pump and solar panels.
- 3 new 10' diameter tire tanks with miscellaneous valves.
- A short pipeline from the well to the tanks.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

____
____
____

Who is the owner of the project? ______Soapstone Grazing Association____________________

Who owns the land that the project is to be built on? _______Mike Gallegos_______________

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? ___________________________________
The west ½ of Sec 25, the east ½ of Section 26, and part of the north of Section 35, T13N, R69W would benefit from this project. This includes approximately 900 acres.
____

What is the total estimated project cost? ____________$55,000______________________________

Photographs: These photographs show the old Goose Camp Well and existing tire stock tank.

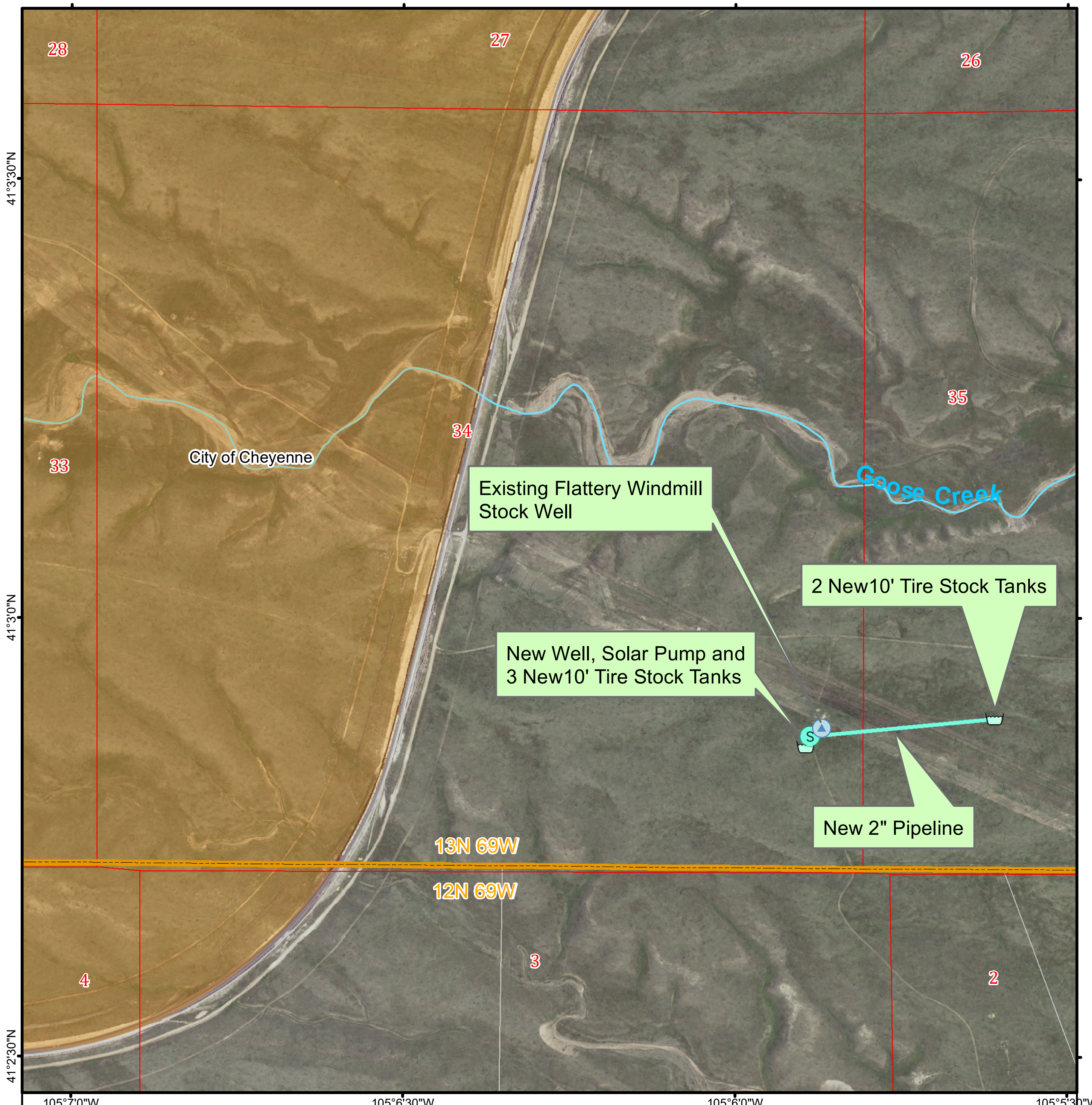
SPRWS Project Cost Estimate

SPRWS Project No. **13-69-26.1**

Project Name Soapstone Goose Camp Well Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,345.00	$ 4,345.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	4	$ 2,900.00	$ 11,600.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	500	$ 3.50	$ 1,750.00
7	Miscellaneous Valves and piping at tank(s)	Ea	3	$ 500.00	$ 1,500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF	300.00	$ 3.00	$ 900.00
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$ 47,795.00
Contingency - 15%	$ 7,169.25
Budget for Project with Contingency	**$ 54,964.25**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

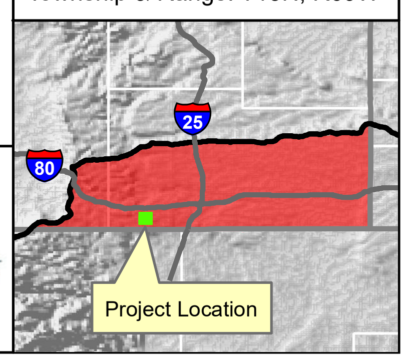
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T13N, R69W



Project 13-69-34.1: Soapstone Grazing Association, New Well, Solar Pumps and Tanks

Document Name: Soapstone_13-69-34.1
Date Saved: 9/5/2017

SPRWS PROJECT NUMBER: 13-69-34.1
Flattery Windmill Well and Stockwater Project
SE ¼ SE ¼ Sec. 34 T13N R69W

PROJECT NAME: Soapstone Grazing Association Flattery Windmill Replacement

Soapstone Grazing Association ______________________________ (Applicant – Name of Entity)

_____Mike Gallegos______________________________ (Contact)

118 S. Cribbon__________ Cheyenne, WY 82007

_Laramie___ _______970-219-3884________________ _______rgallegos6@aol.com____

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		X		41.0478N	105.0979W
Solar Platforms		X		41.0478N	105.0979W
Pipeline		X	☐		
Tanks 1 at well		X	☐	41.0478N	105.0979W
Tank 2			☐	41.049N	105.093W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	69W	34	SE ¼ SE ¼

Project Description:

This project involves the replacement of the Flattery windmill well, WY SEO Permit No. UW 196467. There is an existing submersible pump in this well, because the windmill is damaged. The owner needs to travel to the site and run the pump off a generator. During the site visit, the generator would not start, so the yield of the well is unknown.

The most complete option for this project is to plug and abandon the old well and re-drill a new well. A new solar pump would be installed in the new well. This location is fairly remote and getting concrete trucks to the site to construct a bottomless tank could be difficult. Therefore three 10' diameter tire tanks are proposed at the well.

Approximately one-quarter mile from the well to another set of tanks would be constructed. This set of tanks is in the SW ¼ of Section 35. A pipeline will be constructed from the well to the tanks.

There is a gas pipeline that would need to be considered during final design of this project.

If the new well yielded enough, a network of pipelines could feed into as many as five (5) stock tanks. Initially, tanks at the two locations described above are proposed.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

____
____
____

Who is the owner of the project? ______Soapstone Grazing Association____________________

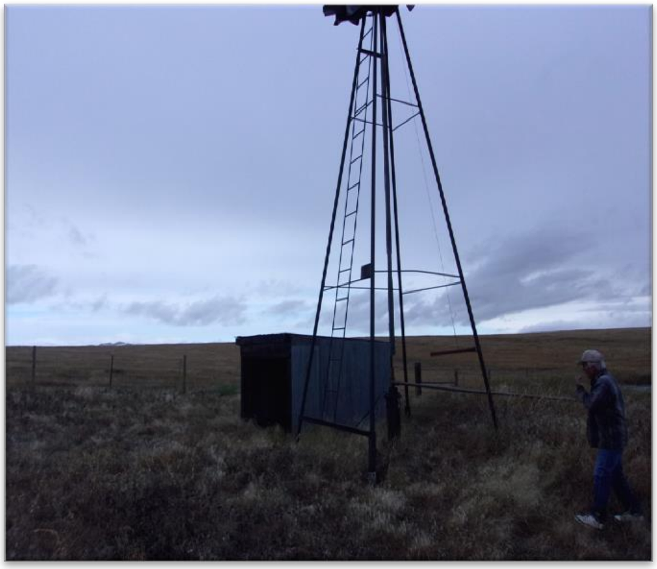
Who owns the land that the project is to be built on? _______Mike Gallegos_______________

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? ___________________________________
A total of approximately 500 acres, including all of the SE ¼ of Section 34 and the south half of Section 35 would be served by this new stockwater system. No other stock water sources are in this area.
____

What is the total estimated project cost? _____$62,750____

Photographs showing the existing Flattery Windmill.



SPRWS Project Cost Estimate

SPRWS Project No. **13-69-34.1**

Project Name Soapstone Flattery Well Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,950.00	$ 4,950.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	5	$ 2,900.00	$ 14,500.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	1,400	$ 3.50	$ 4,900.00
7	Miscellaneous Valves and piping at tank(s)	Ea	3	$ 500.00	$ 1,500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF	300.00	$ 3.00	$ 900.00
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	54,450.00
Contingency - 15%	$	8,167.50
Budget for Project with Contingency	**$**	**62,617.50**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

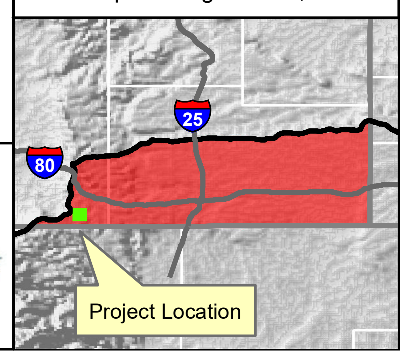
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T13N, R72W



Project 13-72-36.1 and 13-72-36.2: Bath Family, Spring Rehab, Dam and Stock Reservoir

Document Name: Bath_13-72-36.1
Date Saved: 9/1/2017

SPRWS PROJECT NUMBER: 13-72-36.1

Spring Development

SE¼ NW¼ Sec 36 T13N R72W

Site Visit Date: Nov. 9, 2016

PROJECT NAME: Bath – State Spring Development

Bath Family Limited Partnership (Applicant – Name of Entity)

Nancy Bath (Contact)

438 Dale Creek Road

Tie Siding, WY 82084

Albany

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank		X		41.0547N	105.4167W
Spring Development		X		41.0547N	105.4167W
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	72W	36	SE NW

Project Description:

This project will involve a spring development, pipeline, and tank, and then installing a fence around the spring. This project is located on Section 36, which is a school section. Specifically, this project will include:

- A spring development with perforated pipe, gravel, and spring box.
- 400' of 1-1/2" pipe downhill (east) from the spring box to the tanks.
- Two new 10'dia. by2' deep stock tanks.
- Construct 400' of fence with gate around the spring.

Public Benefit:

____
____
____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie Rivers Conservation District; the State of Wyoming____________________________
____
____

Who is the owner of the project? ______Bath Family Limited Partnership and the State of Wyoming

Who owns the land that the project is to be built on? _______State of Wyoming__________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
_______The entire 640 acres in Section 36, T13N, R72W will benefit from the improved water source.___
____
____

What is the total estimated project cost? ____$20,000____

Photographs:

Bath spring development location in the SENW Sec 36, T13N, R72W

SPRWS Project Cost Estimate

SPRWS Project No. **13-72-36.1**

Project Name Bath Spring Development and Tanks

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,562.50	$ 1,562.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS	1	$ 3,800.00	$ 3,800.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	2	$ 2,900.00	$ 5,800.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	400	$ 4.50	$ 1,800.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	400	$ 5.00	$ 2,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	17,187.50
Contingency - 15%	$	2,578.13
Budget for Project with Contingency	**$**	**19,765.63**

Work Items and Quantities
Bath Stock Reservoir
SE ¼ NW ¼ Sec. 36 T13N R72W
SPRWS Project No. 13-72-36.2

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization	LS	1	$ 5,000.00	$ 5,000.00
2	Strip, Stockpile, and Replace Topsoil	CY	304	$ 5.00	$ 1,521.53
3	Excavation and Placement Embankment Fill	CY	1,600	$ 4.50	$ 7,200.00
4	Special backfill around pipes. Compaction around and min. 2' over pipes.	CY	200	$ 12.00	$ 2,400.00
5	Riprap - 8" nominal sized rock - 12" thick	CY	0	$ 125.00	$ -
6	Filter fabric under riprap	SY	0	$ 4.00	$ -
7	24" dia. CMP culvert spillway	LF	50	$ 50.00	$ 2,500.00
8	8" low level outlet pipe	LF	90	$ 40.00	$ 3,600.00
9	8" gate valve and valve box	LS	1	$ 1,750.00	$ 1,750.00
10	Site Revegetation and reclamation	Acre	1	$ 1,250.00	$ 937.50
11	Miscellaneous work - road and fencing	LS	1	$ 2,500.00	$ 2,500.00

Sub-Total Estimated Component Costs	$	27,409.03
Contingency - 15%	$	4,111.35
Opinion of Probable Costs	**$**	**31,520.38**

SPRWS PROJECT NUMBER: 13-72-36.2
New Stock Reservoir
SE¼ NW¼ Sec 36 T13N R72W
Site Visit Date: Nov. 9, 2016

PROJECT NAME: Bath – State Stock Reservoir

Bath Family Limited Partnership (Applicant – Name of Entity)

Nancy Bath (Contact)

438 Dale Creek Road

Tie Siding, WY 82084

Albany

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		X		41.0542N	105.4152W
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
13N	72W	36	SE NW

Project Description:

This project will involve construction of new small stock reservoir on an ephemeral draw, tributary to Johnson Creek. This project is located on Section 36, which is a school section. Specifically, this project will include:

- Construction of the dam and stock reservoir.
- The dam will be approximately 12' tall and 150' long.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie Rivers Conservation District; State of Wyoming ____________________

____

Who is the owner of the project? ______Bath Family Limited Partnership and the State of Wyoming

Who owns the land that the project is to be built on? _______State of Wyoming__________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
_______ The entire 640 acres in the State Section, Section 36, T13N, R72W will benefit from the improved water source.

What is the total estimated project cost? _____$31,500____________________________________

Photographs:

Stock Reservoir dam site.

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

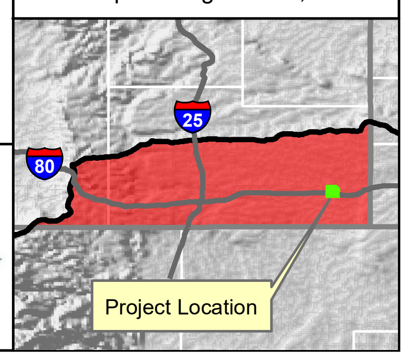
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T14N, R61W



Project 14-61-20.1: Bowman, Environmental

Document Name: Bowman_14-61-20.1
Date Saved: 9/1/2017

SPRWS PROJECT NUMBER: <u>14-61-20.1</u>

Grassed Waterway with Checks and Wildlife Habitat

W 1/2 Section 20, T14N, R61W

Site Visit Date: June 7, 2017

PROJECT NAME: Bowman Grassed Waterway, Checks and Wildlife Habitat

Dale Bowman (Applicant – Name of Entity)

Dale Bowman (Contact Name)

6289 I-80 Service Road (Contact Information)

Pine Bluffs, WY 82082

Laramie 307-245-3345

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platform					
Spring Development					
Wetland					
Environmental *		x		41.1659N	104.2300W
Irrigation					
Windmill					

+ The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

Legal Description Well to be located

	Township	Range	Section	Quarter-Quarter
Center of Work Area	14N	61W	20	SE1/4 NW 1/4

Project Description:

This project involves construction of a grassed waterway along Lodgepole Creek in Section 20, T14N, R61W. This area is currently farmed and irrigated via a center pivot. Lodgepole Creek seldom flows in this area, but when it does flow, often there is erosion through this area and the sediment is deposited downstream. The erosion causes loss of top soil. This project will stabilize the area and also provide wildlife habitat along the grassed waterway.

The project will include planting the area along Lodgepole Creek and construction of rock checks in waterway to control the velocity of the creek. The rock checks will provide crossings for the tires on the center pivot. Approximately 10 acres will be planted and 6 rock checks will be installed.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District,____

____

Who is the owner of the project? ______Dale Bowman_____________

Who owns the land that the project is to be built on? Dale Bowman.

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ________________________________
This project will stabilize and minimize erosion through approximately 160 acres, In addition, the wildlife habitat will provide benefits to a larger area. Finally, the reduced erosion and sediment will provide benefits to areas downstream.___________________________________

What is the total estimated project cost? _________$35,000______________________________

Photographs: None available

SPRWS PROJECT NUMBER: 14-63-14.1
Western Skys Irrigation Project
SW ¼ SW ¼ Section 14, T15N, R63W
Site Visit Date: Nov. 14, 2016

PROJECT NAME: Western Skys Ranch Irrigation Project

West Skys Ranch, LLC — Applicant – Name of Entity)

Les Mead — (Contact)

4618 County Road 218 — Burns, WY 82053

Laramie — 307-630-3490 —

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		X		41.2600N	104.4033W
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
15N	63W	14	SW ¼ SW ¼

Project Description:

This project involves the construction of a new small irrigation reservoir and associated irrigation system. This reservoir will be located in an existing low area on the owner's property. Surface water, including possibly water from the county road borrow ditches; will be diverted into the reservoir.

Some of the water stored in the reservoir can be utilized via gravity flow and some of the water will need to be pumped. The key issue with this proposed project is developing an estimate of the available water supply and determining the feasibility of this project.

Additional design work will be necessary for this project to move forward.

Public Benefit:

____

____

____

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District ____

____

____

Who is the owner of the project? ______West Skys Ranch, LLC ____________________

Who owns the land that the project is to be built on? _______ West Skys Ranch, LLC __

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____

____

____

What is the total estimated project cost?

Additional design effort will be necessary to determine the project costs. _____________________

Photo shows the proposed reservoir site within the existing low area on the landowner's property.

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

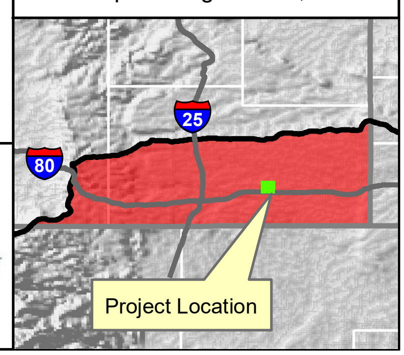
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T14N, R64W



Project 14-64-10.1: McWilliams Solar Pump

Document Name: McWilliams_14-64-10.1
Date Saved: 8/8/2017

SPRWS PROJECT NUMBER: 14-64-10.1
New Solar Pump
SE ¼ SW ¼ Sec. 10 T14N R64W

PROJECT NAME: McWilliams Solar Pump

Chris McWilliams (Applicant – Name of Entity)

P.O. Box 22

Hillsdale, WY 82060

Laramie

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms		X		41.1880	104.5331W
Pipeline					
Tank at well					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
14N	64W	10	SE SW

Project Description:

This project involves installation of a new solar pump system into an existing well, the McWilliams No. 6 Well, Permit No. UW 26918. The solar pumping system will replace a windmill. The tank at the site is in good condition and will not need to be replaced.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Chris McWilliams

Who owns the land that the project is to be built on? Chris McWilliams

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

This project will provide stock water for 320 acres in the s ½ of Sec 10, T14N, R64W.

What is the total estimated project cost? $15,050 including 15% contingency on the construction costs.

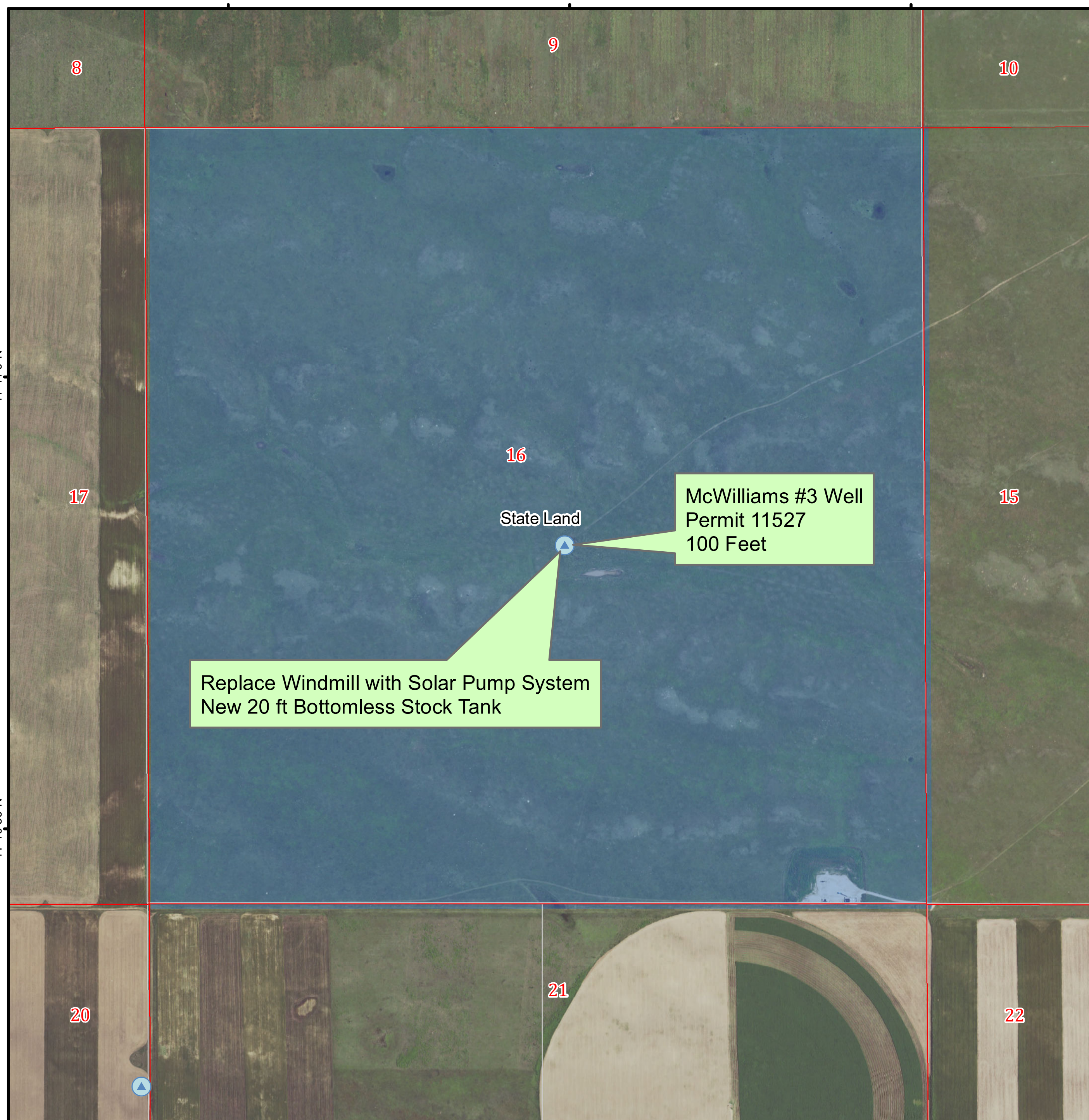
SPRWS Project Cost Estimate

SPRWS Project No. **14-64-10.1**

Project Name McWilliams Section 10 Solar Pump project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,188.75	$ 1,188.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 4.50	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 13,076.25
Contingency - 15%	$ 1,961.44
Budget for Project with Contingency	**$ 15,037.69**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

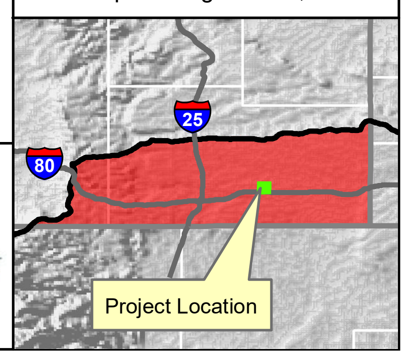
Feet
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T14N, R64W



Project 14-64-16.1: McWilliams Solar Pump and Stock Tank

Document Name: McWilliams_14-64-16.1
Date Saved: 8/8/2017

SPRWS PROJECT NUMBER: 14-64-16.1
New Solar Pump
NW ¼ SW ¼ Sec. 16 T14N R64W

PROJECT NAME: McWilliams State Section 16 Stock water project

Chris McWilliams (Applicant – Name of Entity)

P.O. Box 22

Hillsdale, WY 82060

Laramie

(County) (Phone) (Email)

This project is located on a School Section – Sec 16, T14N, R64W.

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms		X		41.1802	104.5503W
Pipeline					
Tank at well		X		41.1802	104.5503W
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
14N	64W	16	NW SE

Project Description:

This project involves installation of a new solar pump system into an existing well, the McWilliams No. 3 Well, Permit No. UW 11527. The solar pump will replace a windmill. Also, the project will include installation of a new bottomless tank near the well.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District. State of Wyoming – this is a school section.

Who is the owner of the project? Chris McWilliams

Who owns the land that the project is to be built on? State of Wyoming

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

This project will improve stock water for all 640 acres in Sec 16, T14N, R64W.

What is the total estimated project cost? $30,250 including 15% contingency on the construction costs.

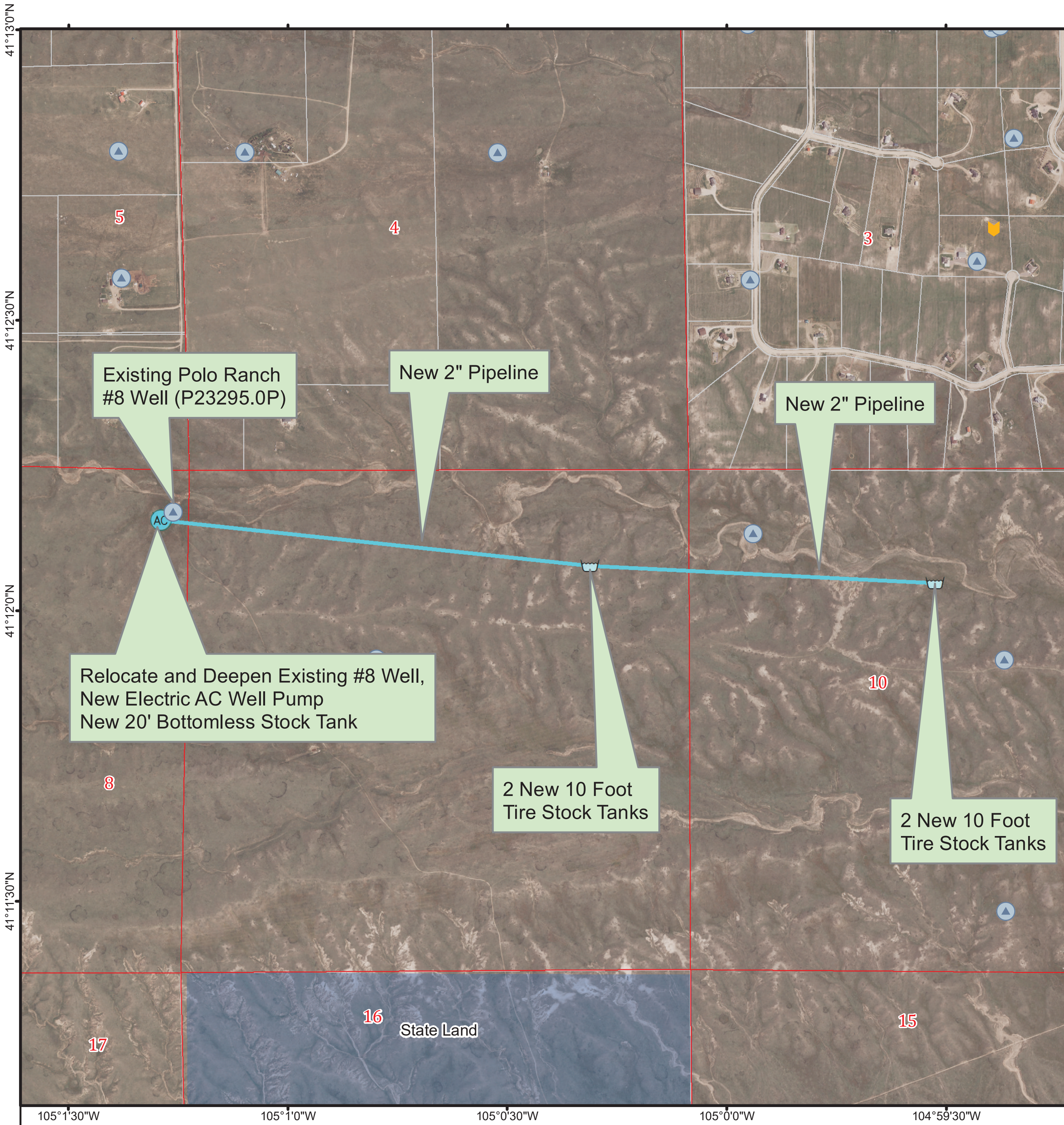
SPRWS Project Cost Estimate

SPRWS Project No. **14-64-16.1**

Project Name McWilliams Section 16 Stock water project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,388.75	$ 2,388.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 4.50	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 26,276.25
Contingency - 15%	$ 3,941.44
Budget for Project with Contingency	**$ 30,217.69**



Existing
- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Irrigation Ditch
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed
- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

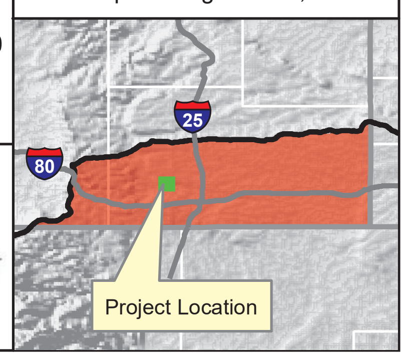
N

Feet
0 750 1,500
1 in = 1,500 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T14N, R68W



Project 14-68-8.1. Polo Ranch Sections 8, 9 and 10 Stock Water Project

Document Name: Polo_Ranch_14-68-8.1
Date Saved: 9/28/2017

SPRWS Project Cost Estimate

SPRWS Project No. **14-68-8.1**

Project Name Polo Ranch Sections 8, 9, and 10 Stockwater project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 7,807.50	$ 7,807.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	450	$ 40.00	$ 18,000.00
2a	Spring Development	LS		$ 3,800.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	4	$ 2,900.00	$ 11,600.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	8,500	$ 3.00	$ 25,500.00
7	Miscellaneous Valves and piping at tank(s)	Ea	3	$ 500.00	$ 1,500.00
8	3 Wire Fence with wood posts	LF	200	$ 5.00	$ 1,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	1.50	$ 1,250.00	$ 1,875.00

Sub-Total Estimated Component Costs	$ 85,882.50
Contingency - 15%	$ 12,882.38
Budget for Project with Contingency	**$ 98,764.88**

SPRWS PROJECT NUMBER: 14-68-8.1
Polo Ranch Sections 8, 9, and 10 Stock Water Project
Polo Ranch Well 8 Location NE1/4 NE1/4 Section 8, T14N R68W
Site Visit Date: July 19, 2017

PROJECT NAME: Polo Ranch Sections 8, 9, 10 Stock Water Project
Enlarge, relocate, and deepen the
Polo No. 8 Well, Permit Nos. UW 23295 and UW 174871

Polo Ranch Company___________________________ (Applicant – Name of Entity)

308 W 7th Ave.

Cheyenne, WY 82001

Brian Harvey, Ranch Manager (Contact)

10321 Polo Ranch Road__________________________________

Cheyenne, WY 82009

_Laramie___ _____________(307) 274-2574 prairiehousehomegoods@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Well with electric submersible pump		X		41.2026N	105.0215W
Tank 1 at well		X		41.2026N	105.0215W
Pipeline Well to Tank 2		X			
Tank 2		X		41.2013N	105.0052W
Pipeline from Tank 2 to Tank 3		X			
Tank 3				41.2008N	104.9921W

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Polo Well 8 location

Township	Range	Section	Quarter-Quarter
14N	68W	8	NE NE

Project Description:

This project involves construction of a new stock watering system, including new well; submersible electric pump, and power service from the existing powerline. The well will be permitted as a relocation, deepening and enlargement of the existing Polo 8 Well, which has two permits UW 23295 and UW 174871. The well will supply 3 sets of tanks with a new pipeline from the well to the tanks.

As shown on the accompanying map, the new well will supply a stock water project, which includes three sets of tanks and pipeline(s). The pipeline run from the well, which is located in the NE1/4 NE1/4 of Section 8, T14N, R68W, to a set of tanks in Section 9 and to another set of tanks in Section 10. The pipeline will be approximately 8500' long.

Specifically, this project will include:

- Drilling a new 450' deep stock well to replace the existing 165' deep Polo 8 Well. This new well will require an enlargement permit and the well will be relocated and deepened.
- Power is available at this site. The old Well 8 windmill has been replaced with a submersible electric pump. A new pump will be installed.
- A new electric submersible pump.
- Three sets of tanks will be installed. One set of tanks will be located near the well. This set of tanks could be a new bottomless tank or two 10' tire tanks. There are two tire tanks near the existing well. These tires could be re-used in the new project or could be replaced with a new tank(s) during this project.
- Conceptually and for the preliminary cost estimate, the two other sets of tanks are assumed to be tire tanks and 2 – 10' diameter tire tanks will be installed at each location.
- A 2" diameter pipelines will be constructed from the well to feed the tanks. The total length of pipeline is approximately 8500'. Miscellaneous valves and floats will be installed at the tanks.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Polo Ranch Company

Who owns the land that the project is to be built on? Polo Ranch Company

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________

_______ This stock water project will provide a reliable water source for approximately 2 – ½ sections or 1600 acres. ____

What is the total estimated project cost? ______$98,750____________________________________

Photographs:

Photo shows the existing Polo 8 Well

Picture shows the existing tire tanks near Well 8

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Irrigation Ditch
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

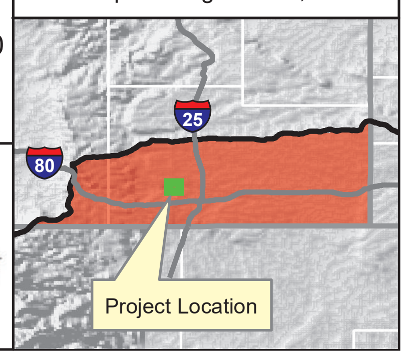
N

Feet

0 1,000 2,000

1 in = 2,000 Feet

Township & Range: T14N, R68W



Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Project 14-68-13.1 & 15.2: Polo Ranch Home Ditch No. 1 & Bell Ditch No. 2 Headgate Rehab, Road Crossing Rehab and Erosion Stabilization

Document Name: Polo_Ranch_14-68-13.1and15.2
Date Saved: 9/28/2017

SPRWS PROJECT NUMBER: 14-68-13.1

Home Ditch No 1 and Bell No. 2 Ditch Diversion Dams and Head gates Rehabilitation Project

Location SW ¼ NW ¼ Section 13, T14N R68W

Site Visit Date: July 19, 2017

PROJECT NAME: Polo Ranch Home Ditch No. 1 and Bell Ditch No. 2 Diversion Dam and Head gate Rehabilitation Project – Territorial Rights, both with March 31, 1888 priority

Polo Ranch Company (Applicant – Name of Entity)

308 W 7th Ave.

Cheyenne, WY 82001

Brian Harvey, Ranch Manager (Contact)

10321 Polo Ranch Road

Cheyenne, WY 82009

Laramie (307) 274-2574 prairiehousehomegoods@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation			X	41.1847N	104.9613W
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Home Ditch No. 1 and Bell Ditch No. 2 locations:

Township	Range	Section	Quarter-Quarter
14N	68W	13	SW NW

Project Description:

This project involves rehabilitation and replacement of the diversion dam(s) and head gates for the Home No. 1 Ditch and the Bell No. 2 Ditch. These ditches are territorial water rights and were adjudicated under the Crow Creek Court decree. The Home Ditch No. 1 has a water right for 1.66 cfs and the Bell No. 2 Ditch has a water right for 4.5 cfs. Both ditches have a priority date of March 31, 1888.

Additional survey and design is necessary before an application for this project will be complete. The diversion dam(s) and head gates need to be replaced, which will require a significant amount of work.

Preliminary cost estimates for this project assumes $130,000. But additional design work and costs estimates are necessary.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Polo Ranch Company

Who owns the land that the project is to be built on? Polo Ranch Company

Which WWDC Watershed Study Boundary is this project within?

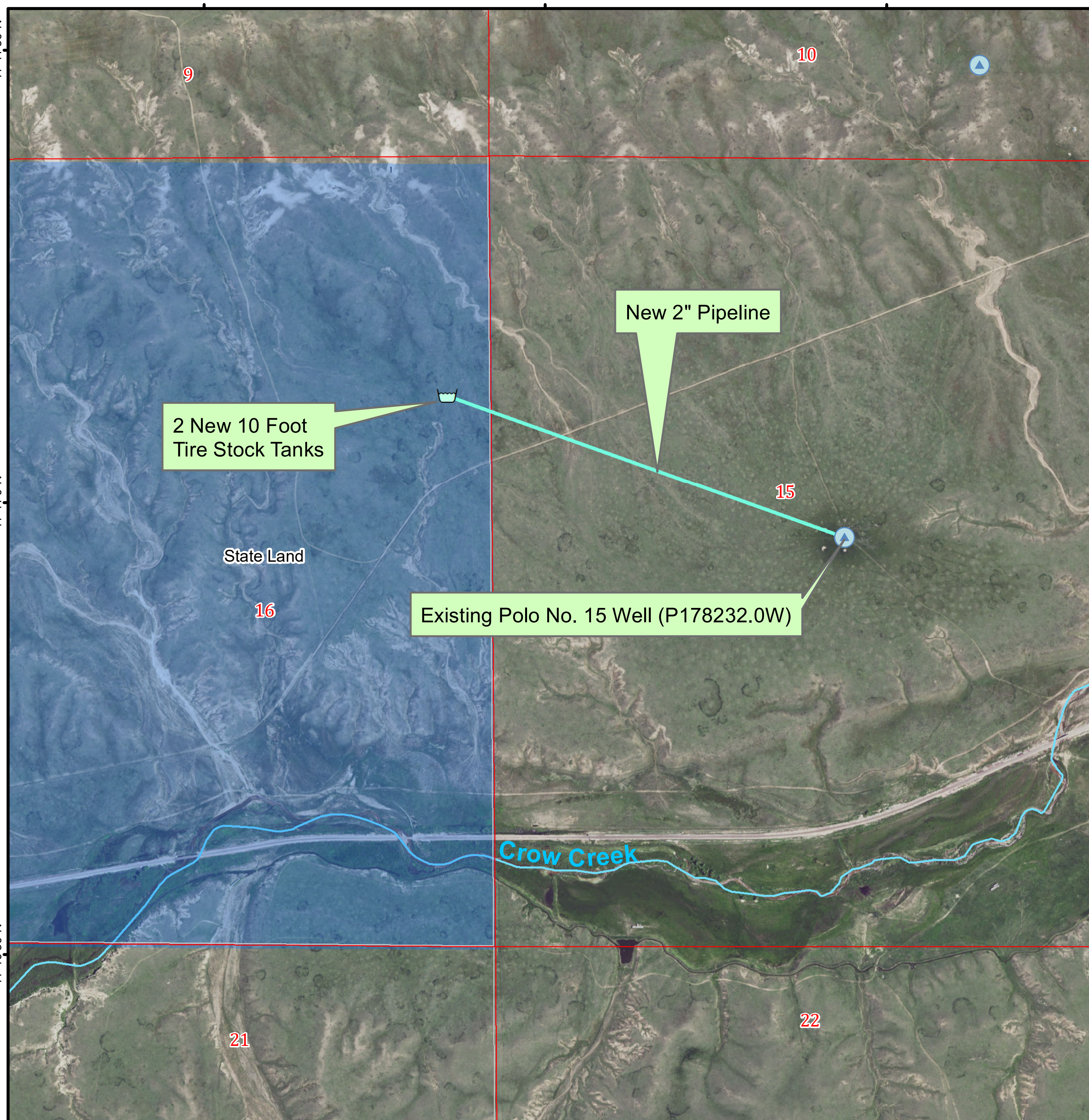
South Platte River Watershed

How many acres will be benefited by this project? Irrigation from these ditches can be restored by this project. In addition, erosion and water quality concerns can be reduced by a project that rehabilitated the diversion dams. .

What is the total estimated project cost? The preliminary cost estimate is $130,000, but this value is only a "place-holder." Additional design work is required to determine if this project will qualify as a Small Water Project.

Photographs:

Existing earth diversion dam and headgate.



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Irrigation Ditch
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

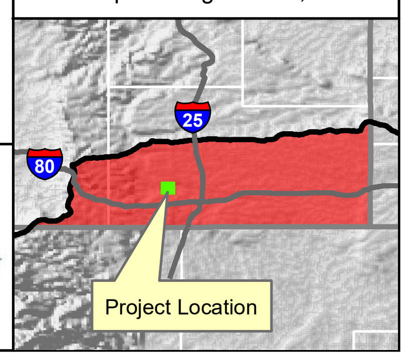
N

Feet
0 500 1,000
1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T14N, R68W



Project 14-68-15.1. Polo Ranch Section 15 Stock Water Project

Document Name: Polo_Ranch_14-68-15.1
Date Saved: 10/19/2017

SPRWS PROJECT NUMBER: 14-68-15.1

Polo Ranch Sections 15 and 16 Stock Water Project
Polo Ranch No. 15 Well Location SE1/4 NW1/4 Section 15, T14N R68W
Site Visit Date: July 19, 2017

PROJECT NAME: Polo Ranch Sections 15 and 16 Stock Water Project
Polo No. 15 Well, Permit Nos. UW 178232 and UW 203580

Polo Ranch Company (Applicant – Name of Entity)

308 W 7th Ave.

Cheyenne, WY 82001

Brian Harvey, Ranch Manager (Contact)

10321 Polo Ranch Road

Cheyenne, WY 82009

Laramie (307) 274-2574 prairiehousehomegoods@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Existing Well with solar pump		X		41.1827N	104.9927W
Tank 1 at well					
Pipeline from Well to Tank 2		X			
Tank 2 in Sect 16		X		41.1853N	105.0024W

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Polo Well 15 location

Township	Range	Section	Quarter-Quarter
14N	68W	15	SE NW
	New Tank in Sec 16		
14N	68W	16	SE NE

Project Description:

This project involves construction of a new stock water pipeline and set of tanks. The water source will be the existing Polo No. 15 Well, Permit Nos. UW 178232 and UW 203580. This well has a solar pumping system and tanks. A pipeline will convey water from the existing No. 15 Well to a new set of tanks, which will be located in the SE NE of Section 16. Section 16 is a State or School Section.

The new tank location is approximately 2800' northwest of the No. 15 Well and the new set of tanks is approximately 80' higher in elevation than the existing No. 15 well and tank. A new solar pump will be required to move water from the No. 15 Well to the new tank(s).

This project may be the initial phase of a larger stock water project. Once the water is pumped to the new tank in Section 16, it can flow by gravity to additional tanks south and west of the new tank. The cost estimate for this project assumes that only the initial 2800' of pipeline and first set of tanks are constructed, at this time.

Specifically, this project will include:

- A new solar pump system to move water from the existing No. 15 Well to the new tank.
- A new set of tanks. For preliminary design, it was assumed that this tank will be a bottomless tank.
- A 2" diameter pipeline will be constructed from the No. 15 Well to supply the new tank. The pipeline will be approximately 2800' long. Miscellaneous valves and floats will be installed at the new tank.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Polo Ranch Company

Who owns the land that the project is to be built on? Polo Ranch Company and the State of Wyoming

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? This stock water project will provide a reliable water source for the east ½ of Section 16, which is a State section. .

What is the total estimated project cost? $42,250

Photographs:

Photo shows the existing Polo No 15 Well and tanks.

SPRWS Project Cost Estimate

SPRWS Project No. **14-68-15.1**

Project Name Polo Ranch Sections 15 and 16 Stockwater project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 3,340.00	$ 3,340.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 3,800.00	$ -
3	Solar Pump System - less than 250' TDH	LS	1	$ 9,650.00	$ 9,650.00
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	2,800	$ 3.00	$ 8,400.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	200	$ 5.00	$ 1,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	1.00	$ 1,250.00	$ 1,250.00

Sub-Total Estimated Component Costs	$ 36,740.00
Contingency - 15%	$ 5,511.00
Budget for Project with Contingency	**$ 42,251.00**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Irrigation Ditch
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

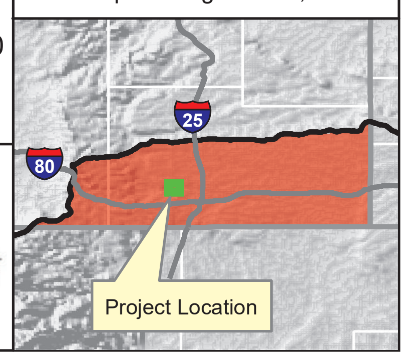
0 1,000 2,000

1 in = 2,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T14N, R68W



Project 14-68-13.1 & 15.2: Polo Ranch Home Ditch No. 1 & Bell Ditch No. 2 Headgate Rehab, Road Crossing Rehab and Erosion Stabilization

Document Name: Polo_Ranch_14-68-13.1and15.2
Date Saved: 9/28/2017

SPRWS PROJECT NUMBER: 14-68-15.2

Polo Ranch Section 15 Road Crossing and Erosion Control Project

Location SE1/4 SE 1/4 Section 15, T14N R68W

Site Visit Date: July 19, 2017

PROJECT NAME: Polo Ranch Section 15 Road Crossing and Erosion Control Project

Polo Ranch Company (Applicant – Name of Entity)

308 W 7th Ave.

Cheyenne, WY 82001

Brian Harvey, Ranch Manager (Contact)

10321 Polo Ranch Road

Cheyenne, WY 82009

Laramie (307) 274-2574 prairiehousehomegoods@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental			X	41.1787N	104.9877W
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Section 15 Road Crossing

Township	Range	Section	Quarter-Quarter
14N	68W	15	SE SE

Project Description:

This project involves rehabilitation of a ranch road crossing Crow Creek, including riprap and erosion control. This area was damaged during the high flows in the spring of 2016 and has been temporarily repaired. If this area is not repaired and a more permanent crossing installed, it is likely the road crossing will wash out again.

The damaged road across Crow Creek is approximately 75' wide (or long). The preliminary cost estimate for this study assumes that 3 – 48" diameter CMP culverts, each approximately 30' long would be installed and that the road would be rebuilt. Riprap would be installed on the road, creek banks and below the culverts to minimize future erosion. Additional design will be necessary to prior to submitting an application for this project.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Polo Ranch Company

Who owns the land that the project is to be built on? Polo Ranch Company

Which WWDC Watershed Study Boundary is this project within?

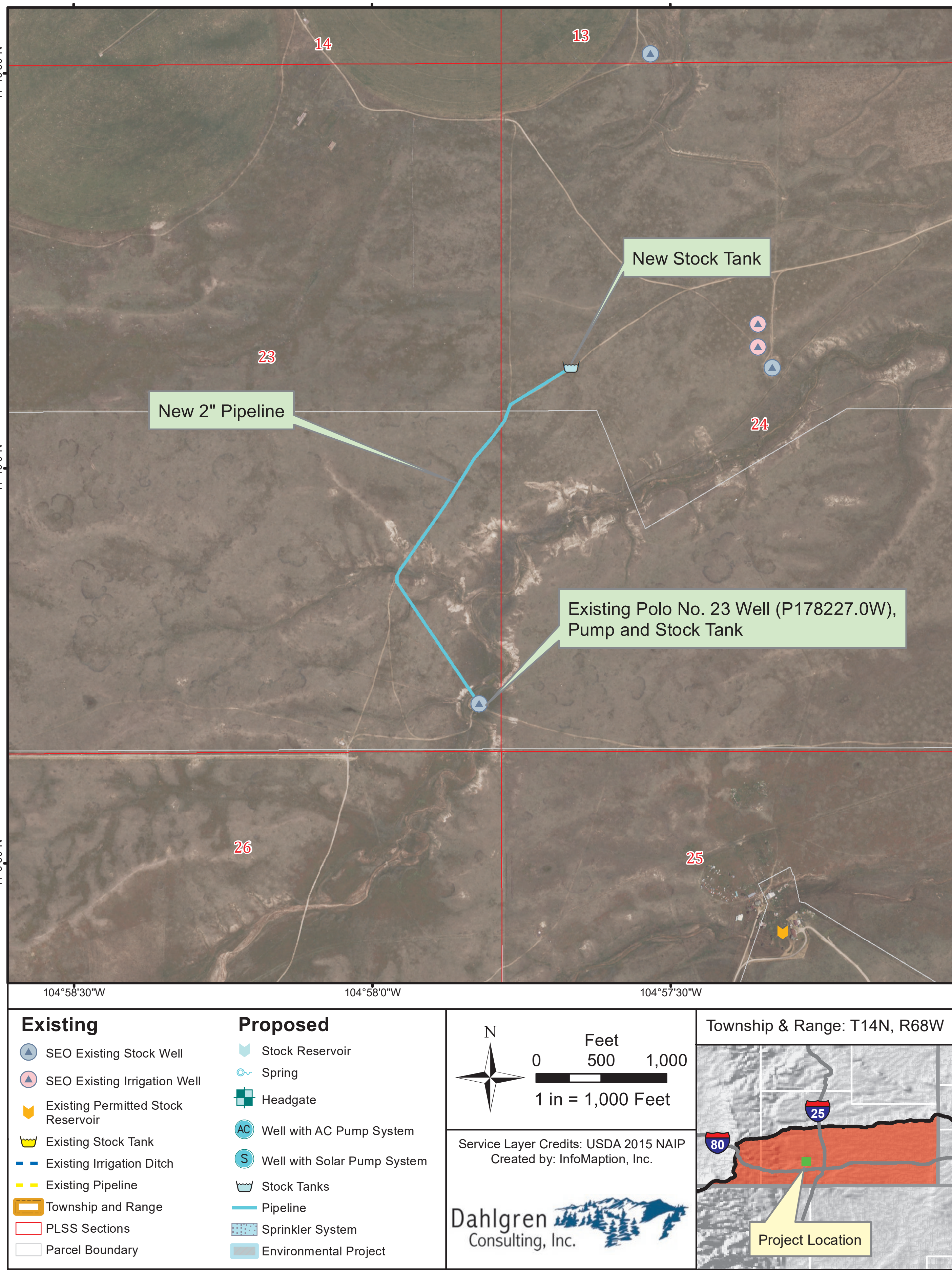
South Platte River Watershed

How many acres will be benefited by this project? This road crossing impacts Crow Creek, so repair and stabilization of this area would benefit a large area downstream of the road.

What is the total estimated project cost? The preliminary cost estimate is $45,000, which includes three new 48" dia. culverts, approximately 125 CY of riprap, and the work to install the culverts, re-grade the road, and place the riprap.

Photograph:

Photo shows the existing temporary Crow Creek crossing that would be replaced by this project.



Project 14-68-23.1. Polo Ranch Stock Water Project

Document Name: Polo_Ranch_14-68-23.1
Date Saved: 9/28/2017

SPRWS PROJECT NUMBER: 14-68-23.1

Polo Ranch Sections 23 and 24 Stock Water Project
Polo Ranch No. 23 Well Location SE 1/4 SE 1/4 Section 23, T14N R68W
Site Visit Date: July 19, 2017

PROJECT NAME: Polo Ranch Sections 23 and 24 Stock Water Project
Polo No. 23 Well, Permit No. UW 178227

Polo Ranch Company (Applicant – Name of Entity)

308 W 7th Ave.

Cheyenne, WY 82001

Brian Harvey, Ranch Manager (Contact)

10321 Polo Ranch Road

Cheyenne, WY 82009

Laramie (307) 274-2574 prairiehousehomegoods@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Existing Well with electric pump				41.1617N	104.9637W
Tank 1 at well				41.1617N	104.9637W
Pipeline from Well to Tank 2		X			
Tank 2 in Sect 24		X		41.1688N	104.9611W

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Polo No. 23 Well location

Township	Range	Section	Quarter-Quarter
14N	68W	23	SE SE
	New Tank in Sec 24		
14N	68W	24	SW NW

Project Description:

This project involves construction of a new stock water pipeline and set of tanks. The water source will be the existing Polo No. 23 Well, Permit Nos. UW 178227. This well has a submersible electric pump and tanks. An enlargement permit for the well will be required for the new tank.

For the preliminary cost estimate it was assumed that a new pump will be installed in the well. A new pipeline will convey water from the existing No. 23 Well to a new set of tanks, which will be located in the SW NW of Section 24.

The pipeline from the existing well to the new tank will be approximately 3400' long. Specifically, this project will include:

- A new submersible pump will be installed in the well.
- A new set of tanks. For preliminary design, it was assumed that this tank will be a bottomless tank.
- A 2" diameter pipeline will be constructed from the No. 23 Well to supply the new tank. The pipeline will be approximately 3400' long. Miscellaneous valves and floats will be installed at the new tank.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Polo Ranch Company

Who owns the land that the project is to be built on? Polo Ranch Company

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? This stock water project will provide a reliable water source for the west ½ of Section 24.

What is the total estimated project cost? $33,500

Photographs:

Photo shows the existing Polo No 23 Well and tanks.

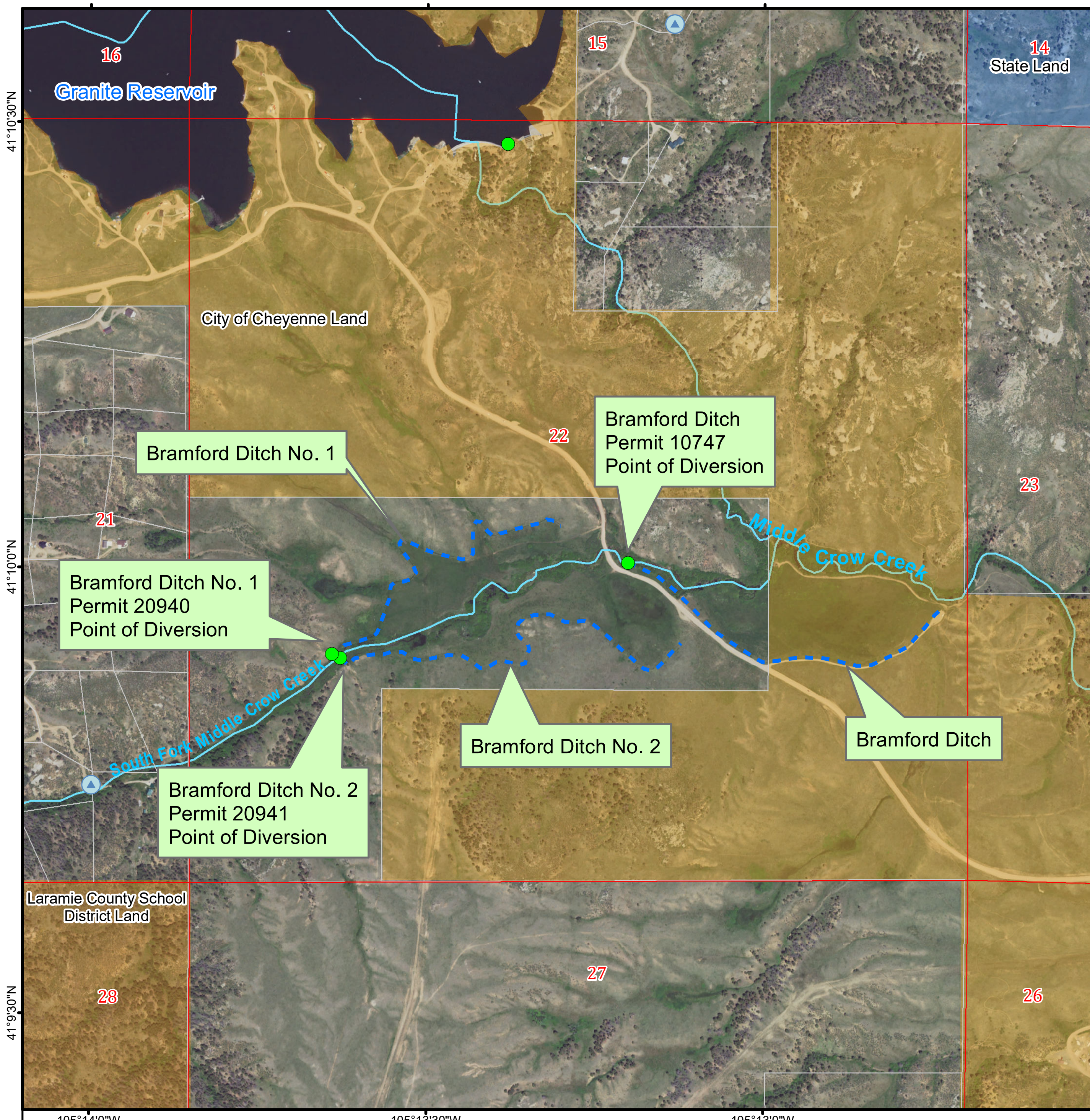
SPRWS Project Cost Estimate

SPRWS Project No. **14-68-23.1**

Project Name Polo Ranch Sections 23 and 24 Stockwater project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,645.00	$ 2,645.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 3,800.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	3,400	$ 3.00	$ 10,200.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF		$ 5.00	$ -
8a	12' Wire Gate	LS		$ 600.00	$ -
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	1.00	$ 1,250.00	$ 1,250.00

Sub-Total Estimated Component Costs	$ 29,095.00
Contingency - 15%	$ 4,364.25
Budget for Project with Contingency	**$ 33,459.25**



Existing

- Point of Diversion (SEO)
- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Irrigation Ditch
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

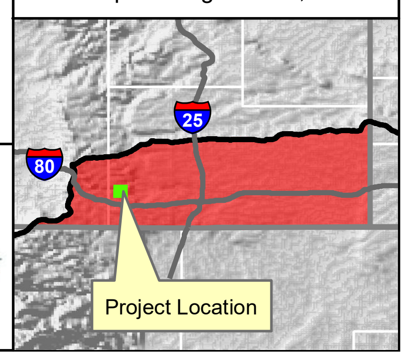
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T14N, R70W



Project 14-70-22.1 and 22.2: Jawbone Gulch Ranch Diversion Dam and Headgate Rehabilitation

Document Name: Jawbone_14-70-22.1_and_22.2
Date Saved: 8/4/2017

SPRWS PROJECT NUMBER: 14-70-22.1

Rehabilitate the Diversion Dam and Headgate for the Bramford Ditch
NW SE Section 22, T14N, R70W
Site Visit Date: July 17, 2017

PROJECT NAME: Bramford Ditch, Permit No, 10747D, CR 36 page 702
Diversion Dam and Headgate Rehabilitation Project

Jawbone Gulch Ranch (Applicant – Name of Entity)

Note that the headgate and upper part of the ditch and irrigated land is owned by the Jawbone Gulch Ranch, but the lower part of the irrigated land is owned by the City of Cheyenne.

Guy Landers (Contact Name)

559 Happy Jack Road (Contact Information)

Cheyenne, WY 82009

Laramie 307-640-3562 guyandkathylanders@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platform					
Spring Development					
Wetland					
Environmental *					
Irrigation			x	41.167N	105.2204W
Windmill					

+ The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

Legal Description Well to be located

	Township	Range	Section	Quarter-Quarter
Headgate Location	14	70	22	NW SE

Project Description:

This project involves repair and rehabilitation of the diversion dam and headgate for the Bramford Ditch, Permit No. 10747 – CR 36, page 702. This water right is for 0.26 cfs and the ditch irrigates 18 acres in the SE ¼ of Section 22, T14N, R70W. The ditch diverts from South Fork Middle Crow Creek approximately one-half mile upstream of Crystal Reservoir. The headgate, diversion dam and part of the irrigated land is owned by the Jawbone Ranch, but the lower part of the irrigated land is owned by the City of Cheyenne.

Two options to repair the diversion were discussed with the Guy Landers, with the Jawbone Gulch Ranch, during the site visit. One option would involve construction of a diversion dam and headgate for the ditch near the location of the historic diversion. In addition to the work on the diversion dam and headgate, this option would also require cleaning of approximately 600' of ditch. The diversion dam and headgate is located just downstream of the Granite Springs Road, which is a Laramie County Road. This site is adjacent to the South Fork Middle Crow Creek and is in the riparian area along the creek. The site is brushy and vegetated. Environmental considerations such as sediment, erosion control and re-vegetation likely will be required for this project. Also, coordination with Laramie County Public Works Department may be required due to the work being located near the County Road.

The second option would be to move the diversion downstream and construct a wet well and pump that would be used to pump the water from the creek into the ditch. A 2 or 3 HP pump would be adequate for this project. Single phase power is nearby and the pump would be supplied from the powerlines. Some of the environmental issues and issues with construction adjacent to the County Road could be minimized by this option.

Additional survey and cost analyses will be required prior to final design of this project.

Public Benefit:

____

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____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District, City of Cheyenne

____

Who is the owner of the project? ______Jawbone Gulch Ranch and the City of Cheyenne both own land irrigated by the ditch.

Who owns the land that the project is to be built on? The work to repair or rehabilitate the ditch, diversion dam and headgate would be done on land owned by the Jawbone Gulch Ranch.

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ___________________________________
The Bramford Ditch irrigates approximately 18 acres in the SE ¼ of Section 22, T14N, R70W. This project will allow continued irrigation of this property. Additional benefits of a properly constructed diversion dam and headgate and/or a wetwell and pump would include reducing sediment and erosion in the creek, which flows into Crystal Reservoir.

What is the total estimated project cost? _______$100,000, but more design is required.

Photographs:

Photo shows the approximate location of the historic Bramford Ditch Diversion.

Rex is standing in the Bramford Ditch. Photo is taken looking generally upstream. Note the vegetation near the ditch.

Photo shows the Bramford Ditch near the upper end of the irrigated meadow. Willows are growing in the ditch and mark its approximate location. The pipe from the pump could discharge into the ditch near this location, as an alternative to re-constructing a diversion dam and headgate.

SPRWS PROJECT NUMBER: 14-70-22.2
Rehabilitate the Diversion Dam and Headgates for the
Bramford No. 1 and No. 2 Ditches
NW SW Section 22, T14N, R70W
Site Visit Date: July 17, 2017

PROJECT NAME: Bramford Ditch No. 1, Permit No, 20940D and the Bramford No. 2 Ditch, Permit No. 20941D Diversion Dam and Headgates Rehabilitation Project

Jawbone Gulch Ranch (Applicant – Name of Entity)

Guy Landers (Contact Name)

559 Happy Jack Road (Contact Information)

Cheyenne, WY 82009

Laramie 307-640-3562 guyandkathylanders@gmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platform					
Spring Development					
Wetland					
Environmental *					
Irrigation			x	41.165N	105.2272W
Windmill					

+ The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

Legal Description Well to be located

	Township	**Range**	**Section**	**Quarter-Quarter**
Location of Headgates and Diversion Dam	14	70	22	NWSW

Project Description:

This project involves repair and rehabilitation of the diversion dam and headgates for the Bramford No. 1 Ditch, Permit No. 20940D and the Bramford No. 2 Ditch, Permit No. 20941D. These ditches share a common diversion dam that diverts water from the South Fork Middle Crow Creek. The Bramford No. 1 Ditch irrigates approximately 11 acres on the north side of the creek and the Bramford No. 2 Ditch irrigates approximately 18 acres on the south side of the creek. These ditches are in the process of being adjudicated.

The diversion dam is located in the NW ¼ SW ¼ of Section 22, T14N, R70W. The headgates, diversion dam and the irrigated land is owned by the Jawbone Ranch.

One option would be to reconstruct the diversion dam with a compacted earthfill embankment. Riprap and erosion protection on the embankment would be needed to provide protection during high flows in the creek. A second option would be to reconstruct the diversion as a rock fill structure. Gabion baskets or a timber cribbed rock fill structure could be considered. An impervious liner would be necessary to reduce seepage through the rock fill.

A 36" diameter culvert with gate would be installed through the diversion dam to allow by-pass of high flows. New headgates for both ditches, consisting of culverts and gates, would be installed.

This site on the South Fork Middle Crow Creek and is in the riparian area. Environmental considerations such as sediment and erosion control and re-vegetation likely will be required for this project.

Additional survey and cost analyses will be required prior to final design of this project.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? The Jawbone Gulch Ranch own the property where the headgates and diversion dam are located and the lands irrigated by the ditches.

Who owns the land that the project is to be built on? The Jawbone Gulch Ranch.

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________

The Bramford No. 1 Ditch irrigates approximately 11 acres on the north side of the creek and the Bramford No. 2 Ditch irrigates approximately 18 acres on the south side of the creek. This project will allow continued irrigation of this land. Additional benefits of a properly constructed diversion dam and headgates include reducing sediment and erosion in the creek, which flows into Crystal Reservoir.

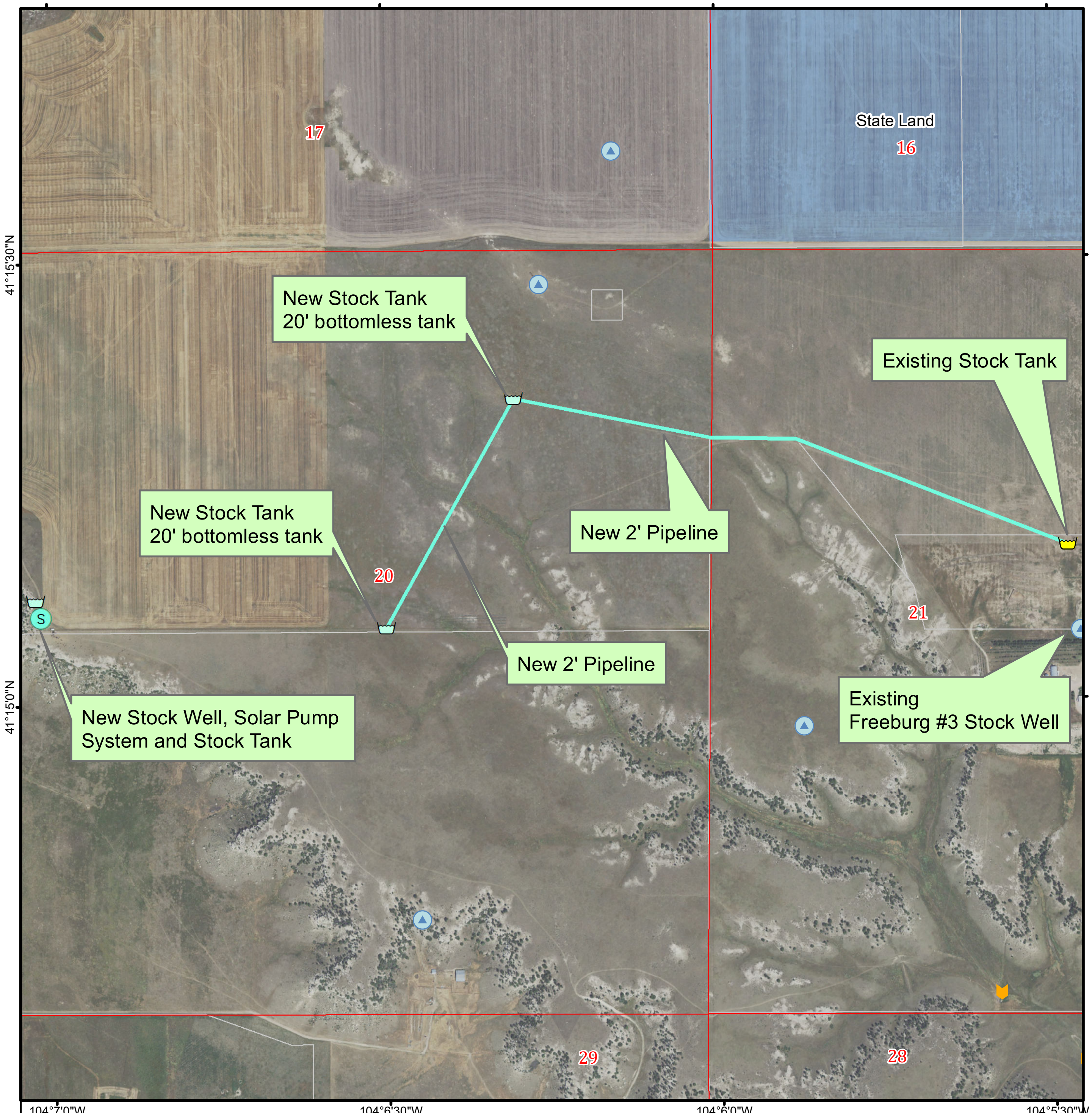
What is the total estimated project cost? __$100,000, but additional design is required.______________

Photographs:

Photo shows the location of the Bramford No. 1 and No.2 Ditch Diversion. This photo is taken from the south bank looking north or northwest across the creek. The creek flows from left to right in the photo.

Another photo of the diversion dam location. The diversion dam is located approximately between the metal fence post and the eroded area seen on the far bank between the trees. In this photo, the water flows from right to left (generally east).

Photo shows the Bramford No. 2 Ditch on the south side of the creek (Guy Landers is standing near the ditch bank) and the irrigated land on the north side of the creek is also visible in the photo. The riparian area along the South Fork Middle Crow Creek is visible in the photo.



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

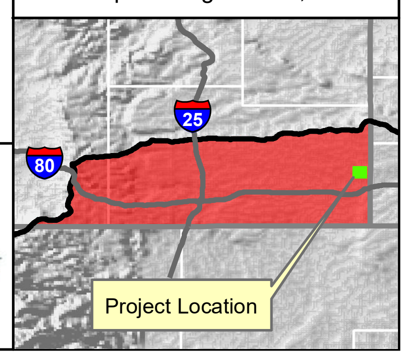
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T15N, R60W



Project 15-60-20.1: R & K Farms, New Stock Well, Solar Pump, Pipelines and Tanks

Document Name: R&KFarms_16-60-20.1
Date Saved: 9/5/2017

SPRWS PROJECT NUMBER: <u>15-60-20.1</u>

Pipeline and Tanks

New stock tanks in the N ½ of Section 20, T15N R60W

Site Visit Date: September 1, 2017

PROJECT NAME: R&K Farms stock water pipeline and new tanks

R&K Farms, Inc. (Applicant – Name of Entity)

Travis Freeburg (Contact Name)

1472 State Highway 215 (Contact Information)

Pine Bluffs, WY 82082

Laramie	307-245-3021 & 307-421-8429 (cell)	travisfreeburg@yahoo.com
(County)	(Phone)	(Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platform					
Tanks – 1 of 2 and pipeline from existing tank to new tank 1		X		41.2556	104.1050
Tanks – 2 of 2 and pipeline from new tank 1 to new tank 2		X		41.2514	104.1083
Spring Development					
Wetland					
Environmental *					
Irrigation					
Windmill					

+ The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

<u>Legal Description Locations of Tanks</u>

Township	Range	Section	Quarter-Quarter
15	60	20	N 1/2

Project Description:

This project involves construction of a pipeline from an existing stock tank in Section 21, T15N, R60W to two new tanks that will be located in Section 20, T15N, R60W. The existing tank is supplied by the Freeburg #3 Well, Permit No. UW 198891. The new tanks will also be supplied from this well.

The tank(s) will be located in the north ½ of Section 20, as shown on the accompanying map. The first tank will be near the old windmill, the Russell #4 Well, UW 5505. This windmill has been removed, because it no longer is a reliable source of water. There is no other water source for the pasture in the north ½ of Section 20 and the owner has to haul water and/or the cattle have to walk to the existing tank. The second tank will be located near the fence between the north and south halves of Section 20. This fence also divides the two pastures in Section 20.

At each tank location one 20' diameter bottomless tank or two 10' diameter galvanized tanks will be installed.

Specifically, this project will include:

- Two new stock tanks or tank batteries.
- Approximately 5800' of 2" dia. pipeline. The pipeline will run from the existing tank in Section 21 to the two new tanks in Section 20.
- Miscellaneous valves and floats.

Public Benefit:

____

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____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District ________________________________

____

Who is the owner of the project? ______R&K Farms, Inc.____________

Who owns the land that the project is to be built on? ________Hayco, LLC_________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ______________________________________

This project will provide stock watering for an approximately 320 acre pasture located in the north half of Section 20 T15N, R60W owned by R&K Farms. Also, the second tank will provide water to the pasture in the south half of Section 20 that currently does not have water. Water for wildlife is another benefit of this project.

What is the total estimated project cost? $54,000

Photograph:

This photo shows the old stock tank and tower for the old windmill at the Russell #4 Well location. One of the new stock tanks will be installed near here to replace the windmill that has become un-reliable.

SPRWS Project Cost Estimate

SPRWS Project No. **15-60-20.1**

Project Name R&K Farms Stock Water Pipeline and Tanks

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,252.50	$ 4,252.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	2	$ 12,000.00	$ 24,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	5,800	$ 2.50	$ 14,500.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	240	$ 5.00	$ 1,200.00
8a	12' Wire Gate	LS	2	$ 600.00	$ 1,200.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs $ 46,777.50
Contingency - 15% $ 7,016.63

Budget for Project with Contingency **$ 53,794.13**

SPRWS PROJECT NUMBER: 15-60-20.2
New stock well, solar pumping plant and tanks
in the SWNW of Section 20, T15N R60W
Site Visit Date: September 1, 2017

PROJECT NAME: R&K Farms Section 20 New Stock Well and Tanks

R&K Farms, Inc. (Applicant – Name of Entity)

Travis Freeburg (Contact Name)

1472 State Highway 215 (Contact Information)

Pine Bluffs, WY 82082

Laramie 307-245-3021 & 307-421-8429 (cell) travisfreeburg@yahoo.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well		X		41.2517	104.1169
Solar Platform		X		41.2517	104.1169
Tank		X		41.2517	104.1169
Spring Development					
Wetland					
Environmental *					
Irrigation					
Windmill					

+ The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

Legal Description Locations of Tanks

Township	Range	Section	Quarter-Quarter
15	60	20	SWNW

Project Description:

This project involves construction of new well, solar pump, and tank in the SWNW of Section 21, T15N, R60W. In addition to the stock water benefits, this well and tank will also provide water for wildlife. The well will be rather deep, because it is located on the table land or bluff above Chivington Draw, which is located to the west and southwest of the site. This project will provide back up or redundancy for the R&K Farms stock water pipeline, listed as project 15-60-20.1.

Specifically, this project will include:

- A new 500' deep well.
- A solar pumping system.
- Two new stock tanks.
- A short pipeline (200') from the well to the tanks.
- Miscellaneous valves and floats.

Public Benefit:

____
____
____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? R&K Farms, Inc.

Who owns the land that the project is to be built on? Hayco, LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

This project will provide stock watering for an approximately 320 acre pasture located in the north half of Section 20 T15N, R60W owned by R&K Farms. Also, the project will provide water for wildlife.

What is the total estimated project cost? $55,000

Photograph:

This photograph is taken from near the proposed well and tank location looking generally west over Chivington Draw. This well will be located near the edge of the bluff. The wooded area along the edge of the bluff is quality wildlife habitat.

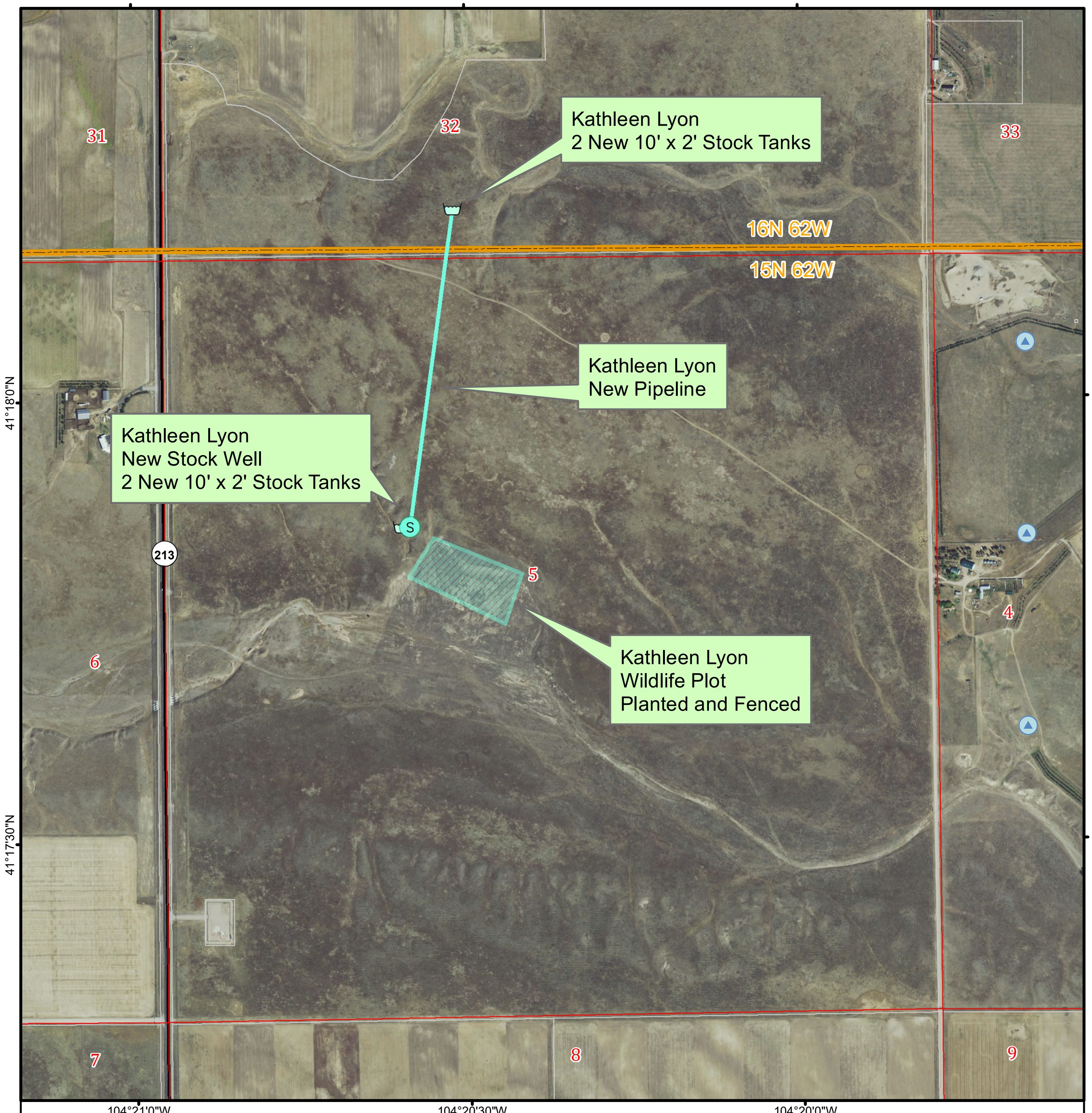
SPRWS Project Cost Estimate

SPRWS Project No. **15-60-20.2**

Project Name R&K Farms Stock Well, Solar Pump, and Tank

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,362.50	$ 4,362.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	500	$ 40.00	$ 20,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS	1	$ 14,500.00	$ 14,500.00
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	2	$ 2,900.00	$ 5,800.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	200	$ 2.50	$ 500.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	47,987.50
Contingency - 15%	$	7,198.13
Budget for Project with Contingency	**$**	**55,185.63**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

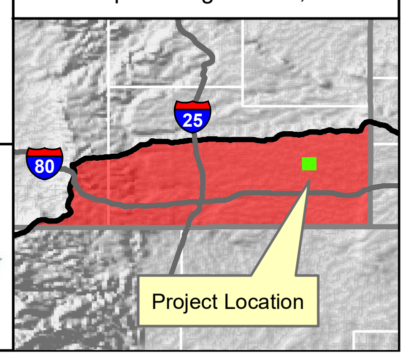
Feet
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T15N, R62W



Project 15-62-5.1: Kathleen Lyon Stock ad Wildlife Watering

Document Name: Lyon_15-62-5.1
Date Saved: 9/1/2017

SPRWS PROJECT NUMBER: 15-62-5.1
New Well, Pump, Pipeline, and Tanks
Section 5, T15N, R62W and S 1/2 Section 32, T16N R62W
Site Visit Date: July 1, 2017

PROJECT NAME: Kathleen Lyon Stock and Wildlife Watering Project

New Well, Solar System, cistern, Tanks, pipeline, 2nd set of tanks, and wildlife plot

V. Kathleen Lyon (Applicant – Name of Entity)

Same (Contact Name)

P.O. Box 312 (Contact Information)

Burns, WY 82053

Laramie 307-245-3839 N/A

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well		X		41.2976	104.3431
Solar Platform		X			
Tanks – 1 of 2		X		41.2976	104.3433
Pipeline from well to 2nd set of tanks		X			
Tanks – 2 of 2		X		41.3036	104.3420
Spring Development					
Wetland					
Environmental *		X		41.2963	104.3420
Irrigation					
Windmill					

+ The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

Legal Description Well to be located

Township	Range	Section	Quarter-Quarter
15	62	5	all
16	62	32	S ½

Project Description:

This project involves construction of a new stock watering system and wildlife plot, including a new well; solar pumping system, 2 – 10' diameter galvanized tanks near the well; ½ mile pipeline; and a second set of tanks (2-10' dia. galvanized tanks) at the end of this pipeline. A wildlife plot will be constructed near the well with a drip system installed to irrigate the vegetation.

Specifically, this project will include:

- A 450' deep stock well.
- A new solar pumping system.
- Four 12' diameter by 2' deep stock tanks – two to be installed at the well and two at the end of the pipeline.
- ½ mile of 2" dia. pipeline.
- Miscellaneous valves and floats.
- A wildlife plot will be planted and fencing will be installed around the wildlife plot. This will be located south (downhill) of the well and tanks.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Kathleen Lyon

Who owns the land that the project is to be built on? Kathleen Lyon

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________

This project will provide stock watering for an approximately 900 acre pasture located in Section 5 T15N, R62W and in the S ½ of Section 32, T16N, R62W. The wildlife plot and fencing will benefit wildlife in the area of this project.

____

What is the total estimated project cost? $64,500

Photograph: Antelope Draw

Location: Photo shows Antelope Draw in the Southern part of Section 5, T15N, R62W. The culverts through Highway 213 are shown on the right (west) side of the photo. This photo is taken from near the location of the new Kathleen Lyon well and one set of stock tanks. The area in the foreground of the photo shows the location of the proposed wildlife habitat. Note that the landowner has planted some trees and that this area is fenced to provide forage and wildlife habitat.

SPRWS Project Cost Estimate

SPRWS Project No. **15-62-5.1**

Project Name Kathleen Lyon Stock and Wildlife Water project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 5,111.25	$ 5,111.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	450	$ 40.00	$ 18,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	4	$ 2,900.00	$ 11,600.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	3,000	$ 2.50	$ 7,500.00
7	Miscellaneous Valves and piping at tank(s)	Ea	4	$ 500.00	$ 2,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.75	$ 1,250.00	$ 937.50

Sub-Total Estimated Component Costs	$	56,223.75
Contingency - 15%	$	8,433.56
Budget for Project with Contingency	**$**	**64,657.31**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

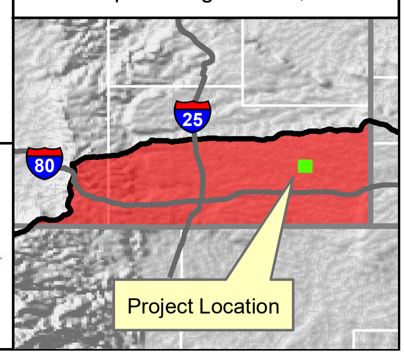
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T15N, R62W



Project 15-62-7.1: Gary Lyon Stock ad Wildlife Watering

Document Name: Lyon_15-62-7.1
Date Saved: 7/5/2017

SPRWS PROJECT NUMBER: 15-62-7.1

New Well, Pump, Pipeline, and Tanks

NW¼ SW ¼ Sec. 7 T15N R62W

Site Visit Date: July 1, 2017

PROJECT NAME: Gary Lyon Stock and Wildlife Watering Project

The existing well to be replaced is the Gary #2 Stock Well, UW54639

New well, electric pump, one set of tanks near well, 2nd set of tanks, pipeline, and wildlife plot north of the 2nd set of tanks.

Gary A Lyon (Applicant – Name of Entity)

4906 Road 218 (Contact Address)

Burns, WY 82053

Laramie (County) 307-630-3216 (Phone) glyon101@gmail.com (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well		X		41.2803	104.3675
Solar Platforms					
Pipeline		X			
Tanks – 1 of 2		X		41.2801	104.3677
Tanks – 2 of 2		X		41.2823	104.3604
Spring Development					
Wetland					
Environmental		X		41.2823	104.3604
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

Legal Description Well to be located

Township	Range	Section	Quarter-Quarter
15	62	7	NWSW

Project Description:

This project involves construction of a new stock watering system, including new well; electric pump, 2 – 10' diameter galvanized tanks near the well; ¾ mile pipeline; and a second set of tanks (2-10' dia. galvanized tanks) at the end of this pipeline. The new well will be a replacement for the existing Gary #1 Stock Well, Permit No. UW 54639. A wildlife habitat plot will be constructed near the 2nd set of tanks.

Specifically, this project will include:

- A 460' deep stock well. This new well will be permitted as a relocation and deepening of the existing Gary #1 Stock Well, which was drilled in approximately 1920.
- A new AC electric pump with service from the existing powerline.
- Four 10' diameter by 2' deep stock tanks – two to be installed at the well and two at the end of the pipeline.
- ¾ mile of 2" dia. pipeline.
- Miscellaneous valves and floats.
- A wildlife plot will be planted and fencing will be installed around the wildlife plot. This will be located north (downhill) of the second set of tanks.

Public Benefit:

____

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Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? ______Gary Lyon__________

Who owns the land that the project is to be built on? _______Gary Lyon__________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________

A corral near the well and all of the North ½ and part of the SE ½ of Section 7, T15N, R62W will benefit from the improved water sources. This pasture is approximately 450 acres. The wildlife plot and fencing will benefit wildlife in the area of this project.

What is the total estimated project cost? _____$61,000_______________________________________

Photographs: Gary #2 Stock Well, UW 54639

Location: NWSW Sec 5, T15N R62W. The existing well is located near the power pole and transformer. New well will be located near the existing well and the pump will be an electric pump. One set of stock tanks will be constructed in the corrals around the well and the 2nd set will be located north, as shown on the map.

SPRWS Project Cost Estimate

SPRWS Project No. **15-62-7.1**

Project Name Gary Lyon Stock and Wildlife Water project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,798.75	$ 4,798.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	450	$ 40.00	$ 18,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 1,750.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	4	$ 2,900.00	$ 11,600.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	4,000	$ 2.50	$ 10,000.00
7	Miscellaneous Valves and piping at tank(s)	Ea	4	$ 500.00	$ 2,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.75	$ 1,250.00	$ 937.50

Sub-Total Estimated Component Costs	$ 52,786.25
Contingency - 15%	$ 7,917.94
Budget for Project with Contingency	**$ 60,704.19**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

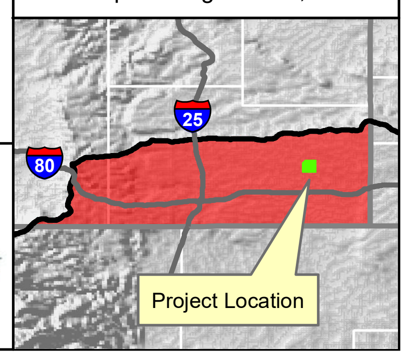
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T15N, R62W



Project 15-62-8.1: Larry Lyon Stock ad Wildlife Watering

Document Name: Lyon_15-62-8.1
Date Saved: 9/1/2017

SPRWS PROJECT NUMBER: 15-62-8.1
New Well, Solar Pump, and Tanks
NW¼ SE ¼ Section 8, T15N, R62W
Site Visit Date: July 1, 2017

PROJECT NAME: Larry Lyon Stock Watering Project

New well, solar pumping system and one set of tanks near well.

Lewis T. Lyon Trust (Applicant – Name of Entity)

Larry Lyon (Contact Address)

4914 Road 219

Burns, WY 82053

Laramie 307-630-1580 or 307-547-3315 N/A

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well		X		41.2805	104.3388
Solar Platforms		X		41.2805	104.3388
Pipeline					
Tanks – 1 of 1		X		41.2805	104.3388
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

Legal Description Well and tanks to be located

Township	Range	Section	Quarter-Quarter
15	62	8	NWSE

Project Description:

This project involves construction of a new stock watering system, including new well; solar pumping system, and 2 – 10' diameter tire tanks near the well.

Specifically, this project will include:

- A 460' deep stock well. This new well will require a new stock well permit.
- A new solar pumping system, including panels, solar pump, and cistern.
- Two 10' diameter by 2' deep stock tanks to be installed near the well.
- Miscellaneous valves and floats.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Lewis T. Lyon Trust

Who owns the land that the project is to be built on? Lewis T. Lyon Trust

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

This stock watering system will provide benefits to all of Section 8, T15N, R62W and part of the west ½ of Section 9 in this same township.

What is the total estimated project cost? $46,500

SPRWS Project Cost Estimate

SPRWS Project No. **15-62-8.1**

Project Name Larry Lyon Stock Water project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 3,681.25	$ 3,681.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	450	$ 40.00	$ 18,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	2	$ 2,900.00	$ 5,800.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	250	$ 2.50	$ 625.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 40,493.75
Contingency - 15%	$ 6,074.06
Budget for Project with Contingency	**$ 46,567.81**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well withAC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

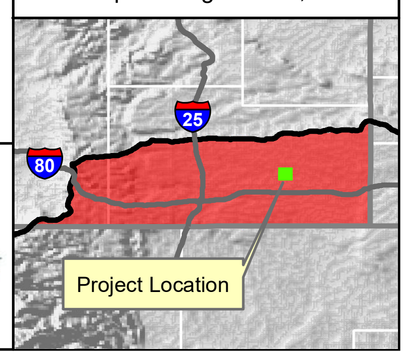
N

Feet
0 500 1,000
1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T15N, R65W



Project 15-63-20.1: Kenan, New Well with Solar Pump and Tank

Document Name: Keenan_15-63-20.1
Date Saved: 11/17/2017

SPRWS PROJECT NUMBER: 15-63-20.1
New Well, Solar Pump, and Tank
SE ¼ SE ¼ Sec. 20 T15N R63W

PROJECT NAME: Keenan Stock Well, Solar Pump, and Tanks

___William Keenan___________________________ (Applicant – Name of Entity)

____ (Contact Address)

10 Katherine Lane

Simsbury, CT 06070

Laramie___ ____________________ ___________________________

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well		X		41.2455N	104.4464W
Solar Platforms		X		41.2455N	104.4464W
Pipeline		X			
Tank at well		X		41.2455N	104.4464W
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
15N	63W	20	SE SE

Project Description:

This project involves construction of a new stock watering system, including new well; solar pump, panels and associated equipment; and a tank near the well.

This well will require a new well permit.

Specifically, this project will include:

- A 360' deep stock well.
- A solar pump, with solar panels, controller, 1250 gallon cistern.
- A bottomless tank, which will be installed near the well.
- A short pipeline.
- Miscellaneous valves and floats.

Public Benefit:

____
____
____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? William Keenan

Who owns the land that the project is to be built on? William Keenan

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?
This project will provide stock water for two pastures, which total approximately 340 acres.

What is the total estimated project cost? $51,675

SPRWS Project Cost Estimate

SPRWS Project No. **15-62-20.1**

Project Name Keenan Stock Water Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,085.00	$ 4,085.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	360	$ 40.00	$ 14,400.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	500	$ 4.50	$ 2,250.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$ 44,935.00
Contingency - 15%	$ 6,740.25
Budget for Project with Contingency	**$ 51,675.25**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well withAC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

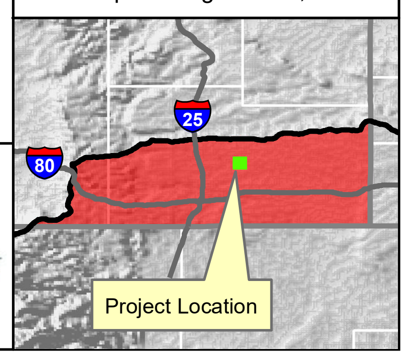
N

Feet
0 500 1,000
1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T15N, R65W



Project 15-65-4.1: Paul Life & Trust, New Solar Pump and Tank

Document Name: PaulLife_15-65-4.1
Date Saved: 9/6/2017

SPRWS PROJECT NUMBER: 15-65-4.1
Hallock Stock Water project

NE ¼ SW ¼ Sec. 4 T15N R65W
Site Visit Date: 11/14/2016

PROJECT NAME: Hallock Stock Water Project
Existing Hallock #1 Well, UW 202658

Rosalie Hallock (Applicant – Name of Entity)

333 Old Mill Road, No. 317

Santa Barbara, CA 93110

805-967-3708

Laurel Paul (Contact)

3301 Rd. 222 Cheyenne WY

Laramie 307-632-9316 laurelpaul40@yahoo.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		☐	☐		
Solar Platforms		X		41.2950N	104.6644W
Pipeline		☐	☐		
Tank		X		41.2950N	104.6644W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
15N	65W	4	NE ¼ SW ¼

Project Description:

This project involves installation of a solar pump, panels and tank(s) at the Hallock #1 Well, which has been drilled and completed. However, a pump has never been installed in the well. The permit number for the well is 202658 UW.

No statement of completion for this well has been filed, so the yield of the well is unknown. This well is located on property owned by Rosalie Hallock, but the contact for the project is Laurel Paul.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

________________LCCD____

____

Who is the owner of the project? ______Rosalie Hallock___________________

Who owns the land that the project is to be built on? _______Rosalie Hallock

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? _____________________________________

_______The south half of Section 4, where this well is located has been subdivided into 10 – 32 acre tracts. The well is located on one of the tracts.____

What is the total estimated project cost? _______$23,850___________________________________

Photographs:

Photo shows the cased Hallock #1 Well. Currently, there is no pump in the well.

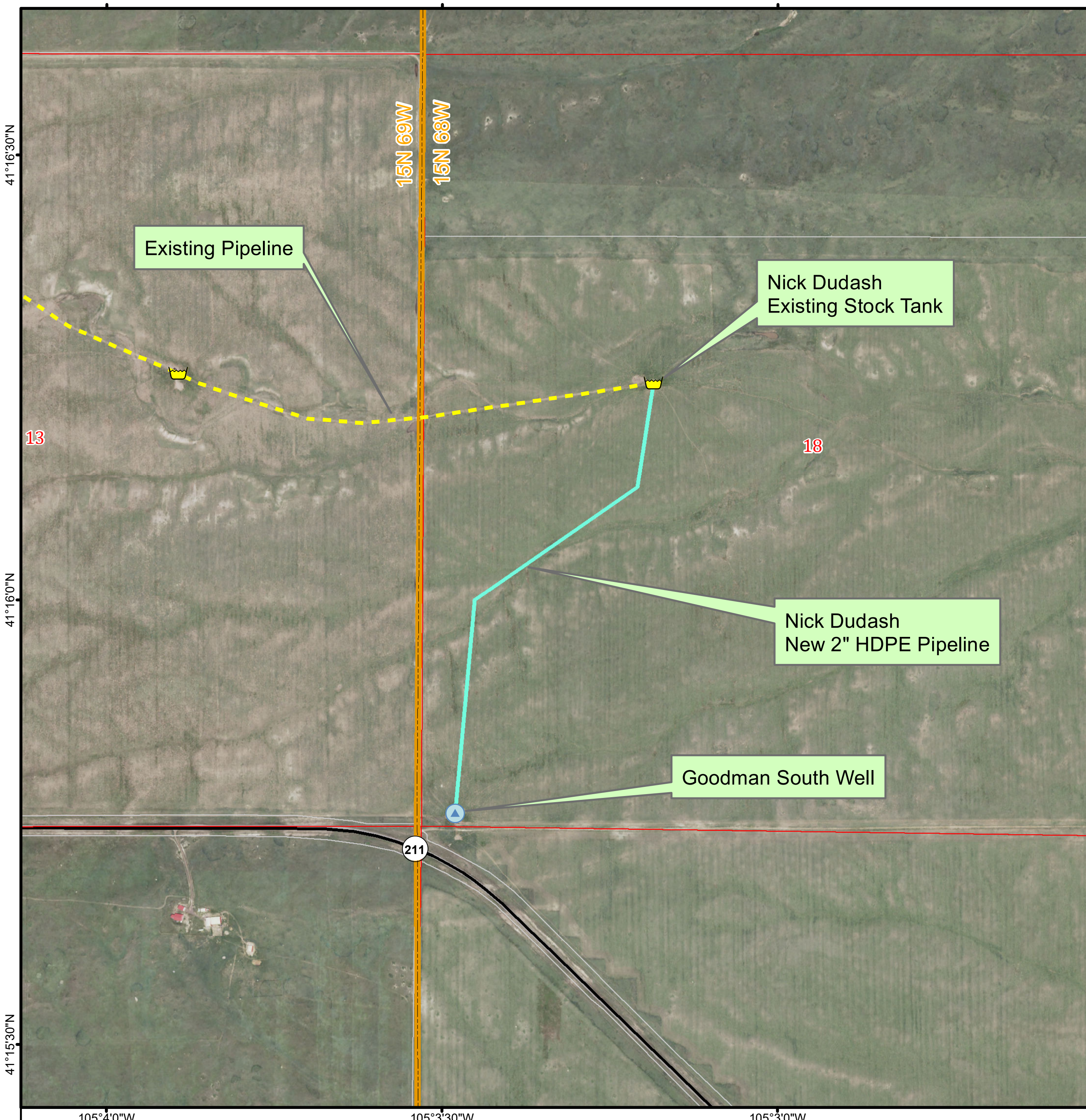
SPRWS Project Cost Estimate

SPRWS Project No. **15-65-4.1**

Project Name Hallock Stock Water Project Section 4

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,885.00	$ 1,885.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	2	$ 2,900.00	$ 5,800.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	100	$ 3.50	$ 350.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	20,735.00
Contingency - 15%	$	3,110.25
Budget for Project with Contingency	**$**	**23,845.25**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

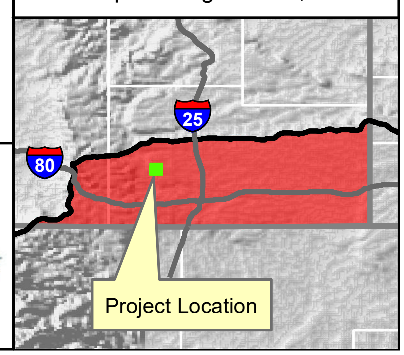
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T15N, R68W



Project 15-68-18.1: Nick Dudash Stockwater Pipeline

Document Name: Dudash_15-68-18.1
Date Saved: 8/2/2017

SPRWS PROJECT NUMBER: 15-68-18.1

Stockwater pipeline
Section 18, T15N, R68W
Site Visit Date: July 12, 2017

PROJECT NAME: Nick Dudash stock water pipeline
Add an additional stock tank point of use to the existing Goodman South Stock Well, Permit No. UW 144810

Nick Dudash (Applicant – Name of Entity)

Nick Dudash (Contact)

920 Ridgeland Street   Cheyenne, WY 82009

(County)	(Phone)	(Email)
Laramie	307-638-6166 307-630-5892 (cell)	N/A

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well			☐		
Solar Platforms			☐		
Pipeline		X	☐	41.2707N	105.0531W
Tank			☐		
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

	Township	Range	Section	Quarter-Quarter
Well location	15N	68W	18	SW1/4 SW 1/4
Existing Tank location	15N	68W	18	SE ¼ NW 1/4

Project Description:

This project involves construction of a pipeline to connect the existing Goodman South Well, Permit No. UW 144810 to an existing tire tank. The Goodman South Well supplies a stock tank near the well and both the tank and well are located near the south west corner of Section 18, T15N, R68W. The existing tire tank that the new pipeline would supply is located closer to the center of Section 18. The existing tank is an 11’ diameter by 18” deep tire tank (the capacity of the tank is approximately 1000 gallons).

The Statement of Completion (SOC) for the Goodman South Well indicates that the well was completed in 2002. The Goodman South Well pump is a 1 HP submersible pump powered by electricity off the powerline. The SOC indicates that the well will pump 8 gpm, the static water level is at 130', and the total depth of the well is 320'. No pump test was conducted on the Goodman South well during the site visit, but based on the information contained in the Statement of Completion for the well it appears to be capable of supplying water for the additional tank.

Currently the existing stock tank that would be connected via the new pipeline from the Goodman South Well is supplied by well(s) that are located on the adjacent landowner, Mr. Stanley Baer. The pipeline runs from the west to provide water to the existing tank. The age and condition of the current stock water pipeline system is unknown.

Mr. Dudash would like the new pipeline from the Goodman South Well to the tank to be constructed so that he does not need to rely on his neighbor for water. The new pipeline from the existing Goodman South Well would be a more reliable long term source of water. And this project has the added benefit of being a source of water for the Baer stock water pipeline system, if there was a problem with one of their wells.

Specifically, the project will include:

- Construction of approximately 5000' of 2" HDPE waterline.
- Miscellaneous valves and floats.

Public Benefit:

-

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

___Laramie County Conservation District____

Who is the owner of the project? ______Nick Dudash_______________

Who owns the land that the project is to be built on? _______Nick Dudash__

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? Approximately 480 acres in the south ¾ of Section 18, T15N, R 68W will benefit directly from this project. In addition, approximately 950 acres of land located to the west of the Dudash property could receive a back-up water source via the new pipeline from the Goodman South Well.

What is the total estimated project cost? _____$17,250______________________________________

Photo shows the existing stock tank on the Dudash property that would be connected to the pipeline from the Goodman South Well. This tank is located in Section 18, T15N, R68W at 41.2707N, 105.0531W.

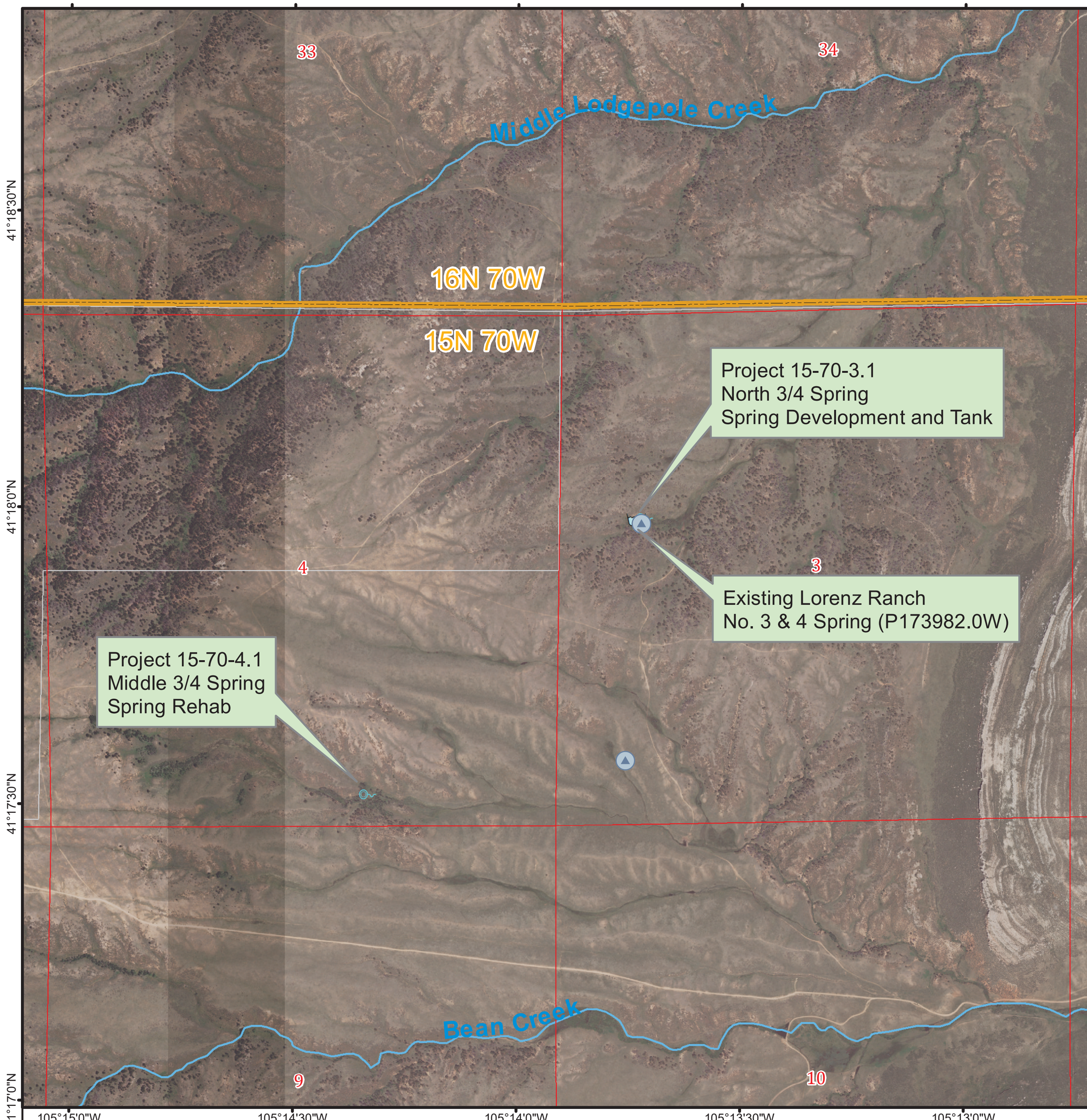
SPRWS Project Cost Estimate

SPRWS Project No. **15-68.18.1**

Project Name Dudash Stock Water Pipeline Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,362.50	$ 1,362.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	5,000	$ 2.50	$ 12,500.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF		$ 5.00	$ -
8a	12' Wire Gate	LS		$ 600.00	$ -
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	14,987.50
Contingency - 15%	$	2,248.13
Budget for Project with Contingency	**$**	**17,235.63**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Irrigation Ditch
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

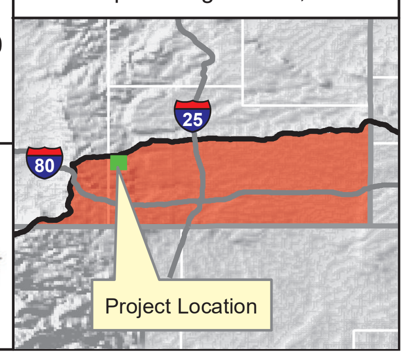
0 750 1,500

1 in = 1,500 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T15N, R70W



Project 15-70-3.1 and 4.1. Lorenz Ranch
3/4 Springs Development and Stock Tanks

Document Name: Lorenz_Ranch_15-70-3.1_4.1
Date Saved: 9/28/2017

SPRWS PROJECT NUMBER: 15-70-3.1
North 3 – 4 Spring Rehabilitation
SW¼ NW¼ Sec 3 T15N R70W
Site Visit Date: Sept 14, 2017

PROJECT NAME: North 3 – 4 Spring Rehabilitation
Permit No. UW 173982

Lorenz Ranch, Inc. (Applicant – Name of Entity)

Contacts:

Tom Twiford 1870 County Road 109 Cheyenne, WY 82009 307-477-6565 Kattlebaron@yahoo.com	OJ Huxtable 1885 County Road 109 Cheyenne, WY 82009 307-359-1628 ojhuxtable@gmail.com

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank		X		41.2997N	105.2286W
Spring Development		X		41.2997N	105.2286W
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
15N	70W	3	SW NW

Project Description:

This project will involve a spring development or rehabilitation, a short pipeline, and tank, and then installing a fence around the spring. The water right for this spring is UW 173982, the 3-4 Spring. Specifically, this project will include:

- A spring development with perforated pipe, gravel, and spring box.
- 300’ of 2” pipe downhill (east) from the spring box to the tanks.
- A new 10’dia. by 2’ deep tire tank.
- Construct 400’ of fence with gate around the spring.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Lorenz Ranch

Who owns the land that the project is to be built on? Lorenz Ranch

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ________________

The NW quarter of Section 3, T15N, R70W will benefit from the improved water source.

____

What is the total estimated project cost? $14,500

Photographs:

Site of the North 3 – 4 Spring located in the SW NW Section 3, T15N, R70W.

SPRWS Project Cost Estimate

SPRWS Project No. **15-70-3.1**

Project Name North 3-4 Spring Rehabilitation

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,146.25	$ 1,146.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS	1	$ 3,800.00	$ 3,800.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	1	$ 2,900.00	$ 2,900.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	300	$ 4.50	$ 1,350.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	400	$ 5.00	$ 2,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$	12,608.75
Contingency - 15%	$	1,891.31
Budget for Project with Contingency	**$**	**14,500.06**

SPRWS PROJECT NUMBER: 15-70-4.1
Section 4 Spring Development
SW¼ SE1/4 Section 4, T15N, R70W
Site Visit Date: Sept 14, 2017

PROJECT NAME: Section 4 Spring Development
Needs new water right – no permit

Lorenz Ranch, Inc. (Applicant – Name of Entity)

Contacts:

Tom Twiford 1870 County Road 109 Cheyenne, WY 82009 307-477-6565 Kattlebaron@yahoo.com	OJ Huxtable 1885 County Road 109 Cheyenne, WY 82009 307-359-1628 ojhuxtable@gmail.com

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank		X		41.2920N	105.2389W
Spring Development		X		41.2920N	105.2389W
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
15N	70W	4	SW SE

Project Description:

This project will involve a spring development or rehabilitation, a short pipeline, and tank, and then installing a fence around the spring. This spring does not have a water right, so a new application will be necessary. Specifically, this project will include:

- A spring development with perforated pipe, gravel, and spring box.
- 300' of 2" pipe downhill (east) from the spring box to the tanks.
- A new 10'dia. by 2' deep tire tank.
- Construct 400' of fence with gate around the spring.

Public Benefit:

____
____
____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? ______Lorenz Ranch

Who owns the land that the project is to be built on? ________Lorenz Ranch________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
The south part of Section 4, T15N, R70W will benefit from the improved water source.

____

What is the total estimated project cost? ____$14,500____

Photographs:

Site of the Section 4 Spring located in the SW SE Section 4, T15N, R70W.

SPRWS Project Cost Estimate

SPRWS Project No. **15-70-4.1**

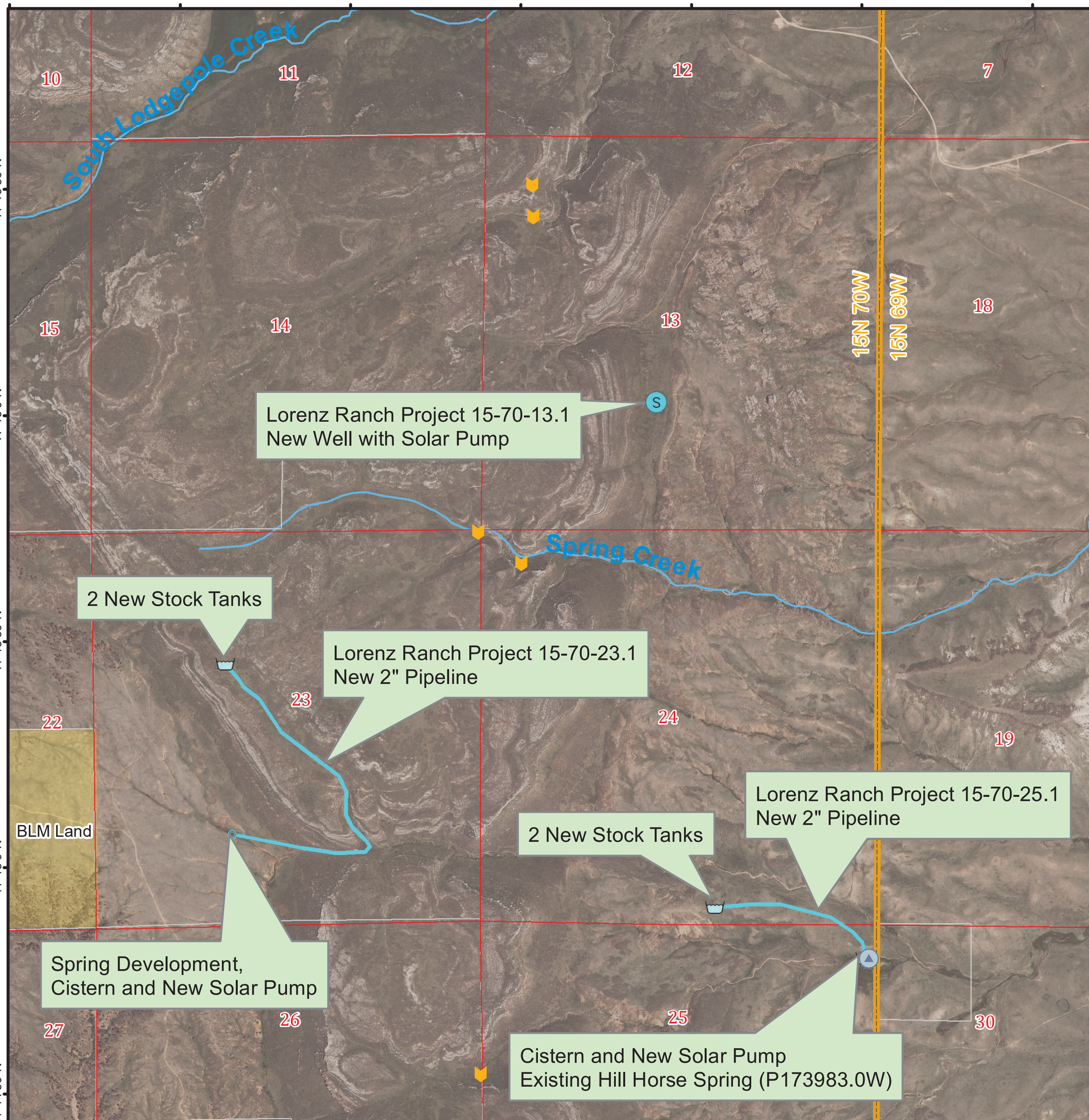
Project Name Section 4 Spring Development

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,146.25	$ 1,146.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS	1	$ 3,800.00	$ 3,800.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	1	$ 2,900.00	$ 2,900.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	300	$ 4.50	$ 1,350.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	400	$ 5.00	$ 2,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs $ 12,608.75

Contingency - 15% $ 1,891.31

Budget for Project with Contingency **$ 14,500.06**



Existing
- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Irrigation Ditch
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed
- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

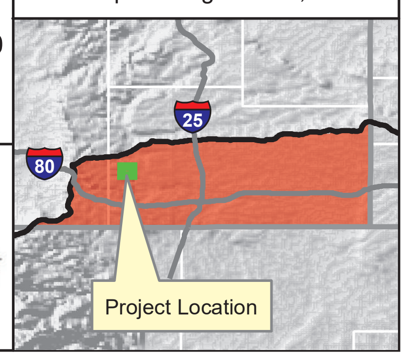
N

Feet
0 1,000 2,000
1 in = 2,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T15N, R70W



Project 15-70-13.1, 23.1 and 25.1. Lorenz Ranch
Mesa Mountain Stock Water Projects

Document Name: Lorenz_Ranch_15-70-13.1_23.1_25.1
Date Saved: 9/28/2017

SPRWS PROJECT NUMBER: <u>15-70-13.1</u>

Section 13 Stock Water Project
NE ¼ SW1/4 Section 13, T15N, R70W
Site Visit Date: Sept 14, 2017

PROJECT NAME: <u>Section 13 Stock Water Project</u>
<u>Needs new water right – no permit</u>

<u>Lorenz Ranch, Inc.</u> (Applicant – Name of Entity)

<u>Contacts:</u>

Tom Twiford 1870 County Road 109 Cheyenne, WY 82009 307-477-6565 Kattlebaron@yahoo.com	OJ Huxtable 1885 County Road 109 Cheyenne, WY 82009 307-359-1628 ojhuxtable@gmail.com

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well		X		41.2642N	105.1850W
Solar Platforms					
Pipeline					
Tank		X		41.2642N	105.1850W
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

<u>Legal Description</u>

Township	Range	Section	Quarter-Quarter
15N	70W	13	NE SW

Project Description:

There are two options for the Section 13 Stock Water Project. One option involves drilling a well, with solar pump and tanks. The second option involves a pump installed in South Lodgepole Creek, near the ranch house, and a 2 mile long pipeline to the site. Final designs of the project will need to be completed prior to an application for a Small Water Project is submitted.

The well is the simplest project. However the success or feasibility of a well at this site is not certain. The site is elevated and is on the edge of a mesa. The well will need to be approximately 400 – 500' deep and drilled through hard rock. Granite may be encountered during drilling and the yield of a well may be low. If the well was successful, a solar pump, tank(s), short pipeline and fence would be installed. The preliminary cost estimate for this option is approximately $60,000.

The well project will include:

- A 400 – 500' deep well.
- A solar pump designed for 400' TDH minimum.
- 300' of 2" pipeline from the well to the tanks.
- Two new 10'dia. by 2' deep tire tanks.
- Installation of approximately 400' of fence with gate around the well and solar panels.

As an alternative to drilling a well at this site, water could be pumped from South Lodgepole Creek near the ranch house through a pipeline to a set of tanks at this location. However, the pipeline will be approximately 2 miles long through difficult terrain. Power is available at the ranch house, so the pump at the creek could be a submersible electric pump and the pump would have the capacity to pump up the hill to the site. The preliminary cost estimate for this option is $66,500. The big advantage of this option is that the water supply is more certain.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? ______Lorenz Ranch

Who owns the land that the project is to be built on? _______ Lorenz Ranch _______________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ___________________________________

_______A large pasture on Mesa Mountain would benefit from this project. Water is scarce in this area.__

____

What is the total estimated project cost? ____$60,000 - $66,500________________________________

Photographs:

This photo shows the site of the Section 13 Stock water project, which is located in the NE SW Section 13, T15N, R70W. The stock tanks would be located near the trucks. A well would be drilled near this site or water would be pumped from the creek to this site.

SPRWS Project Cost Estimate

SPRWS Project No. **15-70-13.1a**

Project Name Lorenz Section 13 Stock water project - Well

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,806.25	$ 4,806.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	450	$ 60.00	$ 27,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS	1	$ 14,500.00	$ 14,500.00
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea	2	$ 1,200.00	$ 2,400.00
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	500	$ 2.50	$ 1,250.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	200	$ 5.00	$ 1,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$	52,868.75
Contingency - 15%	$	7,930.31
Budget for Project with Contingency	**$**	**60,799.06**

SPRWS Project Cost Estimate

SPRWS Project No. **15-70-13.1b**

Project Name Lorenz Section 13 Stock water project - pump from creek

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 5,242.50	$ 5,242.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 60.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea	2	$ 1,200.00	$ 2,400.00
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	10,600	$ 4.00	$ 42,400.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF		$ 5.00	$ -
8a	12' Wire Gate	LS		$ 600.00	$ -
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	57,667.50
Contingency - 15%	$	8,650.13
Budget for Project with Contingency	**$**	**66,317.63**

SPRWS PROJECT NUMBER: 15-70-23.1

Section 23 Stock Water Project
SE ¼ SW1/4 Section 23, T15N, R70W
Site Visit Date: Sept 14, 2017

PROJECT NAME: Section 23 Stock Water Project
Needs new water right – no permit

Lorenz Ranch, Inc. (Applicant – Name of Entity)

Contacts:

Tom Twiford 1870 County Road 109 Cheyenne, WY 82009 307-477-6565 Kattlebaron@yahoo.com	OJ Huxtable 1885 County Road 109 Cheyenne, WY 82009 307-359-1628 ojhuxtable@gmail.com

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank		X		41.2557N	105.2036W
Spring Development		X		41.2505N	105.2039W
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
15N	70W	23	SE SW

Project Description:

This is a stock water project that will provide water to a pasture on Mesa Mountain. Water is scarce on Mesa Mountain and the pasture is under-utilized. One option is to drill a well at the site. The second option involves pumping water from a spring on the west side of the mesa.

The well is the simplest project, however this site is on Mesa Mountain and the success of a well is not certain. The new well will need to be approximately 400 – 500’ deep and drilled through hard rock. A solar pump, tank(s), short pipeline and fence would be installed. The preliminary cost estimate for this option is approximately $60,000.

The well options would include:

- A 400 – 500’ deep well.
- A solar pump designed for 400’ TDH minimum.
- 300’ of 2” pipeline from the well to the tanks.
- Two new 10’dia. by 2’ deep tire tanks.
- Construction of 400’ of fence with gate around the well and solar panels.

As an alternative to drilling a well at this site, water could be pumped from a spring, located on the west side of Mesa Mountain up the hill to a set of tanks at this location. The pipeline will be approximately 5000 feet long and will follow an existing 2-track road. The pipeline will be installed in difficult terrain, but it appears that trenching and burial of the pipeline would be possible.

The water source for the pipeline and tanks will be a spring. A spring development, cistern, and solar pumps will be required to pump the water from the spring, through the pipeline to the tanks. Fencing will be installed at the spring. The preliminary cost estimate for this option is $52,500. Small flows were observed at the spring during the site visit (in September 2017). But the reliability and flow rate of the spring should be evaluated during final design of this project.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District ____

____

Who is the owner of the project? ______Lorenz Ranch

Who owns the land that the project is to be built on? ________Lorenz Ranch________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ______________________________________
_______A large pasture on Mesa Mountain would benefit from this project. Water is scarce in this area.___

____

What is the total estimated project cost? ____$52,500 - $60,800______________________________

Photographs:

Photo shows the site of the Section 23 Spring, which is located in the SE SW of Section 23, T15N, R70W. This spring would be developed, a cistern or tank installed, and a solar pump installed. Water would be pumped from this location up Mesa Mountain to stock tanks. As an alternative, a well would be drilled near the tanks.

This photo is taken from the top of Mesa Mountain looking generally north west. The Section 23 tanks would be installed near this location, just to the right of the photo (which is east).

SPRWS Project Cost Estimate

SPRWS Project No. **15-70-23.1a**

Project Name Lorenz Section 23 Stock water project - Well

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,806.25	$ 4,806.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	450	$ 60.00	$ 27,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS	1	$ 14,500.00	$ 14,500.00
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea	2	$ 1,200.00	$ 2,400.00
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	500	$ 2.50	$ 1,250.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	200	$ 5.00	$ 1,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 52,868.75
Contingency - 15%	$ 7,930.31
Budget for Project with Contingency	**$ 60,799.06**

SPRWS Project Cost Estimate

SPRWS Project No. **15-70-23.1b**

Project Name Lorenz Section 23 Stock water project - pump from spring

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,152.50	$ 4,152.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 60.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS	1	$ 14,500.00	$ 14,500.00
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea	2	$ 1,200.00	$ 2,400.00
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	5,100	$ 4.00	$ 20,400.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	400	$ 5.00	$ 2,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	45,677.50
Contingency - 15%	$	6,851.63
Budget for Project with Contingency	**$**	**52,529.13**

SPRWS PROJECT NUMBER: <u>15-70-25.1</u>

Section 25 Stock Water Project

NE ¼ NE 1/4 Section 25, T15N, R70W

Site Visit Date: Sept 14, 2017

PROJECT NAME: Section 25 Stock Water Project
Enlargement of the Hill Horse Spring, UW 173983

Lorenz Ranch, Inc. (Applicant – Name of Entity)

Contacts:

Tom Twiford 1870 County Road 109 Cheyenne, WY 82009 307-477-6565 Kattlebaron@yahoo.com	OJ Huxtable 1885 County Road 109 Cheyenne, WY 82009 307-359-1628 ojhuxtable@gmail.com

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank		X		41.2486N	105.1821W
Spring Development		X		41.2469N	105.1745W
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Location of the existing Hill Horse Spring

Township	Range	Section	Quarter-Quarter
15N	70W	25	NE NE

Project Description:

This is a stock water project that will provide water to Mesa Mountain. Water is scarce on Mesa Mountain and the pasture is under-utilized. This project will pump water from an existing spring, through a pipeline, to a set of tanks up the hill. A solar pump, pipeline, tanks and fencing will be required. The existing spring is the Hill Horse Spring, Permit No. UW 173983.

Water could be pumped from the Hill Horse Spring, located on the east side of Mesa Mountain up the hill to a set of tanks. The pipeline will be approximately 2800 feet long. The pipeline will be installed in difficult terrain, but it appears that trenching and burial of the pipeline would be possible.

A solar pump will be required to pump the water from the spring, through the pipeline to the tanks. Fencing will be installed at the spring. The spring appears to be a reliable water source; however, the capacity of this spring needs to be evaluated to verify that it can supply the additional tanks.

The Hill Horse Spring currently supplies water to the pasture located to the east of it.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Lorenz Ranch

Who owns the land that the project is to be built on? Lorenz Ranch

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

A large pasture on Mesa Mountain would benefit from this project. Water is scarce in this area.

____

What is the total estimated project cost? $42,000

Photographs:

This photo shows the Hill Horse Spring, Permit UW 173983. This spring, which is located in the NE NE of Section 25, T15N, R70W, would be the water source for this stock water project. Solar pumps would pump from this spring, through a pipeline, to a set of tanks located on Mesa Mountain.

SPRWS Project Cost Estimate

SPRWS Project No. **15-70-25.1**

Project Name Lorenz Section 25 Stock water project - pump from spring

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 3,295.00	$ 3,295.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 60.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS	1	$ 14,500.00	$ 14,500.00
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea	2	$ 1,200.00	$ 2,400.00
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	2,800	$ 4.00	$ 11,200.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	400	$ 5.00	$ 2,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	1.00	$ 1,250.00	$ 1,250.00

Sub-Total Estimated Component Costs	$ 36,245.00
Contingency - 15%	$ 5,436.75
Budget for Project with Contingency	**$ 41,681.75**

SPRWS PROJECT NUMBER: 15-70-35.1

North Crow Wetlands Rehabilitation

E ½ Section 35, T15N, R70W

Site Visit Date: July 20, 2017

PROJECT NAME: North Crow Wetlands Rehabilitation and Stabilization

City of Cheyenne – Board of Public Utilities (Applicant – Name of Entity)

Casey Whitman (Contact)

2416 Snyder Ave (Contact Address)

Cheyenne, Wyoming 82001

Laramie	307-637-0855	cwhitman@cheyennebopu.org
(County)	(Phone)	(Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tanks – 1 of 1					
Spring Development					
Wetland		X		41.2235N	105.1957W
Environmental		X		41.2235N	105.1957W
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection. This project includes construction of a wildlife habitat plot.

Legal Description

Township	Range	Section	Quarter-Quarter
15N	70W	35	

Project Description:

This environmental project will repair and stabilize the wetland complex, which has developed along North Crow Creek upstream of the North Crow Diversion dam. This project is located in the Woodhouse Recreation and Wildlife Habitat Area in Section 35, T15N, R70W and public access and recreation is allowed in this area. This project is located on land owned by the City of Cheyenne

In the spring of 2016, high flows in North Crow Creek washed out beaver dams and caused damage to the wetland complex that had developed in this area. When the beaver dams washed out, erosion of the stream bank and head cutting caused sediment to wash from this area downstream into the pool above the North Crow Diversion Dam.

This project will stabilize the eroded areas and allow the wetland complex to re-vegetate and stabilize. The project will provide wildlife habitat and environmental benefits. Also, this project is within a habitat area with public access and outdoor recreation opportunities.

Public Benefit:

Project Participants:

Laramie County Conservation District, City of Cheyenne – Board of Public Utilities, Wyoming Game and Fish Department

Who is the owner of the project? City of Cheyenne – Board of Public Utilities

Who owns the land that the project is to be built on? City of Cheyenne

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

This project will improve conditions along approximately 1 mile of North Crow Creek, will reduce sediment, and will improve water quality.

What is the total estimated project cost?

Additional engineering and cost estimates will be done before the final project application is submitted. The work funded through the Small Water Program is estimated to cost $135,000. It is estimate that each check or grade control structure would cost approximately $25,000 and several checks or grade control structures would be installed.

Photographs:

Photo shows North Crow Creek in the area that was damaged during the high flow in the spring of 2016. Photo is looking upstream – i.e. generally north.

This picture shows the upper end of the area where the beaver dams and wetland complex are still intact. North Crow Creek flows from the right of the photo to the left. The damage to the beaver dams and wetlands that occurred to the lower end of the site did not occur in this area. These dams are still intact. However, additional high flows could undermine these dams and then cause the erosion to move upstream.

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

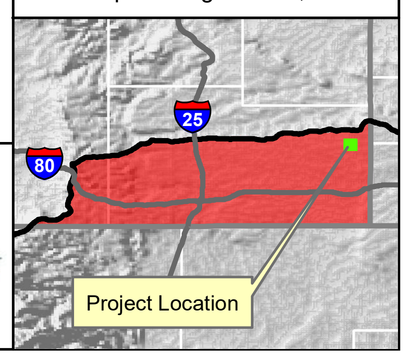
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R61W



Project 16-61-1.1: Bushnell Draw Stock Reservoir

Document Name: Bushnell_16-61-1.1
Date Saved: 9/9/2017

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

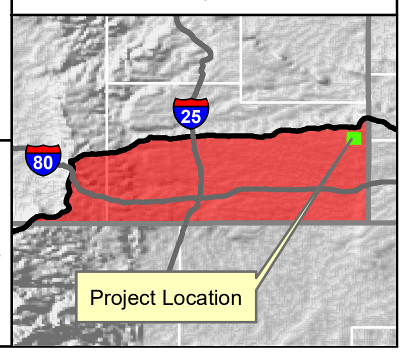
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T17N, R60W



Project 17-60-31.1: Forester Mills Creek Stock and Wildlife Reservoir

Document Name: Forester_17-60-31.1
Date Saved: 11/15/2017

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

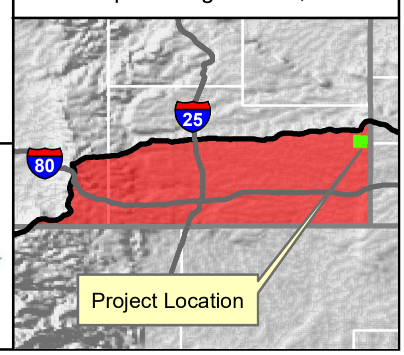
N

Feet
0 500 1,000
1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T17N, R60W



Project 17-60-32.1: Hanson Mills Creek Stock and Wildlife Reservoir

Document Name: Hanson_17-60-32.1
Date Saved: 11/15/2017

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

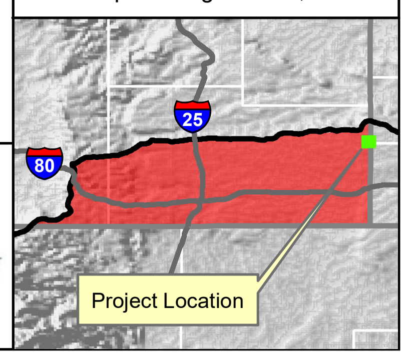
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T17N, R60W



Project 17-60-34.1: Bella Farms, Stock and Wildlife Reservoir

Document Name: BellaFarms_17-60-34.1
Date Saved: 9/9/2017

SPRWS PROJECT NUMBER: <u>Albin Area Small Reservoirs</u>
Stock Water, Wildlife Habitat, Flood Control, and Groundwater Recharge Projects

PROJECT NAME: <u>Albin Area Reservoirs</u>

This project involves construction of four small reservoirs in the Albin, Wyoming area. The locations of the reservoirs are listed in the following table and are shown on the maps that accompany this write-up. The local landowner contact for these projects is Jim Lerwick; however the reservoirs would be constructed on land owned by several landowners, as shown on the following table.

Project No.	Name	Location (Sec, Township, Range)	Landowner	Latitude/Longitude
16-61-1.1	Bushnell Draw Stock Reservoir	SWSE Sec 1, T16N, R61W	Debra Childress	41.3756N 104.1458W
17-60-31.1	Forester Mills Creek Stock Reservoir	NWNE Sec 31, T17N, R60W	David Forester	41.4036N 104.1182W
17-60-32.1	Hansen Mills Creek Stock Reservoir	SENE Sec 32, T17N, R60W	Deidre and Dennis Hansen	41.3995N 104.0941W
17-60-34.1	Bella Farms Stock Reservoir	SENE Sec 34, T17N, R60W	Bella Farms, LLC	41.3967N 104.0544W

<u>Project Description:</u>

Four small reservoirs would be constructed in the Albin area. Each of the reservoirs can provide stock water, wildlife habitat, flood control, and potentially groundwater recharge benefits. It is anticipated that these projects will be eligible for Small Water Project funding.

Additional design work will be required before submitting the final applications for these projects. Conceptually, each of the reservoirs will involve construction of a small dam (less than 20' tall), spillway, and low level outlet to drain the reservoirs. The preliminary design assumes that no riprap would be installed and that the face of the dams would be protected from erosion by vegetation.

<u>Public Benefit:</u>

____

____

<u>Project Participants:</u>

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

<u>Laramie County Conservation District</u>

____

Who is the owner of the project?

The landowners where the projects are constructed would be owners of the reservoirs.

Who owns the land that the project is to be built on? Refer to the list in the table shown above.

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed ______________________________

How many acres will be benefited by this project? ______________________________________

What is the total estimated project cost? _ The preliminary construction cost estimates for a typical dam and reservoir of similar size is approximately $65,250, which includes 15% contingency for the construction costs. Final designs and updated costs estimates will be submitted with each of the final project applications.

Photographs:

Photo shows the site of the Bushnell Draw Stock Reservoir, located in Section 1, T16N, R61W.

Work Items and Preliminary Quantities
for a Typical Small Stock Reservoir

Bid Item	Description	Unit	Quantity	Unit Price	Item Total	Percent of Work
1	Mobilization	LS	1	$ 5,500.00	$ 5,500.00	9.69%
2	Strip, Stockpile, and Replace Topsoil	CY	1,188	$ 5.00	$ 5,937.96	10.47%
3	Excavation and Placement Embankment Fill	CY	6,000	$ 4.50	$ 27,000.00	47.59%
4	Special backfill around pipes. Compaction around and min. 2' over pipes.	CY	200	$ 12.00	$ 2,400.00	4.23%
5	Riprap - 8" nominal sized rock - 12" thick	CY		$ 125.00	$ -	0.00%
6	Filter fabric under riprap	SY		$ 4.00	$ -	0.00%
7	Principal Spillway 36" diameter riser and inlet with Trash Rack and Anti-vortex baffle	LS		$ 5,000.00	$ -	0.00%
8	18" discharge pipe	LF		$ 50.00	$ -	0.00%
9	8" low level outlet pipe	LF	135	$ 40.00	$ 5,400.00	9.52%
10	8" gate valve and valve box	LS	1	$ 1,750.00	$ 1,750.00	3.08%
11	Site Revegetation and reclamation	Acre	5	$ 1,250.00	$ 6,250.00	11.02%
12	Miscellaneous work - road and fencing	LS	1	$ 2,500.00	$ 2,500.00	4.41%

w/o mobilization
$ 51,237.96

Sub-Total Estimated Component Costs	$	56,737.96
Contingency - 15%	$	8,510.69
Opinion of Probable Costs	**$**	**65,248.66**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

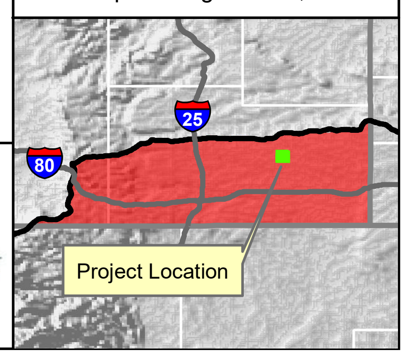
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R63W



Project 16-63-29.1 and 30.1: Spatz Stock Well and Tanks

Document Name: Spatz 16-63-29.1 and 30.1
Date Saved: 11/22/2017

SPRWS PROJECT NUMBER: <u>16-63-29.1 and 30.1</u>

New Well, Electric Pump, Pipelines, and Tanks

Well location NW 1/4 SW ¼ Sec. 29 T16N R63W

PROJECT NAME: Spatz Sections 29 and 30 Stock Water Projects
New Well, Pump, Pipelines and Tanks

Craig Spatz____________________________ (Applicant – Name of Entity)

Craig Spatz__________________ (Contact)

P.O. Box 1_______________________________________

Hillsdale, WY 82060

_Laramie___ _____________________ ____________________________

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Well with electric submersible pump		X		41.3252N	104.4632W
Pipeline 1 Well to Tank 1- Sec 29		X			
Tank 1 – Sec 29		X		41.3288N	104.4600W
Pipeline 2 Well to Tank 2 – Sec 29		X			
Tank 2 Sec 29		X		41.3214N	104.4586W
Pipeline 3 Well to Tank 3 – Sec 30		X			
Tank 3 – Sec 30		X		41.3288N	104.4690W
Pipeline 4 Well to Tank 4 – Sec 30		X			
Tank 4 – Sec 30		X		41.3209N	104.4688W

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

<u>Legal Description</u>

Township	Range	Section	Quarter-Quarter
16N	67W	29 and 30	

Project Description:

This project involves construction of a new stock watering system, including new well; submersible electric pump, and power service from the existing powerline. The well will feed four new stock tanks via four new pipelines.

Specifically, this project will include:

- Drilling a new 350' deep stock well. This new well will require a new permit.
- Power service from the existing powerline located along the County Road 143 on the west side of Section 29, T16N, R63W.
- A new electric submersible pump.
- Four tanks will be installed at the locations shown on the map. Two tanks will be located in Section 29 and two in Section 30.
- Four pipelines will be constructed from the well to feed the tanks. The total length of the pipelines is approximately 5000'. Also miscellaneous valves and floats will be installed at the tanks.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Craig Spatz

Who owns the land that the project is to be built on? Craig Spatz

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ______________________________

The west ½ of Section 29 and the east 1/2of Section 30, T16N, R63W will benefit from the improved water sources.

____

What is the total estimated project cost? $57,722.50 without engineering, contingency, or permitting costs.

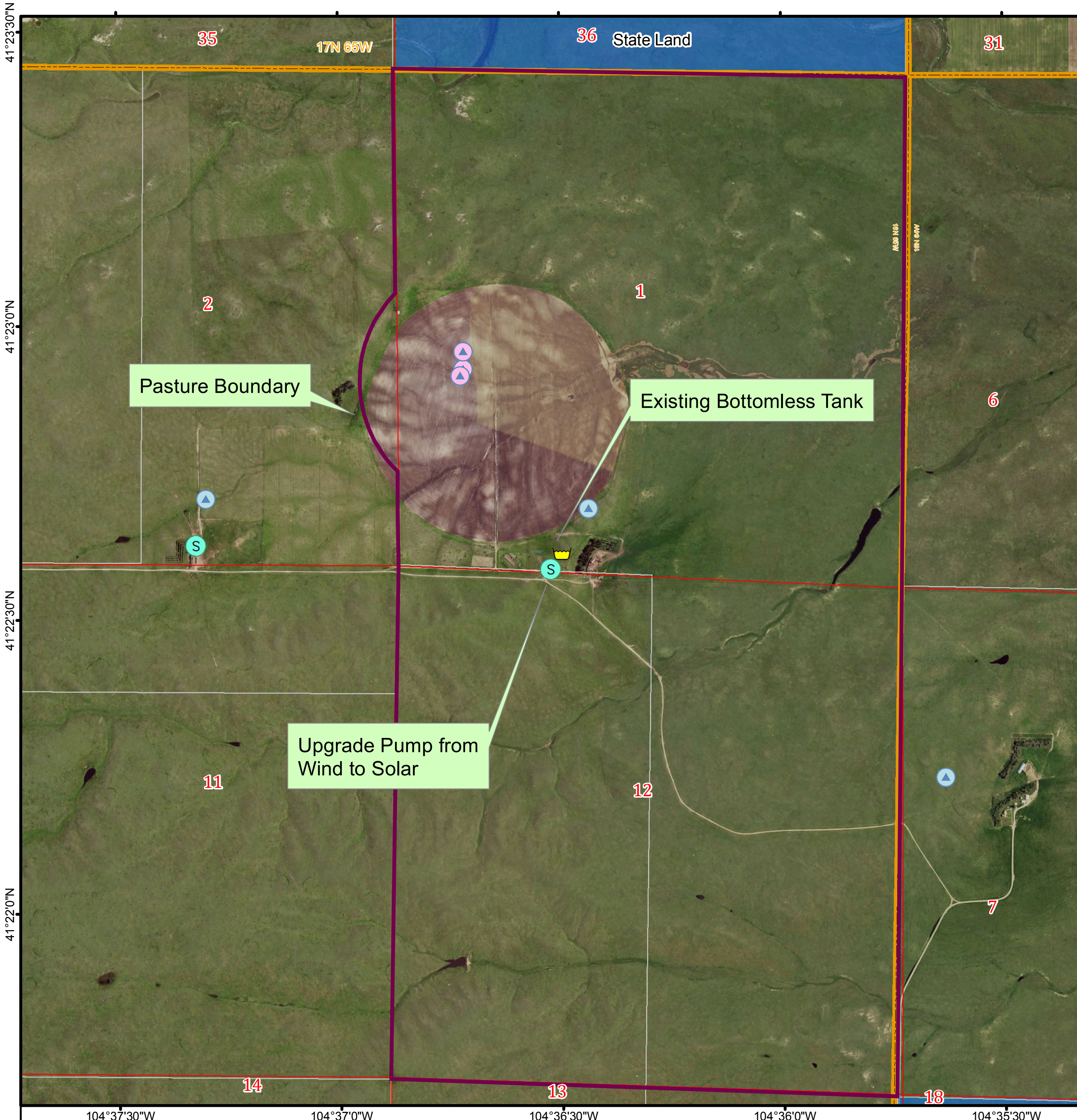
SPRWS Project Cost Estimate

SPRWS Project No. **16-63-29.1 and 30.1 combined project**

Project Name Spatz Sec 29 and 30 Stock water project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 5,247.50	$ 5,247.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	360	$ 40.00	$ 14,400.00
2a	Spring Development	LS		$ 3,800.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	4	$ 2,900.00	$ 11,600.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	5,000	$ 3.00	$ 15,000.00
7	Miscellaneous Valves and piping at tank(s)	Ea	4	$ 500.00	$ 2,000.00
8	3 Wire Fence with wood posts	LF	200	$ 5.00	$ 1,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	1.50	$ 1,250.00	$ 1,875.00

Sub-Total Estimated Component Costs	$ 57,722.50
Contingency - 15%	$ 8,658.38
Budget for Project with Contingency	**$ 66,380.88**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

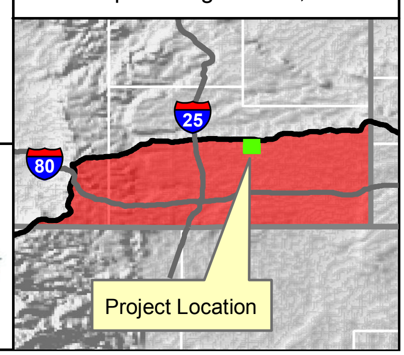
0 700 1,400

1 in = 1,500 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R65W



Project 16-65-1.1: Berry Ranch Solar Conversion S1

Document Name: Project_16_65_1.1
Date Saved: 9/12/2017

SPRWS PROJECT NUMBER: 16-65-1.1 Solar Conversion
SE ¼ SW ¼ Sec. 1 T16N R65W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Berry Ranch Solar Conversion S1

Don Berry (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms	1	X		41.3764	104.6082
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	65W	1	SESW

Project Description:

This project involves upgrading the well pump source from wind to solar. The existing well, Block Shed #1, WY SEO permit No. P18826.0P, is 260 feet deep and includes a backup submersible pump run by a portable generator. The well feeds an existing bottomless tank.

Specifically, the project will include:

- A new solar pumping system, including panels, and solar pump.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)________________________________

____

Who is the owner of the project? ____Don Berry__ __________

Who owns the land that the project is to be built on? _______Berry Ranch LLC___________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
Approximately 1,270 acres in Section 1 and 12 will have reliable access to water pumped via solar energy.

What is the total estimated project cost? _______$28,547.89_______________________________

SPRWS Project Cost Estimate

SPRWS Project No. 16-65-1.1

Project Name Berry Ranch Solar Conversion S1

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,256.75	$ 2,256.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	260	$ 40.00	$ 10,400.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 3.00	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea		$ 500.00	$ -
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF	260.00	$ 3.00	$ 780.00
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 24,824.25
Contingency - 15%	$ 3,723.64
Budget for Project with Contingency	**$ 28,547.89**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

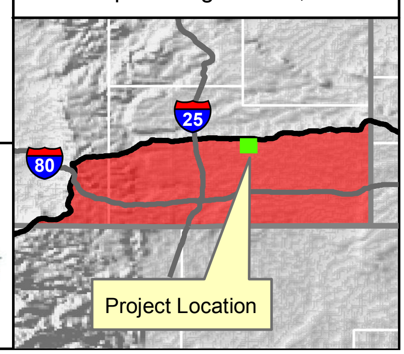
0 700 1,400

1 in = 1,500 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R65W



Project 16-65-2.1: Berry Ranch Solar Conversion S2

Document Name: Project_16_65_2.1
Date Saved: 9/12/2017

SPRWS PROJECT NUMBER: 16-65-2.1 Solar Conversion
SE ¼ SW ¼ Sec. 2 T16N R65W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Berry Ranch Solar Conversion S2

Don Berry (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms	1	X		41.3769	104.6221
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	65W	2	SWSE

Project Description:

This project involves upgrading the well pump source from wind to solar. The existing well, Morrison #1 WY SEO permit No. P11821.0P, is 280 feet deep and includes a backup submersible pump run by a portable generator. The well feeds an existing bottomless tank.

Specifically, the project will include:

- A new solar pumping system, including panels, and solar pump.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)______________________________

____

Who is the owner of the project? ____Don Berry__ __________

Who owns the land that the project is to be built on? ________Berry Ranch LLC____________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
Approximately 1,250 acres in Section 2 and 11 will have reliable access to water pumped via solar energy.

What is the total estimated project cost? _____$29,635.79_______________________________

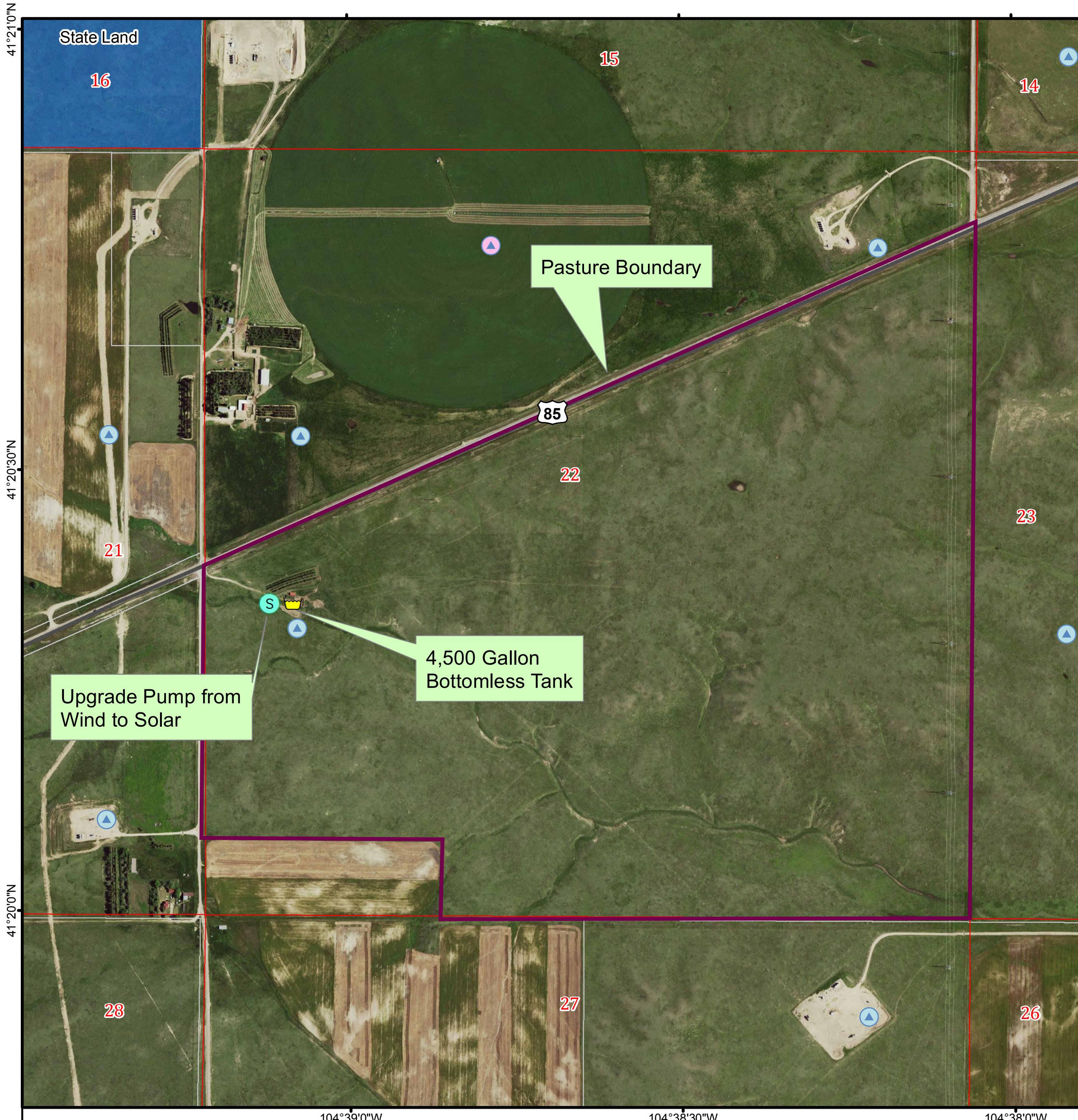
SPRWS Project Cost Estimate

SPRWS Project No. 16-65-2.1

Project Name Berry Ranch Solar Conversion S2

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,342.75	$ 2,342.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	280	$ 40.00	$ 11,200.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 3.00	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea		$ 500.00	$ -
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF	280.00	$ 3.00	$ 840.00
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$	25,770.25
Contingency - 15%	$	3,865.54
Budget for Project with Contingency	**$**	**29,635.79**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

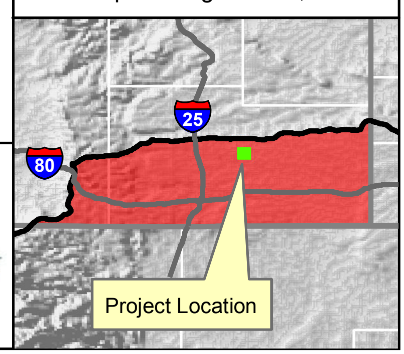
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R65W



Project 16-65-22.1: Berry Ranch Solar Conversion S22

Document Name: Project_16_65_22.1
Date Saved: 9/12/2017

SPRWS PROJECT NUMBER: 16-65-22.1 Solar Conversion
NW ¼ SW ¼ Sec. 22 T16N R65W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Berry Ranch Solar Conversion S22

___Don Berry____ (Applicant – Name of Entity)

___C/o Jim Cochran Laramie County Conservation District___ (Contact)

_ 11221 US Highway 30______________________________________

Cheyenne, WY 82009 (307) 772-2600

_Laramie___ ______________(307) 772-2600 _______jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms	1	X		41.3392	104.6514
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	65W	22	NWSW

Project Description:

This project involves upgrading the well pump source from wind to solar. The existing well, D C #3, WY SEO permit No. P11819.0P, is 280 feet deep. The well feeds an existing bottomless tank.

Specifically, the project will include:

- A new solar pumping system, including panels, and solar pump.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

____

Who is the owner of the project? Don Berry

Who owns the land that the project is to be built on? Berry Ranch LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ___________________________________
Approximately 420 acres in Section 22 will have reliable access to water pumped via solar energy.______
____

What is the total estimated project cost? ____$29,635.79___________________________________

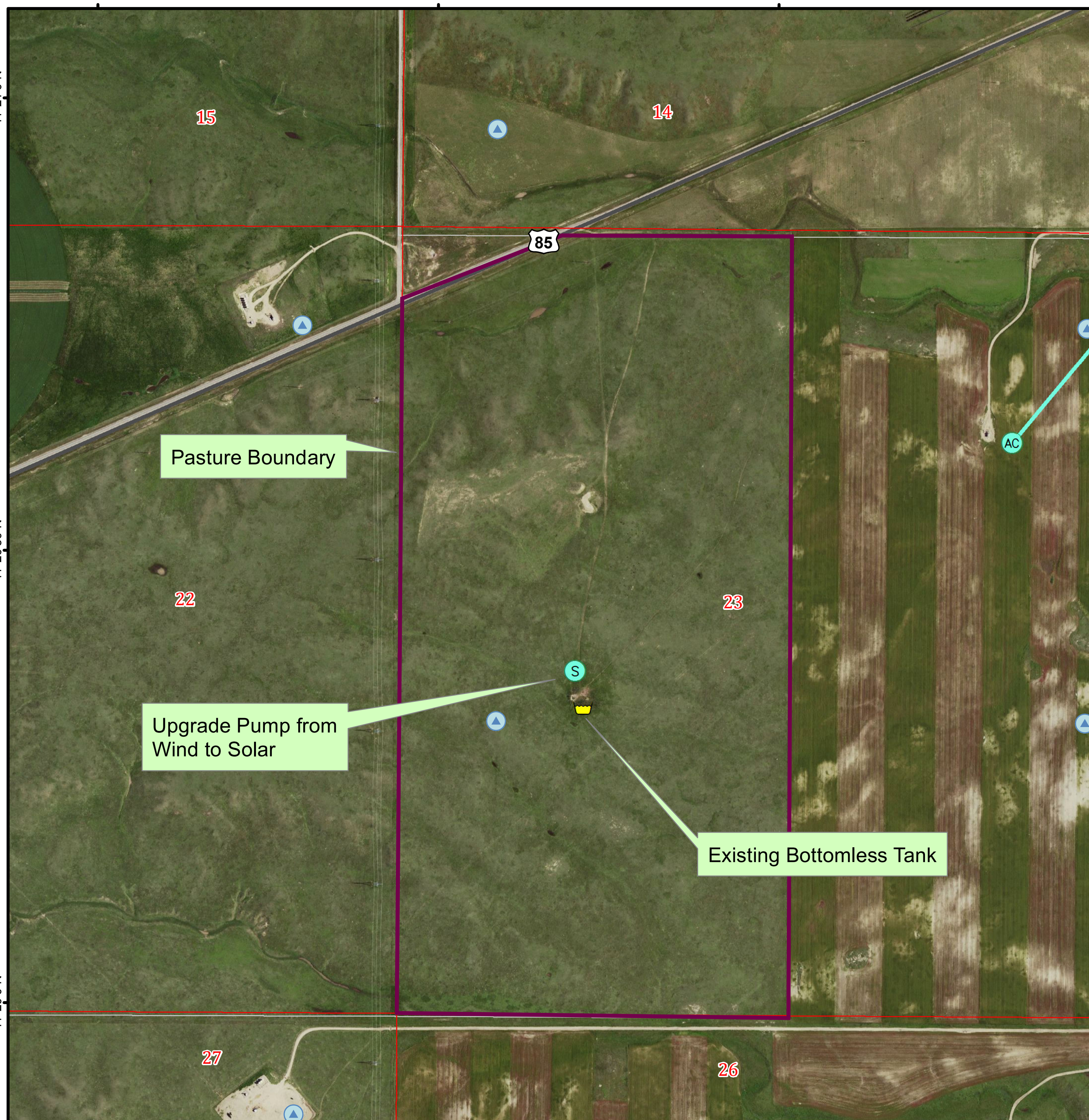
SPRWS Project Cost Estimate

SPRWS Project No. 16-65-22.1

Project Name Berry Ranch Solar Conversion S22

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,342.75	$ 2,342.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	280	$ 40.00	$ 11,200.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 3.00	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea		$ 500.00	$ -
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF	280.00	$ 3.00	$ 840.00
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$	25,770.25
Contingency - 15%	$	3,865.54
Budget for Project with Contingency	**$**	**29,635.79**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

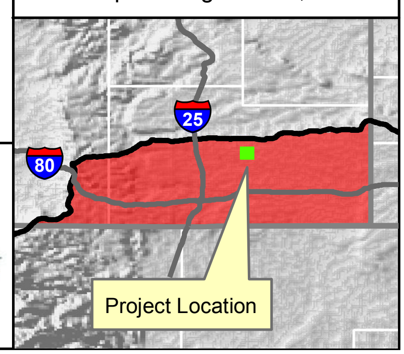
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R65W



Project 16-65-23.1: Berry Ranch Solar Conversion S23

Document Name: Project_16_65_23.1
Date Saved: 9/12/2017

SPRWS PROJECT NUMBER: 16-65-23.1 Solar Conversion
NW ¼ SW ¼ Sec. 23 T16N R65W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Berry Ranch Solar Conversion S23

Don Berry (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms	1	X		41.3389	104.6301
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	65W	23	NWSW

Project Description:

This project involves upgrading the well pump source from wind to solar. The existing well, D C #4, WY SEO permit No. P14620.0W, is 240 feet deep. The well feeds an existing bottomless tank.

Specifically, the project will include:

- A new solar pumping system, including panels, and solar pump.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

____

Who is the owner of the project? Don Berry

Who owns the land that the project is to be built on? Berry Ranch LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
Approximately 310 acres in section 23 will have reliable access to water pumped via solar energy.______
____

What is the total estimated project cost? ___________$27,175.36___________________________

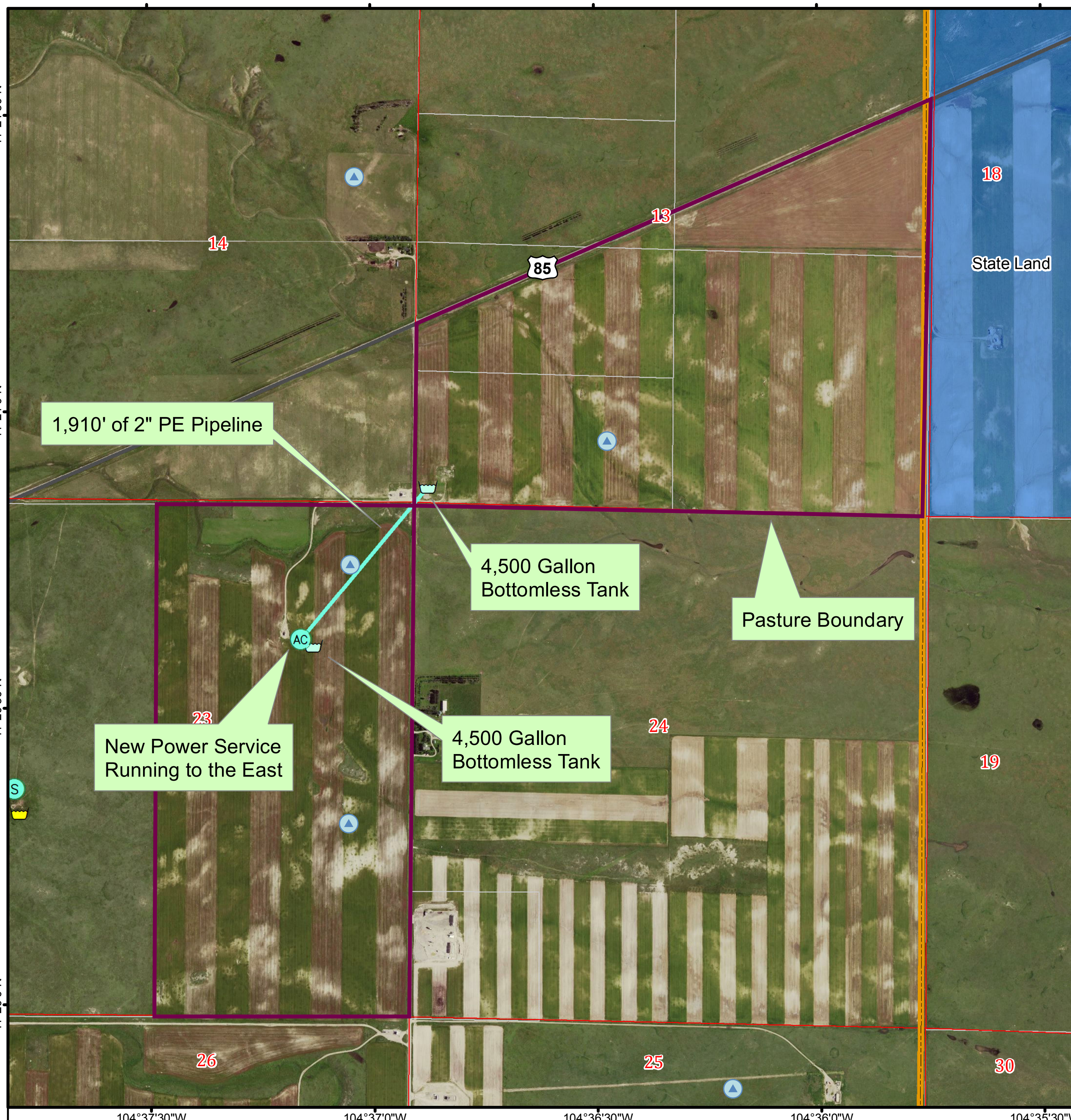
SPRWS Project Cost Estimate

SPRWS Project No. 16-65-23.1

Project Name Berry Ranch Solar Conversion S23

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,148.25	$ 2,148.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	240	$ 40.00	$ 9,600.00
3	Solar Pump System - less than 250' TDH	LS	1	$ 9,650.00	$ 9,650.00
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 3.00	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea		$ 500.00	$ -
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF	240.00	$ 3.00	$ 720.00
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 23,630.75
Contingency - 15%	$ 3,544.61
Budget for Project with Contingency	**$ 27,175.36**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

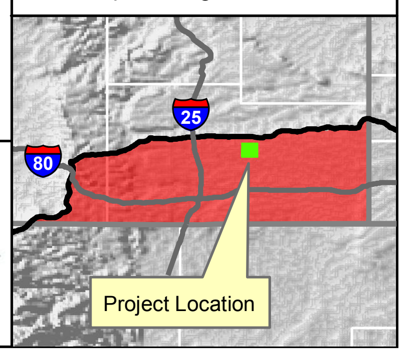
0 700 1,400

1 in = 1,500 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R65W



Project 16-65-23.2: Berry Ranch Stock Pipeline and Tank

Document Name: Project_16_65_23.2
Date Saved: 9/12/2017

SPRWS PROJECT NUMBER: 16-65-23.2 Stock Pipeline and Tank
SE ¼ NE ¼ Sec. 23 T16N R65W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Berry Ranch Stock Pipeline and Tank

Jeff Berry (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms	1	X		41.3436	104.6194
Pipeline	1,910'	X		41.3436	104.6194
Tank	2	X		41.3436	104.6194
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	65W	23	SENE

Project Description:

This project involves the construction of a new pipeline and two new stock tanks in order to provide stock water to two pastures. The existing well, McConnaughey 1-23 WW, WY SEO permit P91315.0W, is 380 feet deep and includes a submersible pump run by a portable generator. The water will be pumped from the well to a stock tank and power for the pump will be provided from the east.

Specifically, the project will include:

- Approximately 1,910 feet of new 2" diameter PE line.
- Two 4,500 gallon bottomless tank to be installed at the end of the pipeline.
- Power service will also run 1,910 feet from the existing well to reliable power to the east.
- Miscellaneous valves and floats.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

____

Who is the owner of the project? Jeff Berry

Who owns the land that the project is to be built on? Berry Ranch LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ___________________________________

Approximately 680 acres in Section 13 and 23 will have reliable access to water pumped via solar energy.

What is the total estimated project cost? ____$52,185.18___________________________________

SPRWS Project Cost Estimate

SPRWS Project No. 16-65-23.2

Project Name Berry Ranch Stock Pipeline and Tank

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 4,125.31	$ 4,125.31
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI	0.22	$ 20,000.00	$ 4,310.61
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	2	$ 12,000.00	$ 24,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	1,910	$ 3.00	$ 5,730.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	240	$ 5.00	$ 1,200.00
8a	12' Wire Gate	LS	2	$ 600.00	$ 1,200.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$	45,378.42
Contingency - 15%	$	6,806.76
Budget for Project with Contingency	**$**	**52,185.18**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

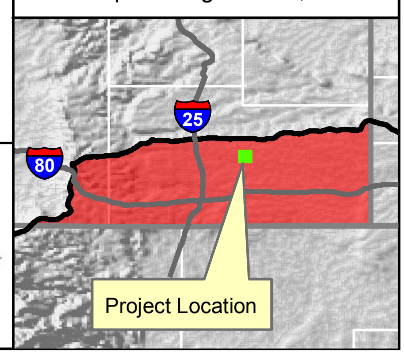
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R65W



Project 16-65-27.1: Berry Ranch Solar Conversion S27

Document Name: Project_16_65_27.1
Date Saved: 9/12/2017

SPRWS PROJECT NUMBER: 16-65-27.1 Solar Conversion
SW ¼ NE ¼ Sec. 27 T16N R65W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Berry Ranch Solar Conversion S27

Jeff Berry (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms	1	X		41.3288	104.6399
Pipeline					
Tank	1	X		41.3288	104.6399
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	65W	27	SWNE

Project Description:

This project involves upgrading the well pump source from wind to solar. The existing well, Section 27, WY SEO permit No. P67208.00W, is 300 feet deep. The well feeds an existing bottomless tank.

Specifically, the project will include:

- A new solar pumping system, including panels, and solar pump.
- One 4,500 gallon bottomless tank to be installed by the pump.
- Miscellaneous valves and floats.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)________________________________

____

Who is the owner of the project?____Jeff Berry______________

Who owns the land that the project is to be built on? ________Berry Ranch LLC___________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
Approximately 320 acres in section 27 will have reliable access to water pumped via solar energy.

What is the total estimated project cost? ______$46,536.19_________________________________

SPRWS Project Cost Estimate

SPRWS Project No. 16-65-27.1

Project Name Berry Ranch Solar Conversion S27

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 3,678.75	$ 3,678.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	300	$ 40.00	$ 12,000.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 3.00	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF	300.00	$ 3.00	$ 900.00
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 40,466.25
Contingency - 15%	$ 6,069.94
Budget for Project with Contingency	**$ 46,536.19**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- PLSS Sections
- Township and Range
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well withAC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

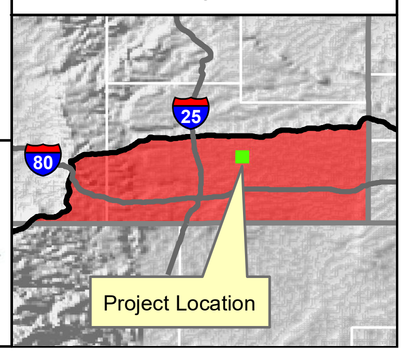
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R65W



Project 16-65-34.1, 34.2 and 34.3: Paul Life & Trust, New Tanks, Well and Solar Pumps

Document Name: PaulLife_16-65-34.1
Date Saved: 9/6/2017

SPRWS PROJECT NUMBER: 16-65-34.1

New Tank for the existing E. Kahler #2 Well

SE ¼ SE ¼ Sec. 34 T16N R65W

Site Visit Date: 11/14/2016

PROJECT NAME: Paul Life Trust new Tank for Existing E. Kahler #2 Well

___Paul Life Trust ______________________________ (Applicant – Name of Entity)

_____Laurel Paul___________________________________ (Contact)

_____3301 Rd. 222_____ _______Cheyenne WY_

_Laramie___ _______307-632-9316___ _______laurelpaul40@yahoo.com______

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		☐	X	41.3061N	104.6374W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	65W	34	SE ¼ SE ¼

Project Description:

This project involves the addition of a stock tank for the exising E. Kahler #2 Well, Permit No. UW 9772. The well has a solar pump. This well and tank is the primary water source for this pasture, which includes most of the South ½ of Section 34. This well and tank will provide water 50 head of cattle. Fencing around the well location and solar panels are also included in this project.

Public Benefit:

____

____

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

_LCCD____

Who is the owner of the project? ______Paul Life Trust____________________

Who owns the land that the project is to be built on? _______Paul Life Trust

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? _________________________________
_____________Approximately 320 acres in the South ½ of Section 34, T16N, R65W._______________

What is the total estimated project cost? $18,500_____________

Photographs: Photograph shows the existing well and tanks. These tanks need to be replaced with a more permanent type tank and the area around the well and solar panels need to be fenced.

SPRWS Project Cost Estimate

SPRWS Project No. **16-65-34.1**

Project Name Paul Life Trust - Tank 1

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,467.50	$ 1,467.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	100	$ 3.50	$ 350.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	16,142.50
Contingency - 15%	$	2,421.38
Budget for Project with Contingency	**$**	**18,563.88**

SPRWS PROJECT NUMBER: 16-65-34.2

New solar pump and tank for the existing #1 Bam-Bam Well

SE ¼ SW ¼ Sec. 34 T16N R65W

Site Visit Date: 11/14/2016

Project Name: Paul Bam Bam Well project

Paul Life Trust (Applicant – Name of Entity)

Laurel Paul (Contact)

3301 Rd. 222 Cheyenne Wy

Laramie	307-632-9316	laurelpaul40@yahoo.com
(County)	(Phone)	(Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		☐	☐		
Solar Platforms		☐	X	41.3061 N	104.6517W
Pipeline		☐	☐		
Tank		☐	X	41.3061 N	104.6517W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	65W	34	SW ¼ SW ¼

Project Description:

This project involves the installation of a solar pump into an existing well, the #1 Bam-Bam 14-34 WSW, WY SEO permit No. UW 92835. A stock tank will be installed next to the well. The project is located in Section 34, Township 16 North, Range 65 West. This well was drilled in 1993 and the reported yield is 25 gpm.

This well, pump and stock tanks, will provide the water for approximately 50 head of cattle. Fencing around this well location will also be necessary to protect the well. A pump test should be performed to confirm the yield of this well, prior to installing a new pump.

Public Benefit:

____

____

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).
LCCD

____

____

Who is the owner of the project? Paul Life Trust

Who owns the land that the project is to be built on? Paul Life Trust

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?
This project could provide water for approximately 320 acres in the south ½ of Section 34, T16N, R65W.

____

What is the total estimated project cost? $31,000

Photographs: This photo shows the existing #1 Bam-Bam 14-34 WSW.

SPRWS Project Cost Estimate

SPRWS Project No. **16-65-34.2**

Project Name Paul Life Trust - Bam-Bam Well Solar Pump and Tanks

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,455.00	$ 2,455.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	100	$ 3.50	$ 350.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	27,005.00
Contingency - 15%	$	4,050.75
Budget for Project with Contingency	**$**	**31,055.75**

SPRWS PROJECT NUMBER: 16-65-34.3

New Well, solar pump and tank for the North of Section 34

NE¼ Sec. 34 T16N R65W

Site Visit Date: 11/14/2016

Project Name: Paul north Section 34 Stock water project

___Paul Life Trust ____________________________ (Applicant – Name of Entity)

_____Laurel Paul _________________________________ (Contact)

_____3301 Rd. 222____ _______Cheyenne Wy__

_Laramie___ _______307-632-9316__ _______laurelpaul40@yahoo.com______

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		X	☐	41.3167N	104.6372 W
Solar Platforms		X	☐	41.3167N	104.6372 W
Pipeline		☐	☐		
Tank		X	☐	41.3167N	104.6372 W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	65W	34	NE ¼ NE ¼

Project Description:

This project involves drilling a new well in the NE1/4NE1/4 Section 34, T16N, R65W. The pump will be a solar pump with panels, and a tank will be installed near the well. The preferred location is near an old oil well location. The oil well has been plugged and abandoned.

As an alternative, the yield of the existing domestic well in the NW ¼ of Section 34 could be reviewed and perhaps a pipeline from this well to a stock tank located near the middle of then ½ of Section 34 could be more economical.

Public Benefit:

____

____

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

____

_____LCCD____

____

Who is the owner of the project? ______Paul Life Trust____________________

Who owns the land that the project is to be built on? _______Paul Life Trust__

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? _____________________________________

____

____

What is the total estimated project cost? __________$44,200__________________________________

Photographs: Photo shows dry hole marker for an old oil well near location of proposed Paul north Section 34 stock well, solar pump and tanks. NE1/4 Sec 34, T16N, R65W

SPRWS Project Cost Estimate

SPRWS Project No. **16-65-34.3**

Project Name Paul Life Trust - North Sec 34 Stock Water project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 3,493.75	$ 3,493.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	2	$ 2,900.00	$ 5,800.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	125	$ 3.50	$ 437.50
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	38,431.25
Contingency - 15%	$	5,764.69
Budget for Project with Contingency	**$**	**44,195.94**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

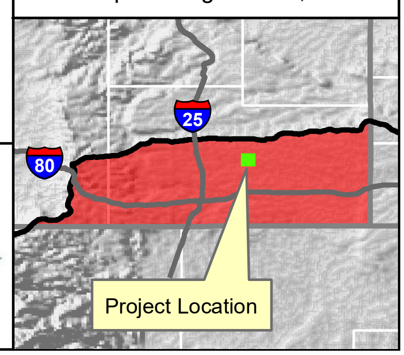
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R65W



Project 16-65-35.1: Kleiman Stock Well, Solar Pump, Pipeline and Tanks

Document Name: Kleiman_16-65-35.1
Date Saved: 9/1/2017

SPRWS PROJECT NUMBER: 16-65-35.1
New Well, Solar Pump, Pipeline, and Tank
NW ¼ SE ¼ Sec. 35 T16N R65W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Kleiman Stock Well, Solar Pump, Pipeline and Tanks
WY SEO Permit No. UW 8772

___Alice Kleiman___________________________ (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact Address)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie___ (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well		X		41.3099	104.6245
Solar Platforms		X			
Pipeline		X			
1st set of tanks at well		X		41.3099	104.6245
2nd set of tanks at end of pipeline		X		41.3048	104.6314
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	**Range**	**Section**	**Quarter-Quarter**
16N	65W	**35**	NWSE

Project Description:

This project involves construction of a new stock watering system, including new well; solar pump, panels and associated equipment; a tank near the well; ½ mile pipeline; and a second tank at the end of the pipeline. The new well will be a replacement for the existing Birdie #1 Well, Permit No. UW 200817.

Specifically, this project will include:

- A 360' deep stock well. This new well will be permitted as a relocation and deepening of the existing Birdie #1 Well, which was drilled in 1958.
- A solar pump, with solar panels, controller, 1250 gallon cistern.
- Four 10' diameter by 2' deep stock tanks – two to be installed at the well and two at the end of the pipeline.
- ½ mile of 2" dia. pipeline.
- Miscellaneous valves and floats.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Alice Kleiman

Who owns the land that the project is to be built on? Alice Kleiman

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

The entire 640 acres in Section 35, T16N, R65W will benefit from the improved water sources

What is the total estimated project cost? $50,000

Photographs: Birdie #1 Well, UW 200817
Location: 41.3099, 104.6245 NWSE Sec 35, T16N R65W

Existing Birdie No. 1 Well and Tanks

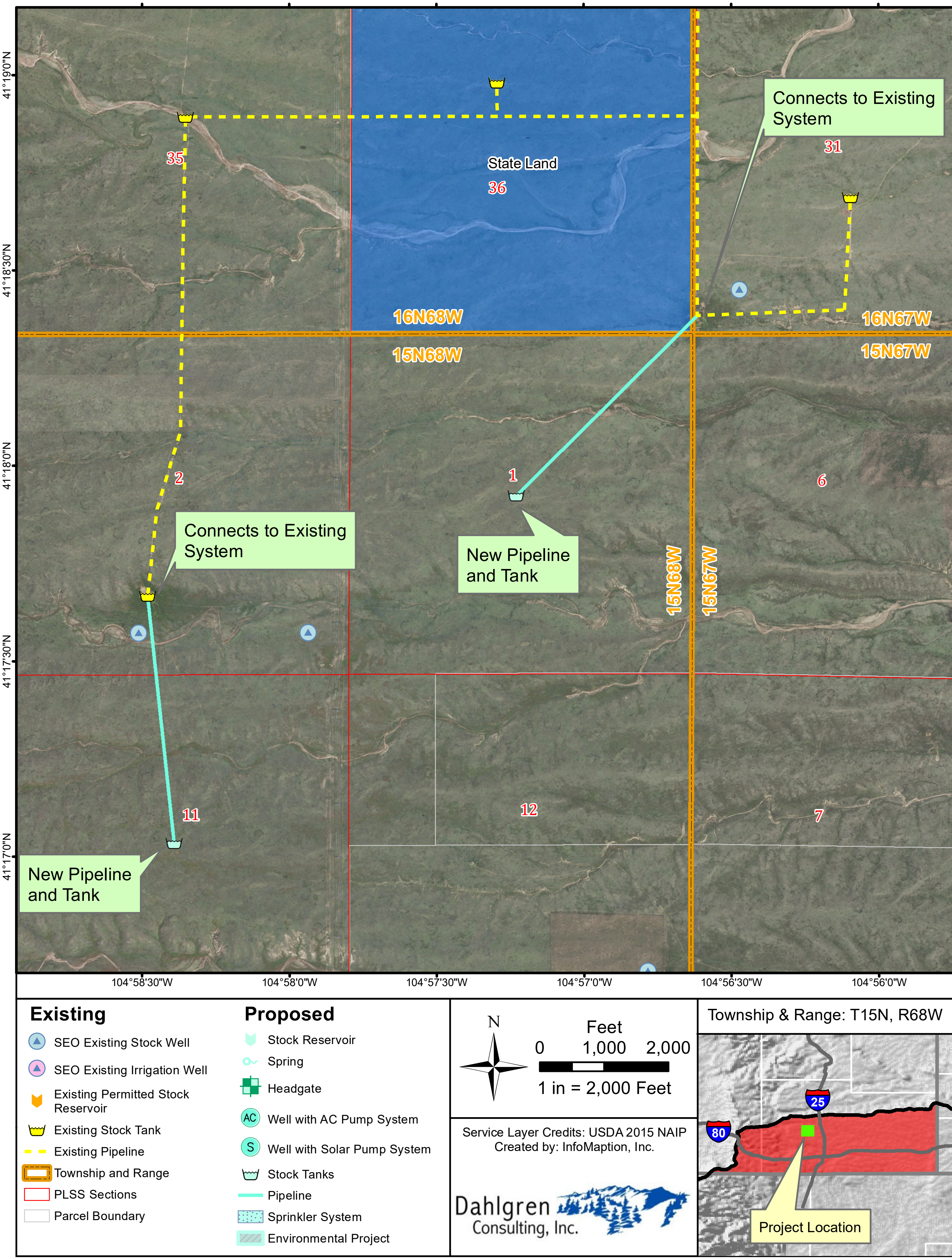
SPRWS Project Cost Estimate

SPRWS Project No. **16-65-35.1**

Project Name Kleiman Stock Well, Solar Pump, and Tanks

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 3,950.00	$ 3,950.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	360	$ 40.00	$ 14,400.00
2a	Spring Development	LS		$ 5,000.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea	4	$ 1,200.00	$ 4,800.00
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	2,640	$ 2.50	$ 6,600.00
7	Miscellaneous Valves and piping at tank(s)	Ea	4	$ 500.00	$ 2,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	43,450.00
Contingency - 15%	$	6,517.50
Budget for Project with Contingency	**$**	**49,967.50**



Project 15-68-1.1: Hollingsworth. New Stock Tanks & Pipelines

Document Name: Hollingsworth_15-68-1.1
Date Saved: 7/4/2017

SPRWS PROJECT NUMBER: 15-68-1.1
New Pipelines and Tanks
Project Location – Tanks in Sections 1 and 11 and T15N R68W
Site Visit Date: March 3, 2017

PROJECT NAME: Hollingsworth South Pipelines and Tanks
New stock water pipelines and tanks

Lindsey Hollingsworth___________________________ (Applicant – Name of Entity)

TJ Hollingsworth_________________________________(Contact)

1875 Road 224___________________________________

Cheyenne, WY 82009

_Laramie___ _____________(307)___ ____________________

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Pipeline to new tank in Sec 1		X		41.3064	104.9436
Tank in Sec 1		X		41.2987	104.9538
Pipeline to new Tank in Sec 11		X		41.2946	104.9750
Tank in Sec 11		X		41.2839	104.9732

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
15N	68W	1 & 11	

Project Description:

This project involves construction of a 2 new pipelines and 2 stock tanks to extend an existing stock watering system to serve additional pastures. Both of the new tanks will be tire tanks.

The first pipeline will be approximately 2000' long and 2" diameter and will serve one new tank located in Section 1. The pipeline will connect to the existing stock water pipeline system, near the SW corner of Section 31, T16N, R67W.

The second pipeline also will be approximately 2000' long and 2" diameter and will serve one new tank in Section 11. The pipeline will connect to the existing stock water pipeline system, near the existing stock tank in Section 2, T15N, R68W.

Both new tanks will be tire tanks. Miscellaneous floats and valves will be installed at the tanks.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Lindsey Hollingsworth

Who owns the land that the project is to be built on? Lindsey Hollingsworth

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

This project will provide water directly for to two pastures, located in three sections, totaling approximately 1280 acres.

What is the total estimated project cost? $24,575

Photographs:

None available

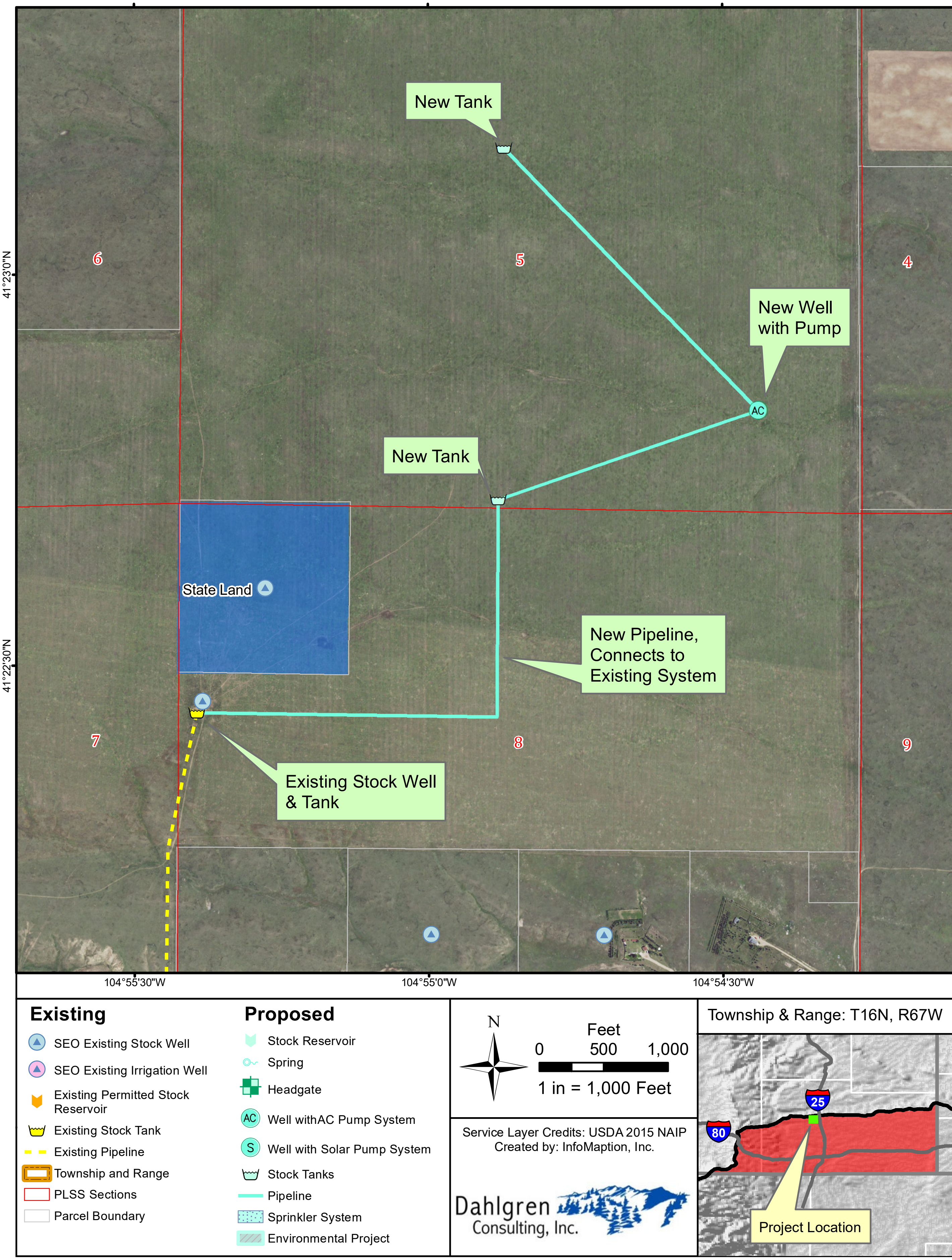
SPRWS Project Cost Estimate

SPRWS Project No. **15-68-1.1**

Project Name Hollingsworth Sec 1 and 11 Pipeline Extension and Tanks Project

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,942.50	$ 1,942.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 3,800.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	2	$ 2,900.00	$ 5,800.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	4,000	$ 3.00	$ 12,000.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF		$ 5.00	$ -
8a	12' Wire Gate	LS		$ 600.00	$ -
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$ 21,367.50
Contingency - 15%	$ 3,205.13
Budget for Project with Contingency	**$ 24,572.63**



Project 16-67-5.1: Hollingsworth. New Stock Well, Pipelines & Tanks

Document Name: Hollingsworth_16-67-5.1
Date Saved: 7/4/2017

SPRWS PROJECT NUMBER: 16-67-5.1
New Well, Electric Pump, Pipelines, and Tanks
Well location SE¼ SE ¼ Sec. 5 T16N R67W
Site Visit Date: March 3, 2017

PROJECT NAME: Hollingsworth North Stock Well, Pump, Pipelines and Tanks
New Well, stock water pipelines, and tanks

Lindsey Hollingsworth_____________________________ (Applicant – Name of Entity)

TJ Hollingsworth (Contact)

1875 Road 224_____________________________________

Cheyenne, WY 82009

_Laramie___ ______________(307)___ _______

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Well with electric submersible pump		X		41.3805	104.9075
Pipeline 1 Well to Tank 1		X			
Tank 1		X		41.3860	104.9145
Pipeline 2 Well to Tank 2		X			
Tank 2		X		41.3785	104.9147
Pipeline 3 from Tank 2 to existing tank and well		X			
Existing Tank and Well				41.3741	104.9231

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	67W	5 and 8	

Project Description:

This project involves construction of a new stock watering system, including new well; submersible electric pump, and power service from the existing powerline. The well will feed two new stock tanks via two new pipelines.

This new well will also provide back-up water supply for an existing stock system. A new pipeline will be constructed Tank 2 (as shown on the accompanying map) and the connection to the existing stock water system will be near the existing tank and well located in the NWNW of Section 8, T16N, R67W. The existing well is the Tuck #4 Stock Well, UW 5911.

Specifically, this project will include:

- Drilling a new 360' deep stock well. This new well will require a new permit.
- Power service from the existing powerline located on the east section line of Section 5, T16N, R67W.
- A new electric submersible pump.
- Three sets of tanks will be installed. One bottomless tank will be located near the well, one tire tank will be located near the center of Section 5 and the other neart the south section line of Section 5. .
- Two 2" diameter pipelines will be constructed from the well to feed the tanks. The total length of both pipelines is approximately 5050'. Also miscellaneous valves and floats will be installed at the tanks.
- Another approximately 3000' of 2" diameter pipeline will be constructed from Tank 2 and tie into the existing stock water system in the NW ¼ of Section 8, T16N, R67W.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District____

____

Who is the owner of the project? ______Lindsey Hollingsworth_____________

Who owns the land that the project is to be built on? ________Lindsey Hollingsworth_______________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ______________________________________
_______ The entire 640 acres in Section 5, T16N, R67W will benefit from the improved water sources. Also this well and pipeline will provide back-up water for the existing stock water pipeline system, which provides water to approximately 10,000 acres. ____
____

What is the total estimated project cost? ______$91,700______________________________________

Photographs:

None available

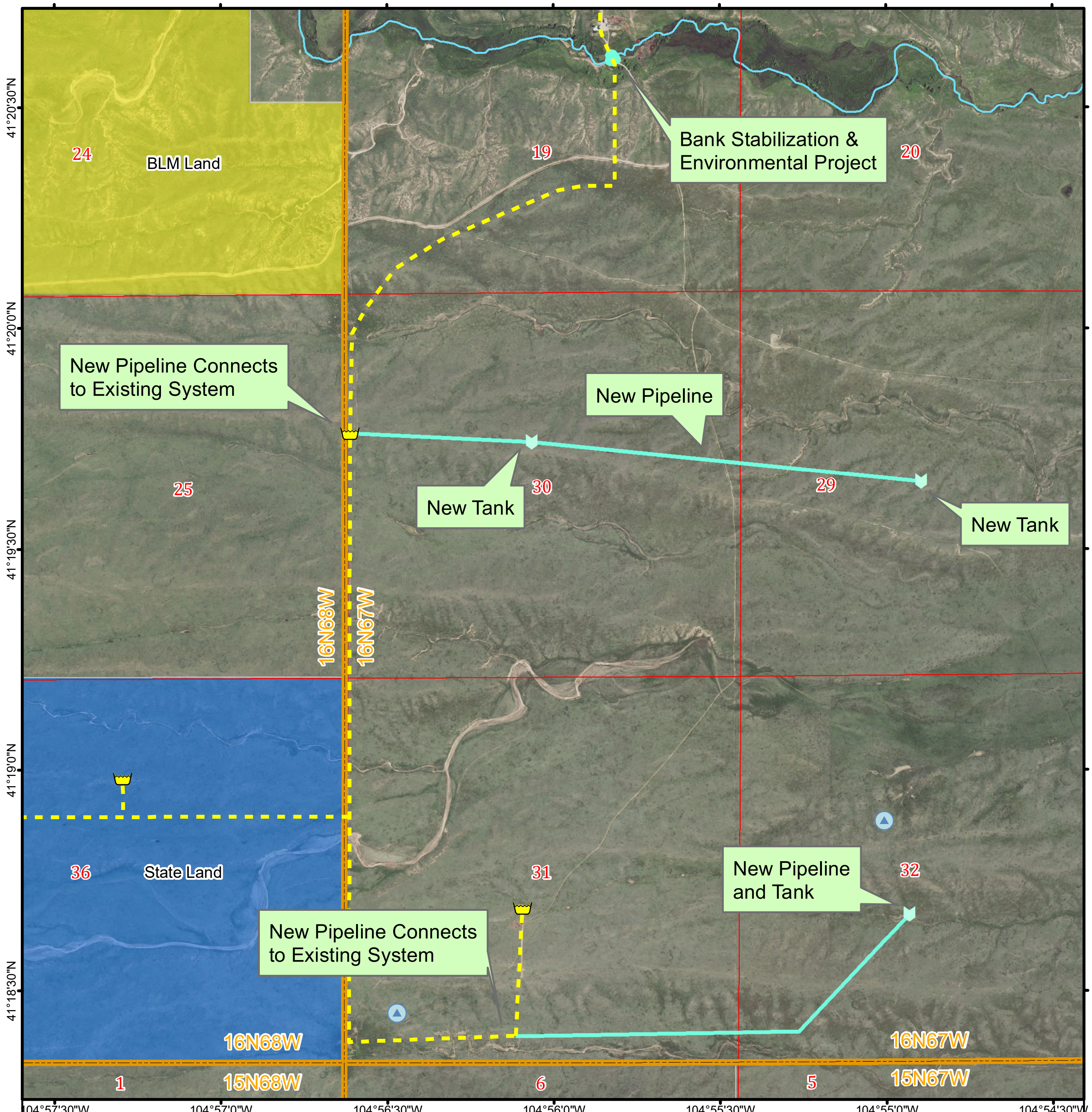
SPRWS Project Cost Estimate

SPRWS Project No. **16-67-5.1**

Project Name Hollingsworth Well, Pipeline, and Tanks

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 7,250.00	$ 7,250.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	360	$ 40.00	$ 14,400.00
2a	Spring Development	LS		$ 3,800.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	4	$ 2,900.00	$ 11,600.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	8,050	$ 3.00	$ 24,150.00
7	Miscellaneous Valves and piping at tank(s)	Ea	3	$ 500.00	$ 1,500.00
8	3 Wire Fence with wood posts	LF	200	$ 5.00	$ 1,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	1.00	$ 1,250.00	$ 1,250.00

Sub-Total Estimated Component Costs	$	79,750.00
Contingency - 15%	$	11,962.50
Budget for Project with Contingency	**$**	**91,712.50**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

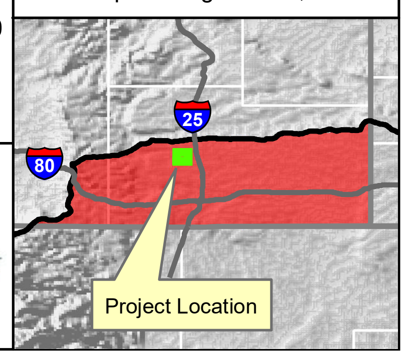
0 1,000 2,000

1 in = 2,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R67W



**Projects 16-67-30.1 and 16-67-19.1:Hollingsworth.
New Stock Tanks, Pipelines & Bank Stabilization**

Document Name: Hollingsworth_16-67-30.1and16-67-19.1
Date Saved: 7/4/2017

SPRWS PROJECT NUMBER: 16-67-19.1
Bank stabilization and Erosion protection
Project location SE¼ NE ¼ Sec. 19 T16N R67W
Site Visit Date: March 3, 2017

PROJECT NAME: Hollingsworth Bank Stabilization and Erosion Protection

Lindsey Hollingsworth (Applicant – Name of Entity)

TJ Hollingsworth (Contact)

1875 Road 224

Cheyenne, WY 82009

Laramie (307)

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental			X	41.3436	104.9306
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	67W	19	SENE

Project Description:

This project involves bank stabilization, placement of riprap, and wetlands construction to control erosion below an existing road that crosses Lodgepole Creek. This project will also protect a critical stock water pipeline that crosses the creek in this location.

Specifically, this project will include:

- Installation of riprap to help stabilize the creek bank in this area.

- Incidental work including fencing and willow plantings to also stabilize the creek bank will be done as part of this project.

Public Benefit:

___

___

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

___

Who is the owner of the project? ______Lindsey Hollingsworth_____________

Who owns the land that the project is to be built on? ________Lindsey Hollingsworth________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? _____________________________________
The entire southern part of the Hollingsworth Ranch is watered via the stock water pipeline that crosses Lodgepole Creek in this area. This system provides water to 8 sections.

What is the total estimated project cost? ______$12,500____

Photographs:

None available.

SPRWS PROJECT NUMBER: 16-67-30.1
New Pipelines and Tanks
Project Location – Tanks in Section 29, 30, and 32 T16N R67W
Site Visit Date: March 3, 2017

PROJECT NAME: Hollingsworth Middle Pipelines and Tanks
New stock water pipelines and tanks

Lindsey Hollingsworth__________________________ (Applicant – Name of Entity)

TJ Hollingsworth________________________________(Contact)

1875 Road 224_________________________________

Cheyenne, WY 82009

_Laramie___ _____________(307)___ ____________________

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Pipeline to new tanks in Sec 30 and 29		X		41.3294	104.9435
Tank in Sec 30		X		41.3290	104.9345
Tank in Sec 29		X		41.3275	104.9149
Pipeline to new Tank in Sec 32		X		41.3094	104.9352
Tank in Sec 32		X		41.3112	104.9156

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	67W	29, 30, 31 & 32	

Project Description:

This project involves construction of 2 new pipelines and 3 stock tanks to extend an existing stock watering system to serve additional pastures. All of the new tanks will be tire tanks and miscellaneous floats and valves will be installed at each tank.

The first pipeline will be approximately8000' long and will be 2" diameter pipe. This pipeline will provide water to two tanks, one in Section 29 and one in Section 30, T16N, R67W. The pipeline will connect to the existing stock water pipeline system, located near the west side of Section 30.

The second pipeline will be approximately 6250' long and will be 2" diameter pipe. This pipeline will serve one tank in Section 32, T16N, R67W. The pipeline will connect to the existing stock water pipeline system near the existing stock tank in Section 31.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District____

____

Who is the owner of the project? ______Lindsey Hollingsworth_____________

Who owns the land that the project is to be built on? _______ Lindsey Hollingsworth_______________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? _____________________________________
This project will provide water directly for to three pastures, located in three sections, totaling approximately 1920 acres.

____

What is the total estimated project cost? ___$68,600_______________________________________

Photographs:

None available.

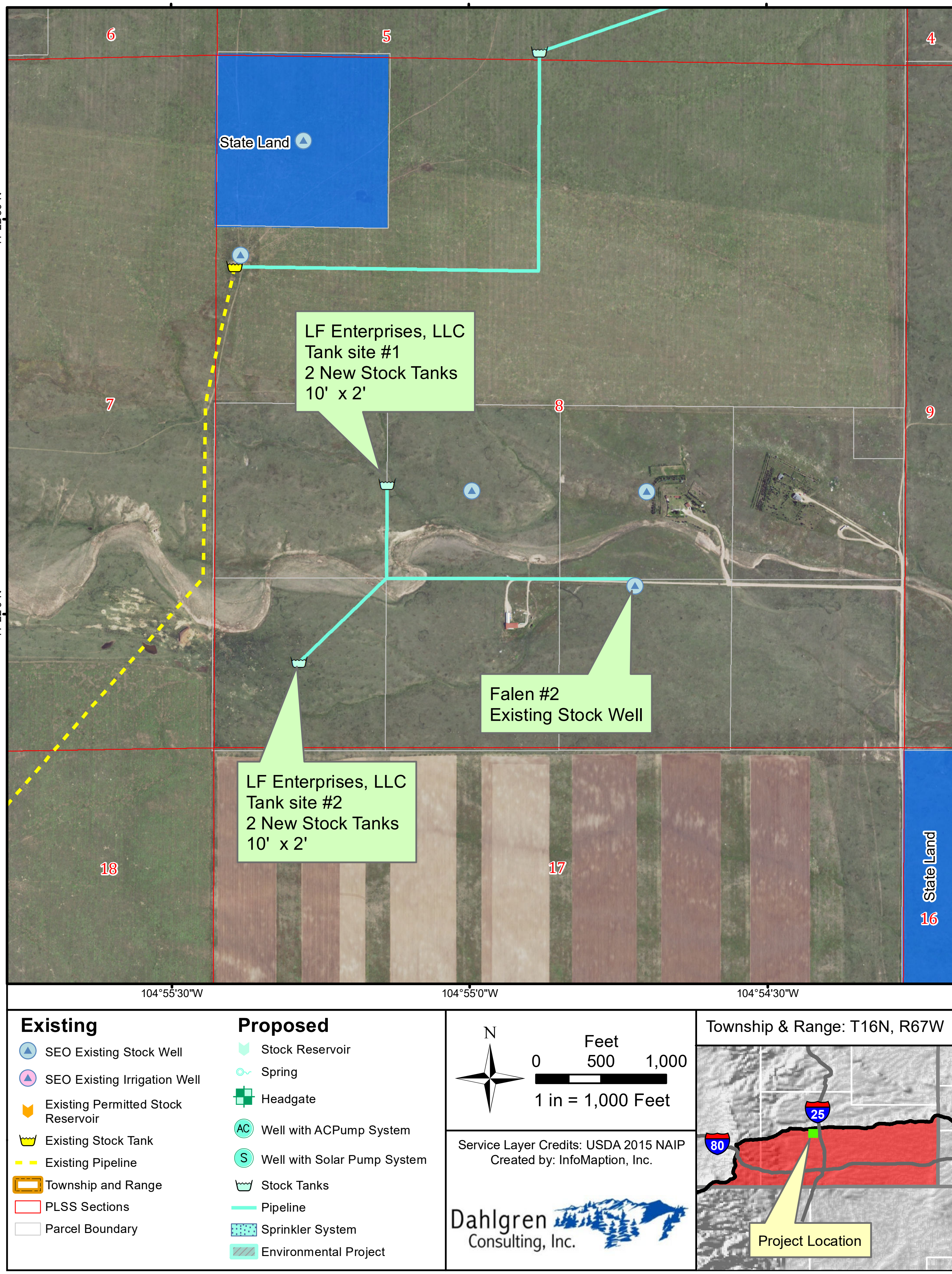
SPRWS Project Cost Estimate

SPRWS Project No. **16-67-30.1**

Project Name Hollingsworth Sections 29, 30, and 32 Tanks and Pipeline Extension

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 5,420.00	$ 5,420.00
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS		$ 3,800.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	3	$ 2,900.00	$ 8,700.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	14,250	$ 3.00	$ 42,750.00
7	Miscellaneous Valves and piping at tank(s)	Ea	3	$ 500.00	$ 1,500.00
8	3 Wire Fence with wood posts	LF		$ 5.00	$ -
8a	12' Wire Gate	LS		$ 600.00	$ -
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	1.00	$ 1,250.00	$ 1,250.00

Sub-Total Estimated Component Costs	$ 59,620.00
Contingency - 15%	$ 8,943.00
Budget for Project with Contingency	**$ 68,563.00**



Project 16-67-8.1: LF Enterprises Livestock Watering

Document Name: LF_Enterprises_16-67-8.1
Date Saved: 9/1/2017

SPRWS PROJECT NUMBER: 16-67-8.1

Stock Tanks and Pipeline

South ½ Section 8, T16N, R67W

PROJECT NAME: LF Enterprises 16-67-8.1 Stock Watering Project

New stockwater pipeline and two sets of new tanks. The existing Falen #2 Well, Permit UW 205814, will provide water for this system.

LF Enterprise, LLC (Applicant – Name of Entity)

Frank Falen (Contact Address)

300 East 18th Street

Cheyenne, WY 82001

Laramie 307-631-6331 Frank@budd-falen.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Tanks – 1 of 2		X		41.3696	104.9190
Pipeline					
Tanks – 2 of 2		X		41.3654	104.9212
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

	Township	Range	Section	Quarter-Quarter
Existing Well	16	67	8	SWSE
New Tank	16	67	8	NWSW
New Tank	16	67	8	SWSW

Project Description:

This project involves construction of a new stock watering system, including pipeline from an existing well and two sets of new tanks. Water will be supplied from the existing Falen #2 Stock well.

Specifically, this project will include:

- Approximately 3600' of 2" pipe.
- Two sets of stock tanks, each with two 10' diameter by 2' deep stock tanks.
- Miscellaneous valves and floats.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? LF Enterprises, LLC

Who owns the land that the project is to be built on? LF Enterprises, LLC

Which WWDC Watershed Study Boundary is this project within? South Platte River Watershed

How many acres will be benefited by this project?
This stock watering system will provide benefits to the SW ¼ of Section 8, T16N, R67W.

What is the total estimated project cost? $28,000

Photograph: Existing Falen #2 Well with Tank

SPRWS Project Cost Estimate

SPRWS Project No. **16-67-8.1**

Project Name **LF Enterprises 16-67-8.1 Stock Water System**

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,222.50	$ 2,222.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 2,400.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	4	$ 2,900.00	$ 11,600.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	3,600	$ 2.50	$ 9,000.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF		$ 5.00	$ -
8a	12' Wire Gate	LS		$ 600.00	$ -
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	24,447.50
Contingency - 15%	$	3,667.13
Budget for Project with Contingency	**$**	**28,114.63**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

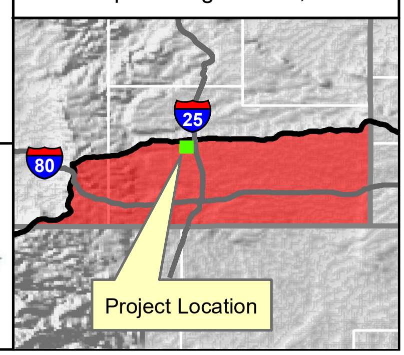
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R67W



Project 16-67-8.2: LF Enterprises Irrigation Well and Irrigation

Document Name: LF_Enterprises_16-67-8.2
Date Saved: 9/1/2017

SPRWS PROJECT NUMBERS: 16-67-8.2
Irrigation Well, Pump, and Sprinkler
SE 1/4 Section 8, T16N, R67W

PROJECT NAME: LF Enterprises 16-67-8.2 Irrigation Project

New irrigation well, pump and side roll sprinkler system. This project will require a new irrigation well permit. This site is outside of the Laramie County Control Area.

LF Enterprise, LLC (Applicant – Name of Entity)

Frank Falen (Contact Address)

300 East 18th Street

Cheyenne, WY 82001

Laramie	307-631-6331	Frank@budd-falen.com
(County)	(Phone)	(Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well		X		41.3658	104.9096
Solar Platforms					
Tank					
Pipeline					
Spring Development					
Wetland					
Environmental					
Irrigation		X		41.3658	104.9096
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

	Township	**Range**	**Section**	**Quarter-Quarter**
New Irrigation Well	16	67	8	SE 1/4
New Irrigated Field	16	67	8	SE 1/4

Project Description:

This project involves construction of a new irrigation project, including a new well, new irrigation pump, and side roll sprinkler system. This project will provide irrigation for approximately 40 acres.

Specifically, this project will include:

- Construction of a 12" diameter by 300' deep irrigation well.
- Installation of a 50 HP pump.
- Installation of 1240' of 6" mainline pipe.
- Installation of a 40 acre side roll or wheel roll sprinkler system.
- Miscellaneous valves.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? LF Enterprises, LLC

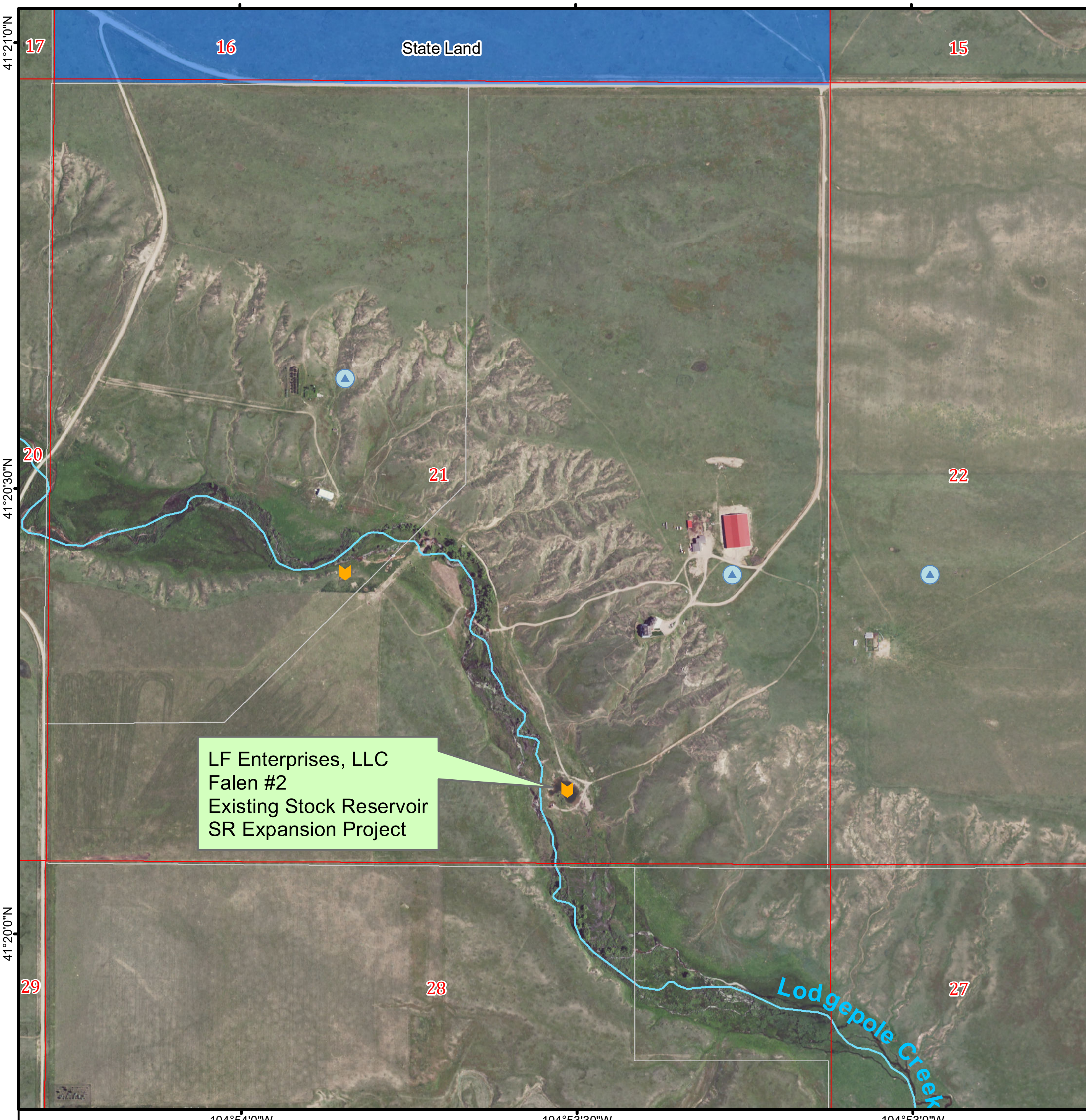
Who owns the land that the project is to be built on? LF Enterprises, LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?
This proposed irrigation system will irrigate approximately new 40 acres in the SE ¼ of Section 8, T16N, R67W.

What is the total estimated project cost? Additional design work is required to complete this project and to provide a more complete cost estimate. The cost of a well, pump and sprinkler system could exceed the $135,000 limit for a Small Water Project. In addition, there will be costs associated with running 3-phase power to the site. Preliminary cost estimates for the well are in the $40,000 to $65,000 range, assuming that the depth of the well is approximately 300' and the well would be constructed with 12" diameter casing and screen. A 50 HP pump with VFD will cost approximately $40,000 - $45,000. More information concerning the yield of the well and the type of the irrigation system is necessary to complete the cost estimates for the irrigation system. A center pivot could cost $40,000 to $75,000 depending on the length of the pivot. Other types of irrigation or sprinkler systems, such as a side roll, may be more appropriate for this system.



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- PLSS Sections
- Township and Range
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

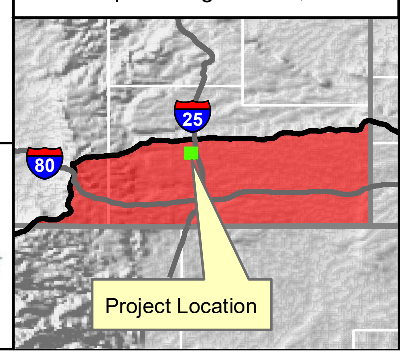
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R67W



Project 16-67-21.1: LF Enterprises Stock Reservoir Enlargement

Document Name: LF_Enterprises_16-67-21.1
Date Saved: 7/5/2017

SPRWS PROJECT NUMBER: 16-67-21.1
New Stock Reservoir
SW ¼ SE 1/4 Section 21, T16N, R67W

PROJECT NAME: Falen #2 Stock Reservoir

This project will involve completion of a stock reservoir. A new stock reservoir permit should be obtained for this project, because the permit for the Falen #2 Stock Reservoir, Permit No. 15978 SR has been cancelled.

LF Enterprise, LLC (Applicant – Name of Entity)

Frank Falen (Contact Address)

300 East 18th Street

Cheyenne, WY 82001

Laramie 307-631-6331 Frank@budd-falen.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		X	X	41.3360	104.8920
Well					
Solar Platforms					
Tank					
Pipeline					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

	Township	Range	Section	Quarter-Quarter
Stock Reservoir	16	67	21	SWSE

Project Description:

This project involves completion of an existing stock reservoir (a pit) that has been constructed near Lodgepole Creek in the SE ¼ of Section 21, T16N, R67W. The permit for the Falen #2 Stock Reservoir, Permit No. 15978 SR, which appears to cover this facility, has been cancelled.

Our understanding is that the landowner wants to slightly enlarge and complete construction of this facility as a Small Water project.

Public Benefit:

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? ______LF Enterprises, LLC________

Who owns the land that the project is to be built on? _______LF Enterprises, LLC________________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

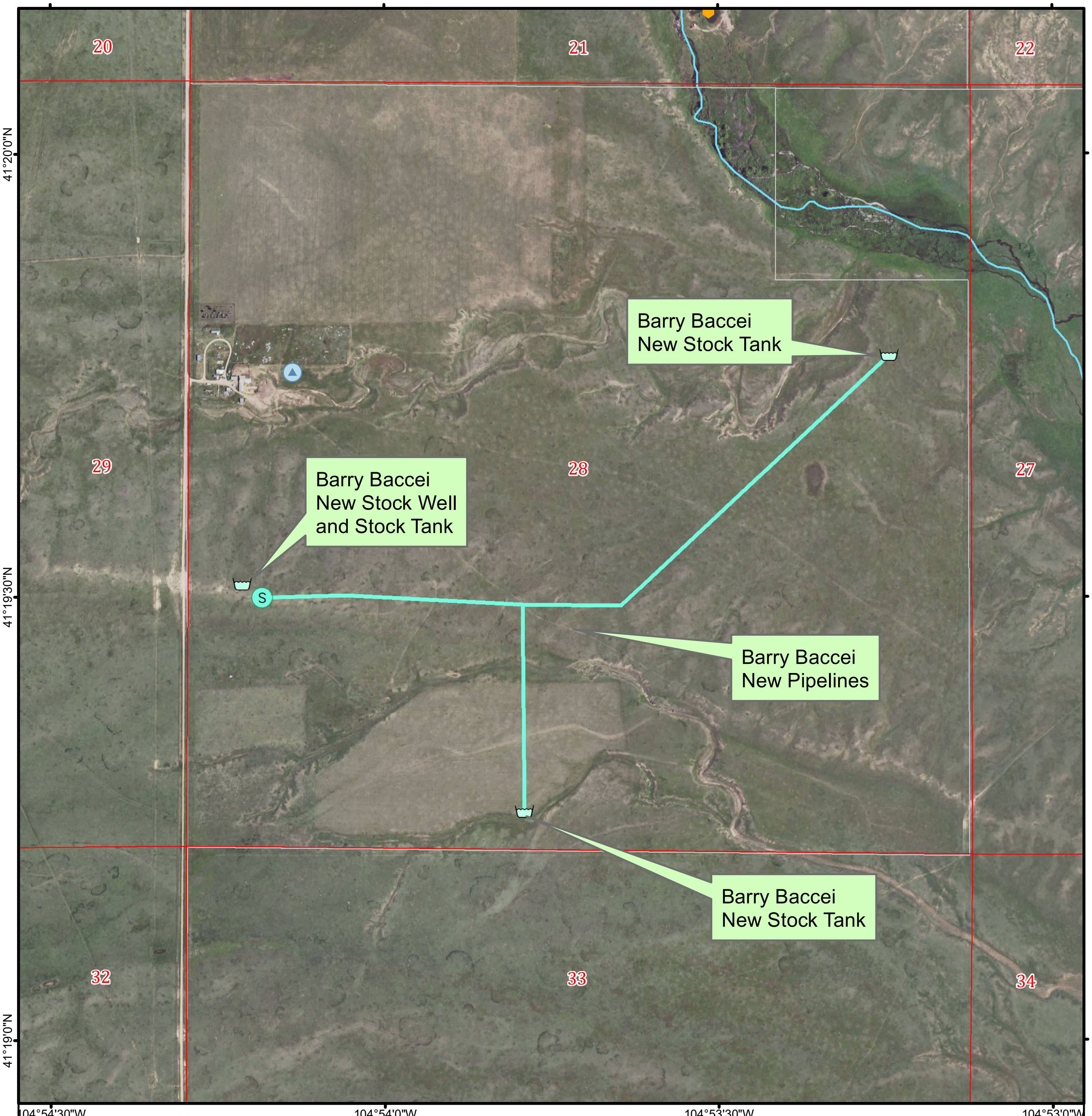
How many acres will be benefited by this project? ____________________________________

____

____

What is the total estimated project cost? The costs for this project have been preliminarily estimated at $25,000 assuming that the project is a time and materials type project and the contractor would be paid an hourly rate for his equipment and personnel. Exact details of the work will need to be defined prior to submitting the small water project application.

Photographs: None available**.**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

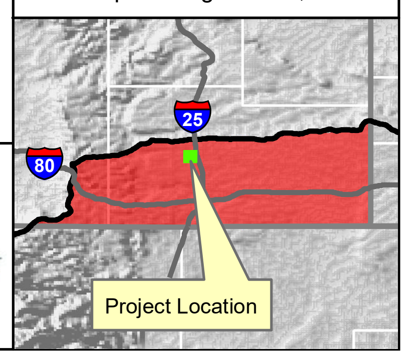
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R67W



Project 16-67-28.1: Barry Baccei Stock Well and Pipeline

Document Name: Baccei_16-67-28.1
Date Saved: 7/5/2017

SPRWS PROJECT NUMBER: 16-67-28.1
New Stock Water Pipeline
Section 28, T16N, R67W

PROJECT NAME: Baccei Stock Water System

Construction of a stock water system, including new well, solar pumping system, three sets of tanks, and pipeline from the well to the tanks. This project will require a new stock well permit.

Barry Joseph Baccei Living Trust (Applicant – Name of Entity)

Frank Falen (Contact Address)

300 East 18th Street

Cheyenne, WY 82001

Laramie 307-631-6331 Frank@budd-falen.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well		X		41.3251	104.9034
Solar Platforms		X		41.3251	104.9024
Tank at Well				41.3251	104.9024
Tanks 2nd set				41.3211	104.8966
Tanks 3rd set				41.3286	104.8885
Pipeline					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

	Township	Range	Section	Quarter-Quarter
Well and Tank	16	67	28	NW ¼ SW 1/4
Tanks- 3 sets	16	67	28	NWSW, SENE, and SESW

Project Description:

This project involves construction and completion of a new stock watering system, including a new well, solar pumping system, cistern, and three sets of stock tanks. Each set of stock tanks will include 2 – 10' diameter tanks or a one 20' diameter bottomless tank. A 2" diameter pipeline will be installed from the well to the tanks. Specifically, this project will include:

- Construction of a 400' deep stock well.
- Installation of a solar pumping system including pump, solar panels, cistern, controls and fencing.
- Construction of one set of tanks at the well in the NW ¼ SW ¼ Section 28.
- Construction of a second set of tanks in SE ¼ SW ¼ of Section 28.
- Construction of a third set of tanks in the SE ¼ NE ¼ of Section 28.
- Approximately 6500' of 2" diameter pipeline.
- Miscellaneous valves and floats.

Public Benefit:

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Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

____

Who is the owner of the project? Barry Joseph Baccei Living Trust

Who owns the land that the project is to be built on? Barry Joseph Baccei Living Trust

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? There are approximately 600 acres of pasture owned by the Barry Joseph Baccei Living Trust in Section 28. In addition, the tanks in the NE corner of the section will provide an alternative water source to Lodgepole Creek and reduce pressure on the riparian area.

What is the total estimated project cost? $94,250

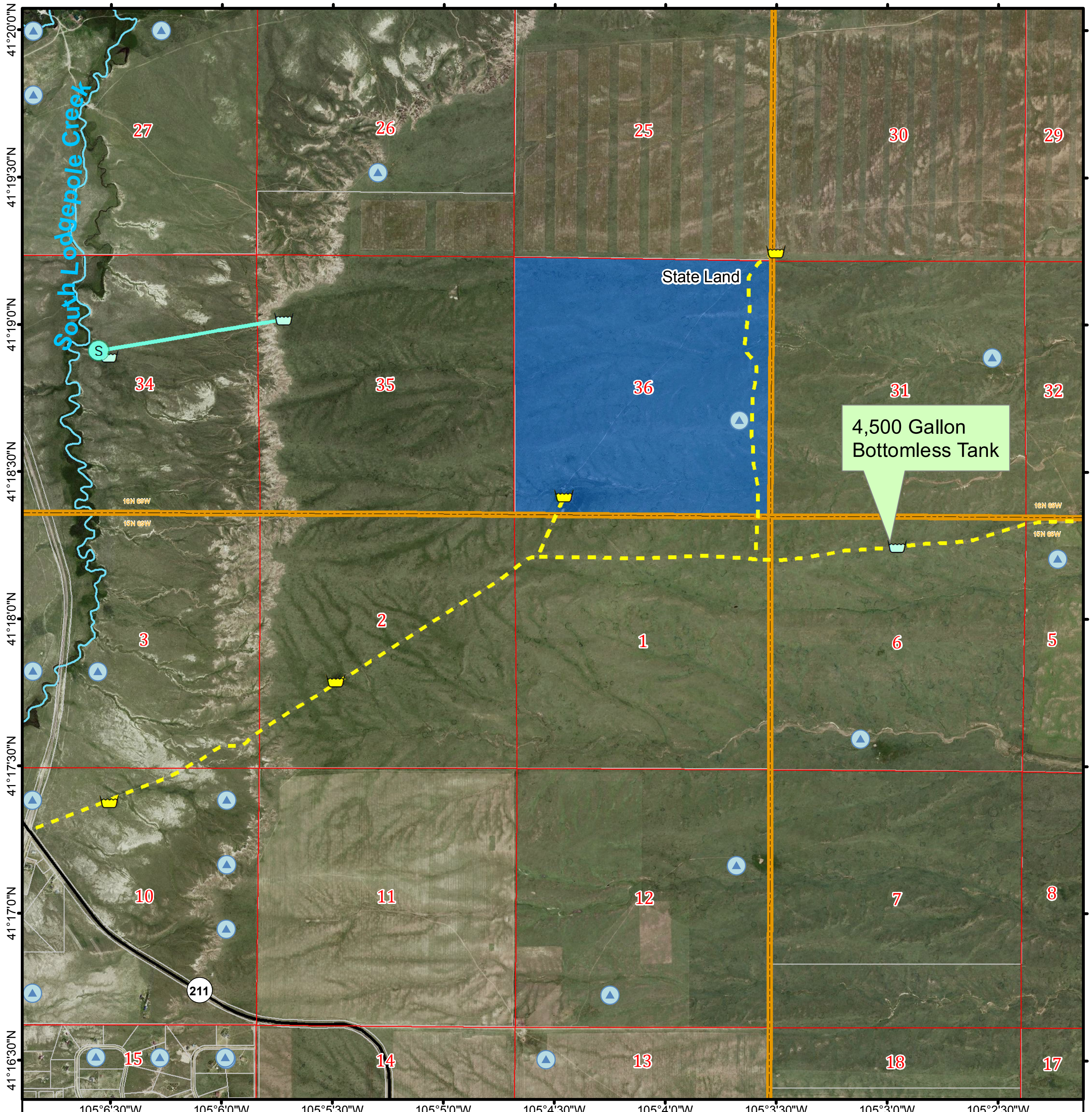
SPRWS Project Cost Estimate

SPRWS Project No. **16-67-28.1**

Project Name **Baccei Stock Water System**

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 7,447.50	$ 7,447.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS	1	$ 14,500.00	$ 14,500.00
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 2,400.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	$ -
5d	1100 gallon 10' diameter tire tank	Ea	6	$ 2,900.00	$ 17,400.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	6,500	$ 3.50	$ 22,750.00
7	Miscellaneous Valves and piping at tank(s)	Ea	4	$ 500.00	$ 2,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$ 81,922.50
Contingency - 15%	$ 12,288.38
Budget for Project with Contingency	**$ 94,210.88**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

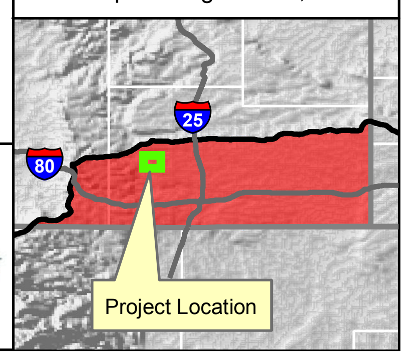
0 1,400 2,800

1 in = 3,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T15N, R68W



Project 15-68-6.1: Vercelli Pipeline Expansion

Document Name: Project_15_68_6.1
Date Saved: 9/18/2017

SPRWS PROJECT NUMBER: 15-68-6.1 Stock Well, Tank, and Pipeline
NW ¼ NE ¼ Sec. 6 T15N R68W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Vercelli Pipeline Expansion

___Chris & Michelle Vercelli____________________________ (Applicant – Name of Entity)

___C/o Jim Cochran Laramie County Conservation District__ (Contact)

_11221 US Highway 30______________________________

Cheyenne, WY 82009 (307) 772-2600

_Laramie___ ______________(307) 772-2600 _______jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank	1	X		41.3041	105.0493
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
15N	68W	6	NWNE

Project Description:

This project involves tapping into an already existing pipeline in order to provide a water source in Section 6, Township 15 North, Range 68 West.

Specifically, the project will include:

- A 4,500-gallon bottomless stock tank.
- Miscellaneous valves and floats.

Public Benefit:

____
____
____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)________________________________
____

Who is the owner of the project? _______Chris & Michelle Vercelli__________

Who owns the land that the project is to be built on? ________Vercelli, Michelle Et. Al.______

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
Approximately 640 acres in section 6 and section 31 will benefit from this additional water source.______
____
____

What is the total estimated project cost? ________$17,725.81**________________________________**

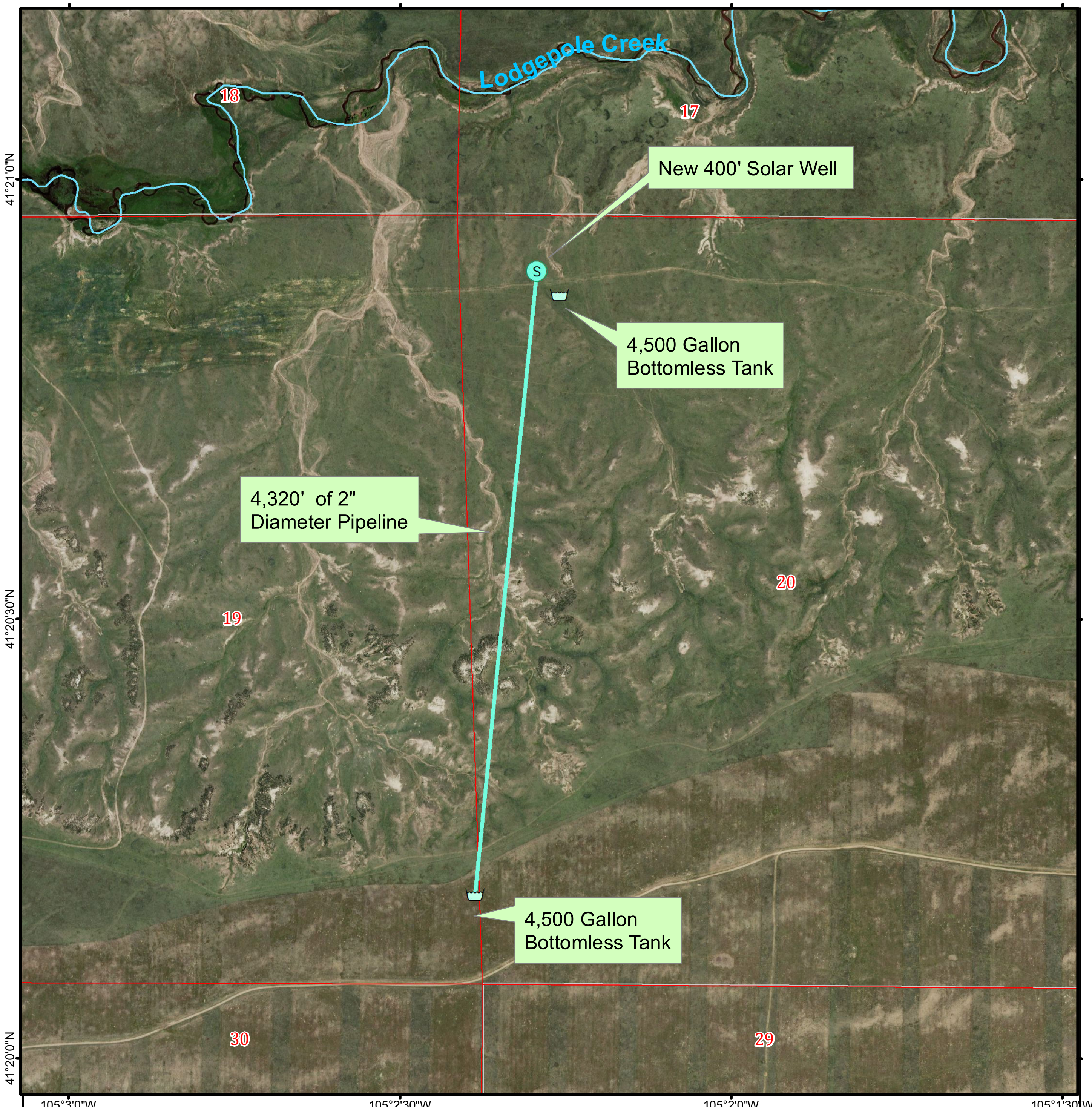
SPRWS Project Cost Estimate

SPRWS Project No. 15-68-6.1

Project Name Vercelli Pipeline Expansion

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,401.25	$ 1,401.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 3.00	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 15,413.75
Contingency - 15%	$ 2,312.06
Budget for Project with Contingency	**$ 17,725.81**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

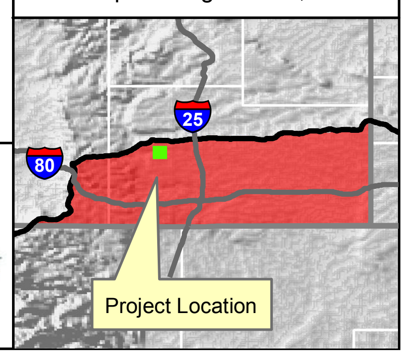
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren
Consulting, Inc.

Township & Range: T16N, R68W



Project 16-68-19.1: Vercelli S19 Stock Well, Tank, and Pipeline

Document Name: Project_16_68_19.1
Date Saved: 9/15/2017

SPRWS PROJECT NUMBER: 16-68-19.1 Stock Well, Tank, and Pipeline
NE ¼ NE ¼ Sec. 19 T16N R68W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Vercelli S19 Stock Well, Tank, and Pipeline

___Chris & Michelle Vercelli___ (Applicant – Name of Entity)

___C/o Jim Cochran Laramie County Conservation District___ (Contact)

_11221 US Highway 30___

Cheyenne, WY 82009 (307) 772-2600

Laramie___ (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well	1	X		41.3491	105.0397
Solar Platforms	1	X		41.3491	105.0397
Pipeline	4,320’	X		41.3491	105.0397
Tank	2	X		41.3491	105.0397
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	68W	19	NENE

Project Description:

This project involves the construction of a new stock well with a solar pump with solar panels and pipeline that will be used to provide stock watering in two pastures.

Specifically, the project will include:

- Drilling of a new well. The well will be approximately 400' deep based on adjacent stock wells.
- A new solar pumping system, including panels, solar pump, and cistern.
- Approximately 4,320 feet of 2-inch diameter pipeline
- Two 4,500-gallon bottomless tanks to be installed near the well.
- Miscellaneous valves and floats.

Public Benefit:

___

___

___

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

___

Who is the owner of the project? Chris & Michelle Vercelli

Who owns the land that the project is to be built on? Vercelli, Michelle Et. Al.

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
Approximately 2,000 acres in Section 19, 20, and 30 will benefit from this additional water source.______
____
____

What is the total estimated project cost? ___$87,092.09____________________________________

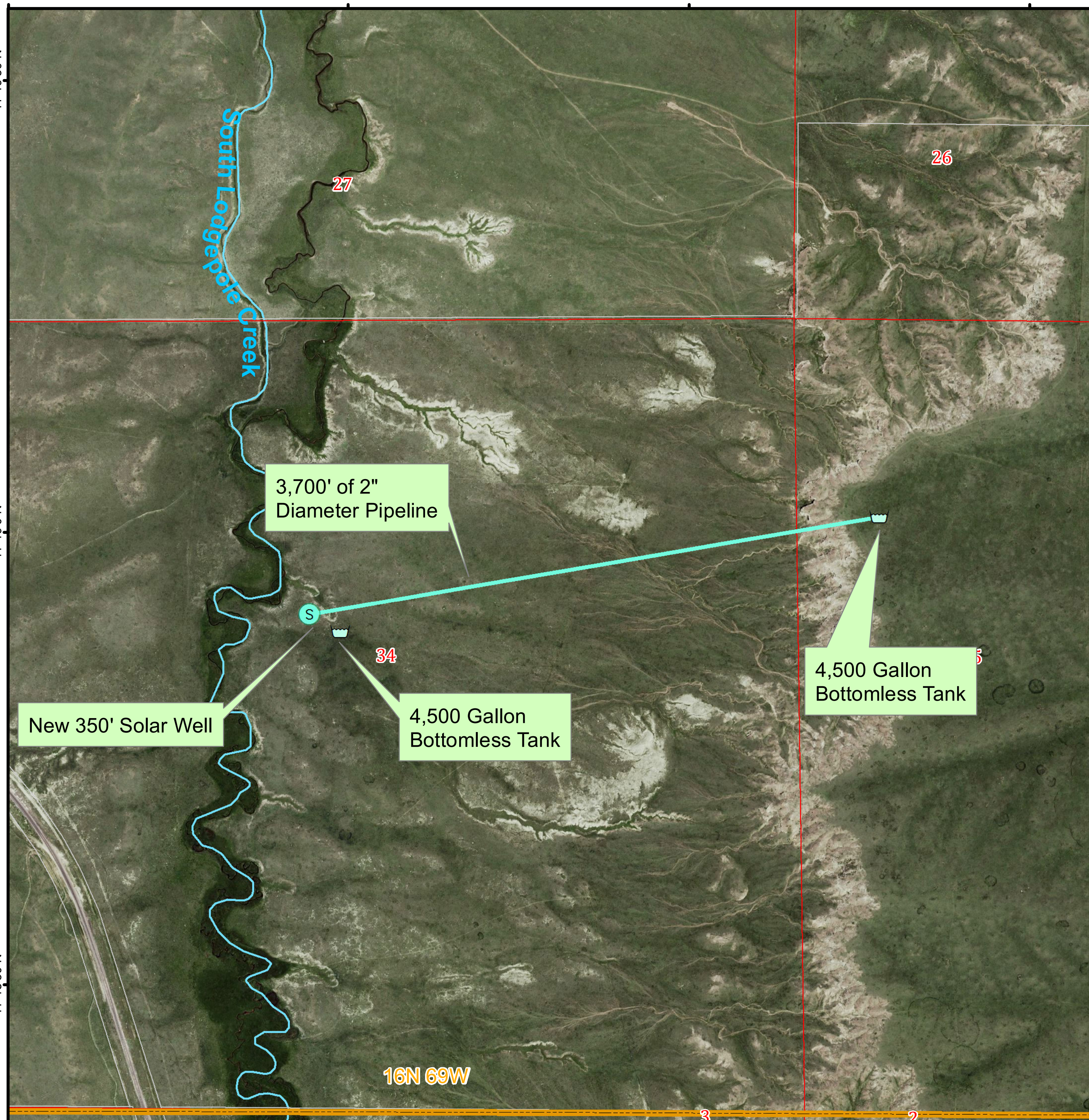
SPRWS Project Cost Estimate

SPRWS Project No. 16-68-19.1

Project Name Vercelli S19 Stock Well, Tank and Pipeline

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 6,884.75	$ 6,884.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	2	$ 12,000.00	$ 24,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	4,320	$ 3.00	$ 12,960.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$	75,732.25
Contingency - 15%	$	11,359.84
Budget for Project with Contingency	**$**	**87,092.09**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

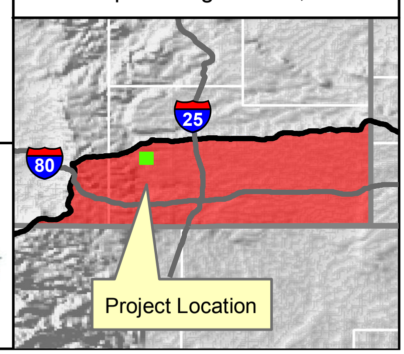
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R69W



Project 16-69-34.1: Vercelli S34 Stock Well, Tank, and Pipeline

Document Name: Project_16_69_34.1
Date Saved: 9/18/2017

SPRWS PROJECT NUMBER: 16-69-34.1 Stock Well, Tank, and Pipeline
NE ¼ SW ¼ Sec. 34 T16N R69W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Vercelli S34 Stock Well, Tank, and Pipeline

Chris & Michelle Vercelli (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well	1	X		41.3129	105.1099
Solar Platforms	1	X		41.3129	105.1099
Pipeline	3,700'	X		41.3129	105.1099
Tank	2	X		41.3129	105.1099
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	**Range**	**Section**	**Quarter-Quarter**
15N	69W	34	NESW

Project Description:

This project involves the construction of a new stock well with a solar pump with solar panels and pipeline that will be used to provide stock watering in two pastures.

Specifically, the project will include:

- Drilling of a new well. The well will be approximately 400' deep based on adjacent stock wells.
- A new solar pumping system, including panels, solar pump, and cistern.
- Approximately 3,700 feet of 2-inch diameter pipeline
- Two 4,500-gallon bottomless tanks to be installed near the well.
- Miscellaneous valves and floats.

Public Benefit:

____
____
____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

____

Who is the owner of the project? Chris & Michelle Vercelli

Who owns the land that the project is to be built on? Vercelli, Michelle Et. Al.

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

Approximately 1,420 acres in Section 26, 34, and 35 will benefit from this additional water source.

What is the total estimated project cost? $84,739.19

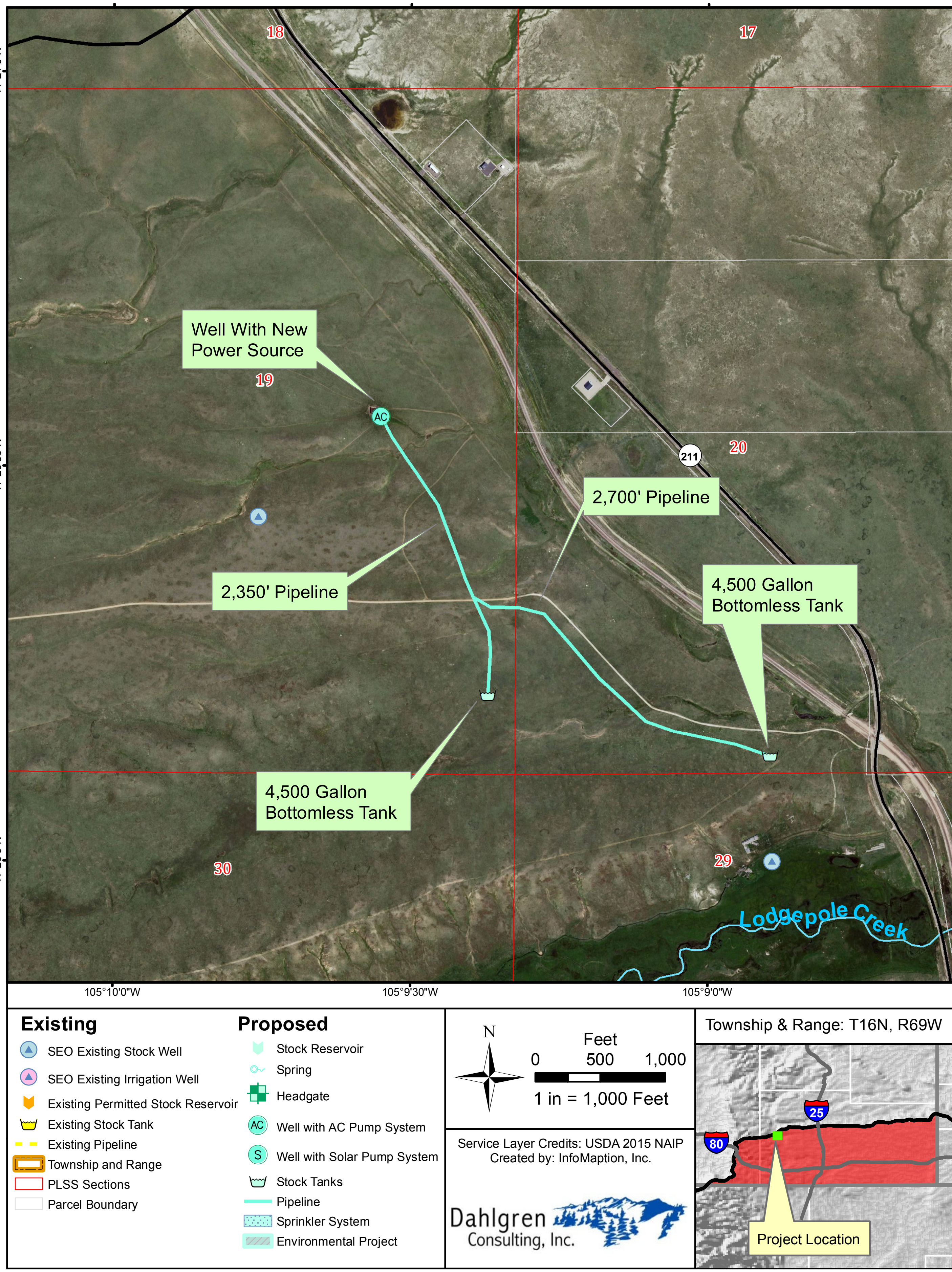
SPRWS Project Cost Estimate

SPRWS Project No. 16-68-34.1

Project Name Vercelli S34 Stock Well, Tank, and Pipeline

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 6,698.75	$ 6,698.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	2	$ 12,000.00	$ 24,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	3,700	$ 3.00	$ 11,100.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 73,686.25
Contingency - 15%	$ 11,052.94
Budget for Project with Contingency	**$ 84,739.19**



Project 16-69-19.1: Y-Cross Ranch Pipeline

Document Name: Project_16_69_19.1
Date Saved: 9/18/2017

SPRWS PROJECT NUMBER: 16-69-19.1 Pipeline
SE ¼ NE ¼ Sec. 19 T16N R69W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Y-Cross Ranch Pipeline

__Tyler & Trisha Kimzey______________________________(Applicant – Name of Entity)

_ C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30__________________________

Cheyenne, WY 82009 (307) 772-2600

_Laramie___ ______________(307) 772-2600 _______jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline	5,050'	X		41.3427	105.1592
Tank	2	X		41.3427	105.1592
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	69W	19	SENE

Project Description:

This project involves construction of two new pipelines and stock tanks. The existing well, LT North, WY SEO permit No. P169572.0W, is 200 feet deep and includes a submersible pump run by a portable generator. The purpose of this project is to diversify water sources to various pastures on the Y-Cross Ranch. Currently, stock water is provided via surface water from the South Fork of Lodge Pole Creek which tends to be unreliable during dry years.

Specifically, this project will include:

- Approximately 5,050' of pipeline
- Two 4,500-gallon bottomless stock tank to be installed at the end of pipelines.
- Power service will also run 1,700' from the existing well to reliable power.
- Miscellaneous valves and floats.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

____

Who is the owner of the project? Tyler & Trisha Kimzey

Who owns the land that the project is to be built on? Y-Cross Ranch

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
Approximately 650 acres in Section 19 and 20 will have reliable access to water.____________________
____

What is the total estimated project cost? _______$79,268.06_________________________________

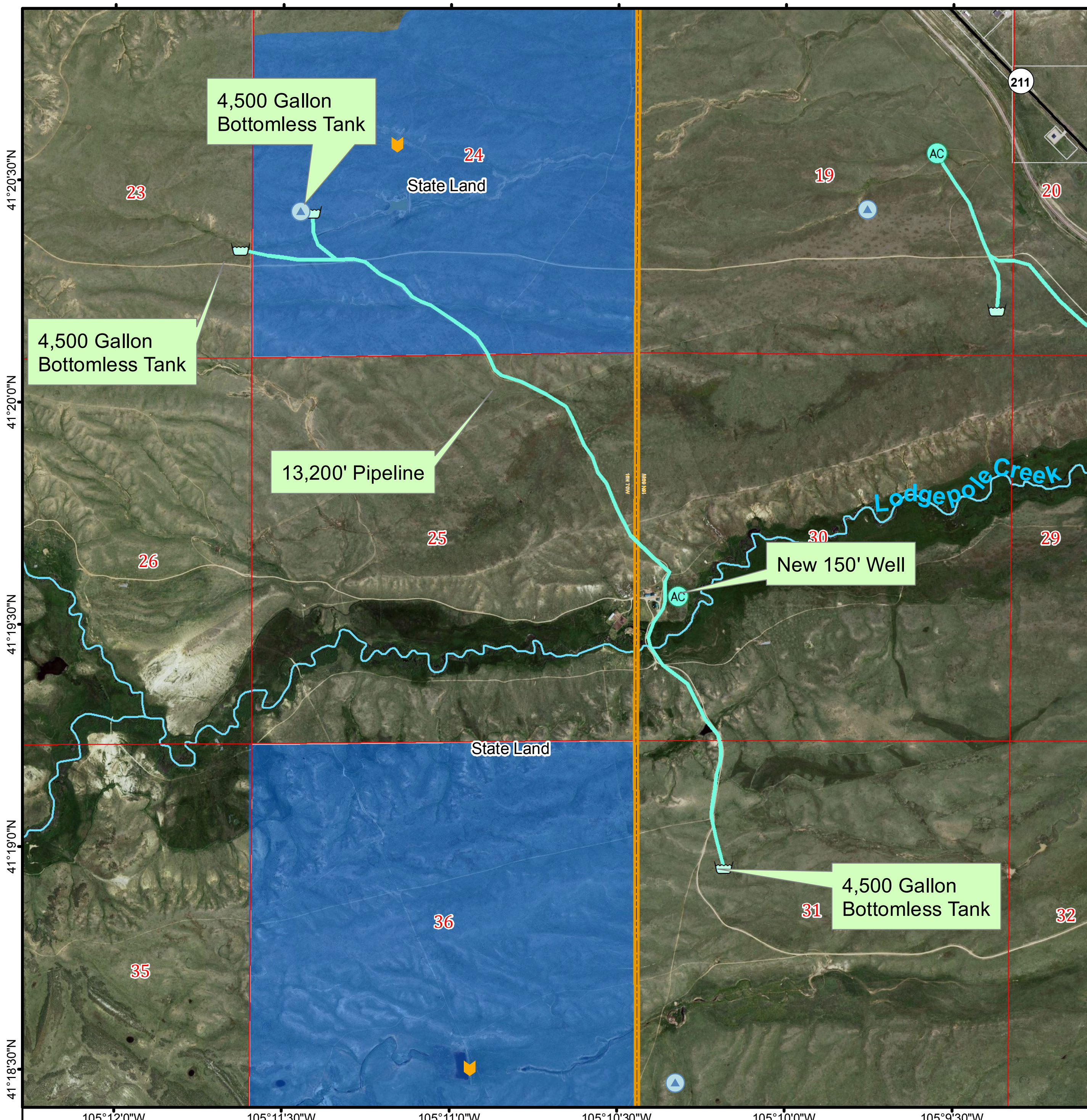
SPRWS Project Cost Estimate

SPRWS Project No. 16-69-19.1

Project Name Y-Cross Ranch Pipeline

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 6,266.25	$ 6,266.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	200	$ 40.00	$ 8,000.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI	0.32	$ 20,000.00	$ 6,400.00
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	2	$ 12,000.00	$ 24,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	5,050	$ 3.00	$ 15,150.00
7	Miscellaneous Valves and piping at tank(s)	Ea	2	$ 500.00	$ 1,000.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF	200.00	$ 3.00	$ 600.00
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 68,928.75
Contingency - 15%	$ 10,339.31
Budget for Project with Contingency	**$ 79,268.06**



Existing
- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed
- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

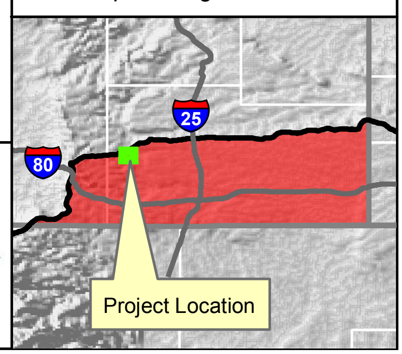
N

Feet
0 940 1,880
1 in = 2,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R69W



Project 16-69-30.1: Y-Cross Stock Well and Tank

Document Name: Project_16_69_30.1
Date Saved: 9/18/2017

SPRWS PROJECT NUMBER: 16-69-30.1 Stock Well and Tank
NW ¼ SW ¼ Sec. 30 T16N R69W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Y-Cross Stock Well and Tank

Tyler & Trisha Kimzey (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well	1	X		41.3259	105.1727
Solar Platforms					
Pipeline	13,200'	X		41.3259	105.1727
Tank	3	X		41.3259	105.1727
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	69W	30	NWSW

Project Description:

This project involves the construction of a new well, pipeline, and stock tanks to diversify the water source to various pastures on the Y-Cross Ranch. Currently, stock water is provided via surface water from the South Fork of Lodge Pole Creek which tends to be unreliable during dry years.

Specifically, this project will include:

- Drilling a new well that will be approximately 150’ deep.
- Approximately 13,200’ of 2-inch diameter pipeline.
- Three 4,500-gallon bottomless stock tank to be installed at the end of pipelines.
- Power service will also run 260’ from the existing well to reliable power.
- Miscellaneous valves and floats.

Public Benefit:

____

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____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

____

Who is the owner of the project? Tyler & Trisha Kimzey

Who owns the land that the project is to be built on? Y-Cross Ranch

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ______________________________________
Approximately 3,000 acres in T16 69W Section 31 and 32 and T16 70W Section 22, 23, 24, and 36 will have reliable access to water.
____

What is the total estimated project cost? ______$116,459.06 _____________________________

SPRWS Project Cost Estimate

SPRWS Project No. 16-69-30.1

Project Name Y-Cross Ranch Stock Well and Tank

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 9,206.25	$ 9,206.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	150	$ 40.00	$ 6,000.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS	1	$ 2,500.00	$ 2,500.00
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI	0.05	$ 20,000.00	$ 1,000.00
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	3	$ 12,000.00	$ 36,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF	13,200	$ 3.00	$ 39,600.00
7	Miscellaneous Valves and piping at tank(s)	Ea	3	$ 500.00	$ 1,500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF	150.00	$ 3.00	$ 450.00
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$	101,268.75
Contingency - 15%	$	15,190.31
Budget for Project with Contingency	**$**	**116,459.06**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with AC Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

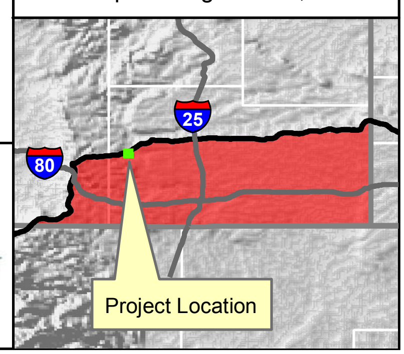
0 125 250

1 in = 250 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R70W



Project 16-70-24.1: Y-Cross Islay Draw #1 Stock Reservoir Rehab

Document Name: Project_16_70_24.1
Date Saved: 9/18/2017

SPRWS PROJECT NUMBER: 16-70-24.1 Reservoir Rehabilitation
SE ¼ NE ¼ Sec. 24 T16N R70W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Y-Cross Islay Draw #1 Stock Reservoir Rehabilitation

Tyler & Trisha Kimzey (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir	1		X	41.3408	105.1857
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	70W	24	NESW

Project Description:

This project will involve maintenance activities for the Islay Draw #1 Stock Reservoir, which provides water for stock and wildlife. Islay Draw #1 Stock Reservoir is permitted for 19.60 acre feet of storage and is currently in disrepair due to wave action.

Specifically, the project will include:

- Removal of vegetation from the dam embankment
- Dam crest leveling
- Erosion control on the water side of the dam embankment.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)______________________________________

____

Who is the owner of the project? ____Tyler & Trisha Kimzey ________________

Who owns the land that the project is to be built on? ________Y Cross Ranch______________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ___________________________________

_______Approximately 2,270 acres will benefit from the reclamation of this reservoir.________________

____

What is the total estimated project cost? __N/A____

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

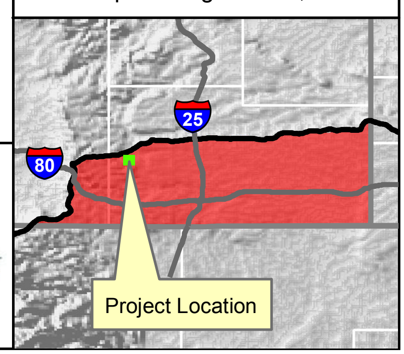
0 250 500

1 in = 500 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R70W



Project 16-70-36.1: Y-Cross Table Top Reservoir Liner and Rehabilitation

Document Name: Project_16_70_36.1
Date Saved: 9/18/2017

SPRWS PROJECT NUMBER: 16-70-36.1 Reservoir Liner and Rehabilitation
SW ¼ SE ¼ Sec. 36 T16N R70W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Y-Cross Table Top Reservoir Liner and Rehabilitation

__Tyler & Trisha Kimzey________________________ (Applicant – Name of Entity)

___C/o Jim Cochran Laramie County Conservation District__ (Contact)

_ 11221 US Highway 30____________________________________

Cheyenne, WY 82009 (307) 772-2600

_Laramie___ ______________(307) 772-2600 _______jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir	1		X	41.3085	105.1826
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	70W	36	SWSE

Project Description:

This project will involve rehabilitation of the Table Top Reservoir. The Table Top Reservoir provides water for stock and wildlife and is permitted for 49.80 acre feet of storage. The existing water rights have expired. The existing dam is in disrepair due to wave action and experiences excessive seepage.

Specifically, this project will include:

- Potential rehabilitation of the dam and liner installation

Public Benefit:

____
____
____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)______________________________________
____

Who is the owner of the project? ___Tyler & Trisha Kimzey_________

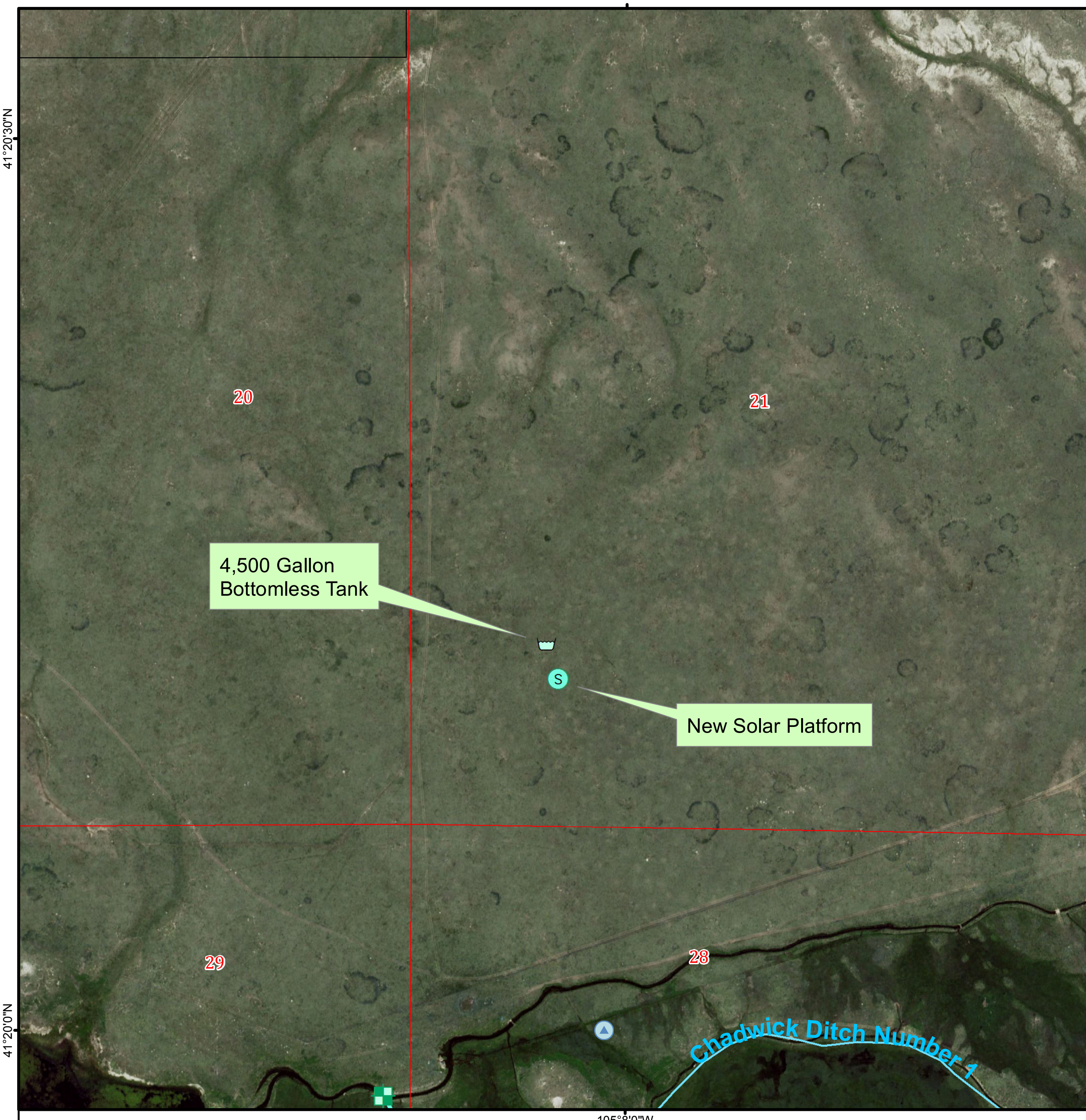
Who owns the land that the project is to be built on? ________Y-Cross Ranch________

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ______________________________________
_______Approximately 1,590 acres will benefit from the reclamation of this reservoir.________________
____

What is the total estimated project cost? ____N/A**____**



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

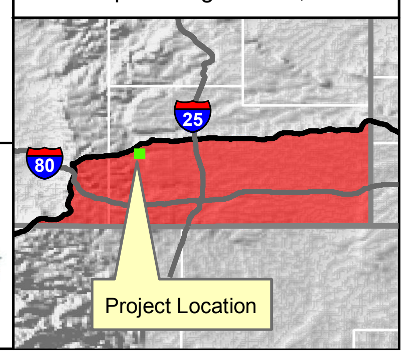
0 250 500

1 in = 500 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R69W



Project 16-69-21.1: Islay Ranch North Pasture Stock Well and Tank

Document Name: Project_16_69_21.1
Date Saved: 9/6/2017

SPRWS PROJECT NUMBER: 16-69-21.1 North Pasture Stock Well and Tank
NW ¼ SE ¼ Sec. 21 T16N R69W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Islay Ranch North Pasture Stock Well and Tank

T.C. Berry (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well	1	X		41.3388	105.1409
Solar Platforms	1	X		41.3388	105.1409
Pipeline					
Tank	1	X		41.3388	105.1409
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	69W	21	NWSE

Project Description:

This project would include construction of a well with solar platform. There are no existing wells in this area. The goal of the project is to reduce or eliminate stock access to the adjacent riparian areas along Lodge Pole Creek.

Specifically, this project will include:

- Drilling of a new well. Existing stock wells adjacent to this section have well depths ranging 20-100 feet.
- A new solar pumping system, including panels, and solar pump.
- One 4,500-gallon bottomless tank will be installed near the well.
- Miscellaneous valves and floats.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

____

Who is the owner of the project? T.C. Berry

Who owns the land that the project is to be built on? Berry Ranch LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ____________________________________
_______Approximately 860 acres of Section 20 and 21 will benefit from the improved water source.______
____
____

What is the total estimated project cost? _______$39,420.56_______________________________

SPRWS Project Cost Estimate

SPRWS Project No. 16-69-21.1

Project Name Islay Ranch North Pasture Stock Well and Tank

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 3,116.25	$ 3,116.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	100	$ 40.00	$ 4,000.00
3	Solar Pump System - less than 250' TDH	LS	1	$ 9,650.00	$ 9,650.00
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS	1	$ 3,500.00	$ 3,500.00
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 3.00	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$	34,278.75
Contingency - 15%	$	5,141.81
Budget for Project with Contingency	**$**	**39,420.56**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

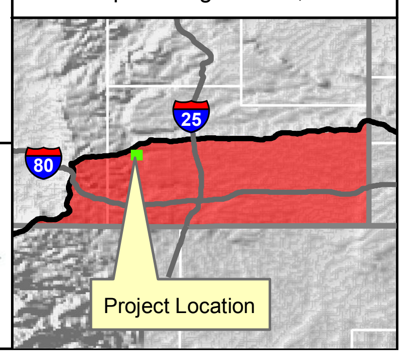
Feet
0 250 500

1 in = 500 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R69W



Project 16-69-29.1: Islay Ranch Chadwick Reservoir No.3 Dam Maintenance

Document Name: Project_16_69_29.1
Date Saved: 9/15/2017

SPRWS PROJECT NUMBER: 16-69-29.1 Chadwick No. 3 Reservoir Dam Rehabilitation

NE ¼ NE ¼ Sec. 29 T16N R69W

Site Visit Date: Nov. 3, 2016

PROJECT NAME: Islay Ranch Chadwick Reservoir No. 3 Dam Rehabilitation

T.C. Berry (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir	1		X	41.3318	105.1391
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	69W	29	NENE

Project Description:

Rehabilitation work is recommended for the existing Chadwick Reservoir No. 3 dam, State Engineer’s Office Permit No. 5289 Res. The Chadwick Reservoir No. 3 is an on-channel reservoir on Lodge Pole Creek and it is permitted for 27 acre-feet. The existing dam is approximately 1,100 feet long and 10’ tall. The reservoir includes a primary concrete spillway controlled by stop-logs, an emergency spillway on the north side of the reservoir and the concrete head gate for the Chadwick No. 3 Ditch, which is a territorial water right. The Chadwich No. 3 dam acts as the diversion for the Chadwick No. 3 Ditch, and the reservoir provides irrigation water, stock water and wildlife habitat.

The recommended work includes removal of vegetation from the dam embankment, leveling and re-grading of the dam crest, repair of the spillway, repair of the head gate, and placing riprap on the face of the dam. The exact work to be done will need additional study and design efforts; therefore no detailed cost estimates were prepared for this project. The work funded through the Small Water Program will be less than the $135,000 limit.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

Who is the owner of the project? T.C. Berry

Who owns the land that the project is to be built on? Berry Ranch LLC

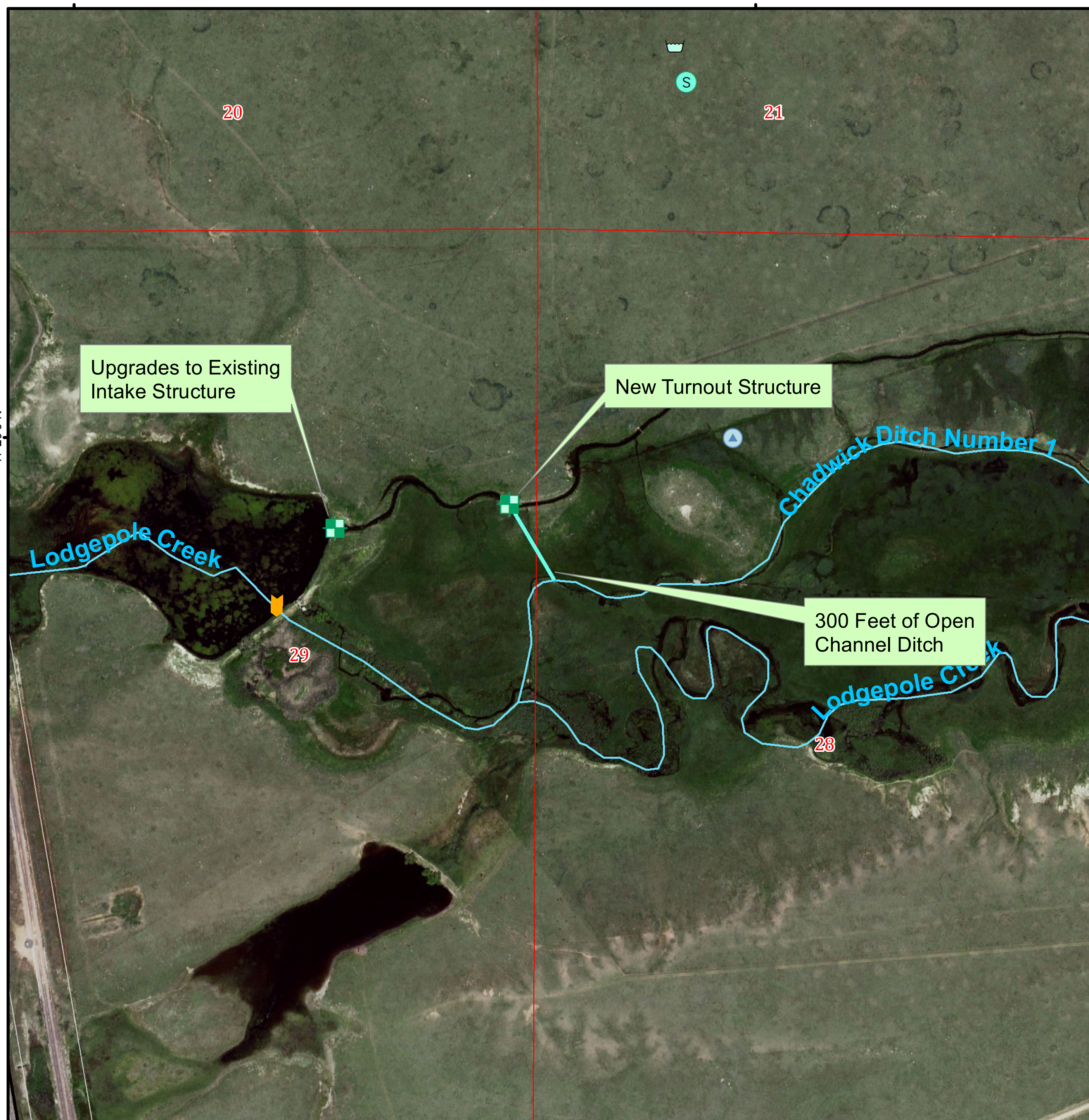
Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

Approximately 150 acres primarily in Section 27, 28, and 29 of irrigated grounds will benefit from the improved water sources.

What is the total estimated project cost? N/A – additional design work required to develop cost estimates for this project



Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- Township and Range
- PLSS Sections
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- AC Well with AC Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

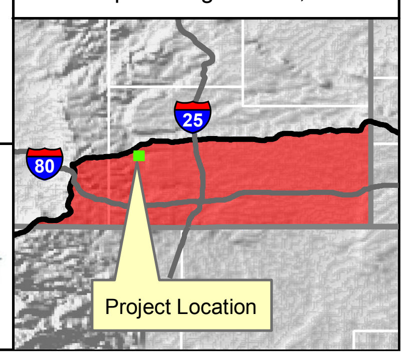
Feet
0 250 500

1 in = 500 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T16N, R69W



Project 16-69-29.2: Islay Ranch Chadwick No.1 Ditch Diversion

Document Name: Project_16_69_29.2
Date Saved: 9/15/2017

SPRWS PROJECT NUMBER: 16-69-29.2 Chadwick No. 1 Ditch Diversion Rehabilitation SE ¼ NE ¼ Sec. 29 T16N R69W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Islay Ranch Chadwick No. 1 Ditch Diversion/Headgate Structure

T.C. Berry (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well					
Solar Platforms					
Pipeline					
Tank					
Spring Development					
Wetland					
Environmental					
Irrigation	1	X		41.3310	105.1361
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	69W	29	SENE

Project Description:

The Chadwick No. 1 Ditch point of diversion is currently located on Lodge Pole Creek, approximately 1000’ below the Chadwick #3 Reservoir. Moving the point of diversion upstream to the existing Chadwick No. 3 Reservoir is recommended, because this effort would eliminate the need to repair and maintain a separate diversion structure in the creek. This project would include work on the Chadwick No. 3 Ditch so that it can convey the additional water to the Chadwick No. 1 Ditch, installing a new turnout structure, and construction of approximately 300 feet of new ditch between the No. 3 and No. 1 Ditches.

Material is pushed into the Lodgepole Creek during lowflows, so that the full water right can be diverted. The existing head gate consists of a slide gate mounted to a corrugated metal pipe which is currently in disrepair. During high flows in the creek, water goes around the intake and directly into the ditch, making it difficult to control and shut-off the water. Moving the point of diversion to the reservoir would reduce impacts to the stream and associated riparian area caused by current operation of the ditch and maintenance of the diversion dam and head gate.

This project will involve moving the point of diversion for the Chadwick No. 1 Ditch, which is a territorial water right to the existing Chadwick No. 3 Reservoir. Moving the point of diversion to the reservoir would reduce impacts to the stream and associated riparian area from routine maintenance operations.

Specifically, this project will include:

- Enlarging the Chadwick No. 3 Ditch.
- Permitting a new point of diversion.
- Installing a new turnout structure and approximately 300 feet of new open channel ditch.
- Upgrades to the existing Chadwick No.3 Ditch intake structure.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

Who is the owner of the project? T.C. Berry

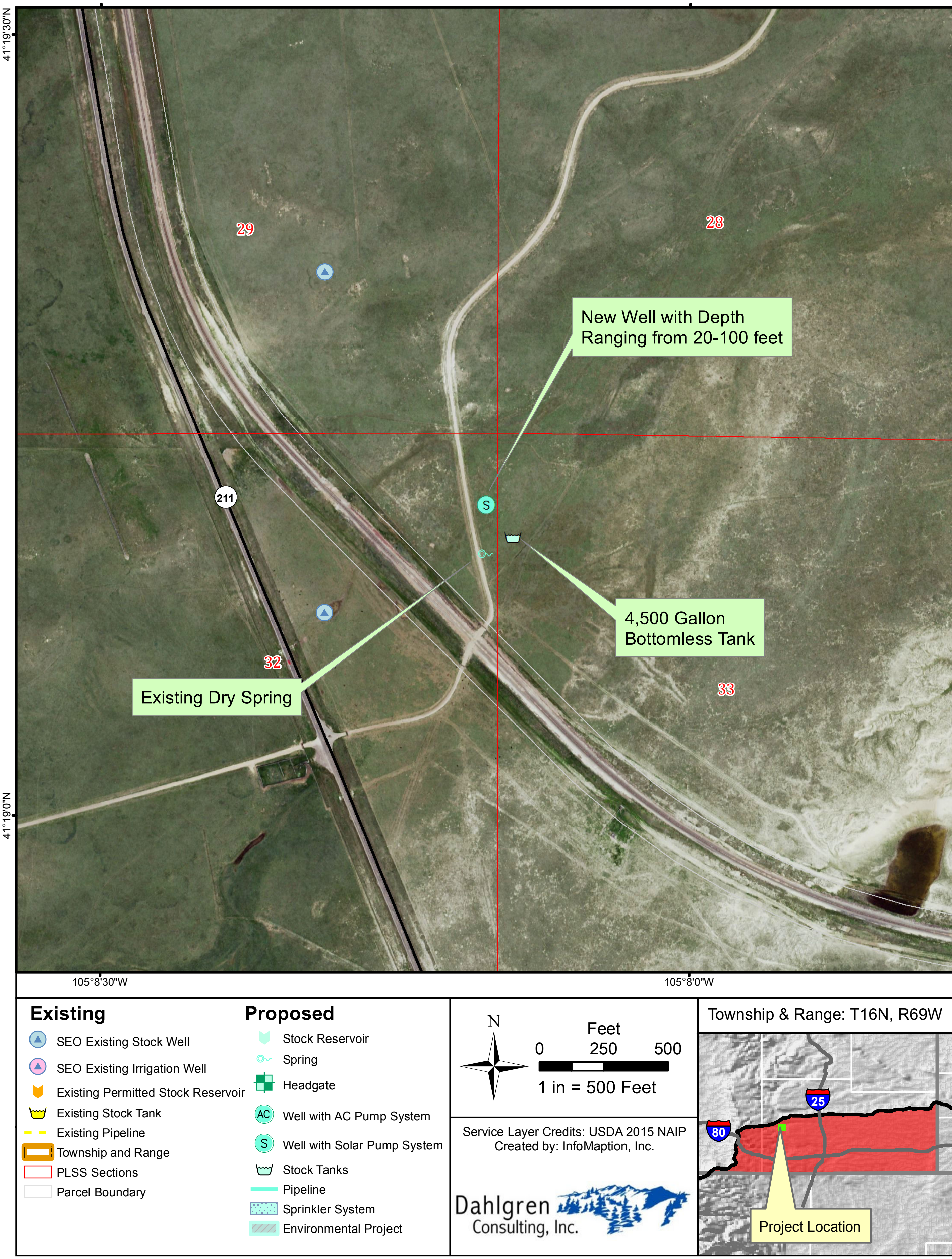
Who owns the land that the project is to be built on? Berry Ranch LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?
Approximately 150 acres in Section 27, 28, and 29 will have access to a reliable irrigation system.

What is the total estimated project cost? N/A



Project 16-69-32.1: Islay Ranch Road Pasture Spring Development

Document Name: Project_16_69_32.1
Date Saved: 9/18/2017

SPRWS PROJECT NUMBER: 16-69-32.1 Road Pasture Well

NE ¼ NE ¼ Sec. 32 T16N R69W

Site Visit Date: Nov. 3, 2016

PROJECT NAME: Islay Ranch Road Pasture Well

T.C. Berry (Applicant – Name of Entity)

C/o Jim Cochran Laramie County Conservation District (Contact)

11221 US Highway 30

Cheyenne, WY 82009 (307) 772-2600

Laramie (307) 772-2600 jcochran@lccdnet.org

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir					
Well	1	X		41.3191	105.1361
Solar Platforms	1	X		41.3191	105.1361
Pipeline					
Tank	1	X		41.3191	105.1361
Spring Development	1	X		41.3191	105.1361
Wetland					
Environmental					
Irrigation					
Windmill					

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
16N	69W	32	NENE

Project Description:

This project involves replacement of an existing spring with a new well and tank. This project is located in the NE quarter of Section 32 Township 16 North, Range 69 West. The spring has been dry in recent years. Replacing the spring with a well and solar pump and 4,500-gallon bottomless stock tank is recommended. This effort will provide a more reliable water source for this pasture.

Specifically, the project will include:

- Drilling of a new well. Existing stock wells adjacent to this section have well depths ranging 20-100 feet.
- A new solar pumping system, including panels, and solar pump.
- 4,500-gallon bottomless stock tank to be installed near the well.
- Miscellaneous valves and floats.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District (sponsor)

____

Who is the owner of the project? T.C. Berry

Who owns the land that the project is to be built on? Berry Ranch LLC

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project? ______________
Approximately 550 acres primarily in Section 28 and 33 will benefit from the improved water sources.

____

What is the total estimated project cost? $34,993.06

SPRWS Project Cost Estimate

SPRWS Project No. 16-69.32.1

Project Name Islay Ranch Road Pasture Spring Development

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 2,766.25	$ 2,766.25
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	100	$ 40.00	$ 4,000.00
3	Solar Pump System - less than 250' TDH	LS	1	$ 9,650.00	$ 9,650.00
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea	1	$ 12,000.00	$ 12,000.00
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea		$ 2,900.00	$ -
6	2" Class 200 HDPE pipeline installed at 4'	LF		$ 3.00	$ -
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$ 30,428.75
Contingency - 15%	$ 4,564.31
Budget for Project with Contingency	**$ 34,993.06**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Pipeline
- PLSS Sections
- Township and Range
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- E Well with Electric Pump System
- S Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

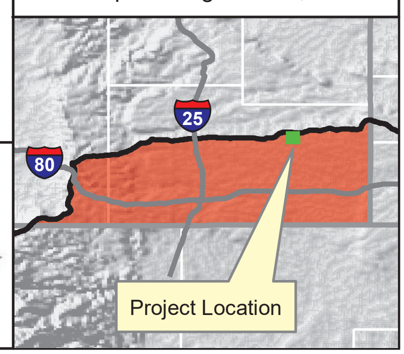
N

Feet
0 500 1,000
1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T17N, R63W



Project 17-63-27.1: Dale Anderson, New Stock Well and Tanks

Document Name: Anderson_17-63-27.1
Date Saved: 9/25/2017

SPRWS PROJECT NUMBER: 17-63-27.1
Stock Well and Stock Tank
Section 27, T17N, R63W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Dale Anderson Well and Solar Platform
Relocate and deepen the existing Anderson No. 3 Well, Permit No. UW 9289

Dale Anderson (Applicant – Name of Entity)

Dale Anderson (Contact)

4618 State Hwy 213 Burns, WY 82053

Laramie 307-640-3268 dhawyo@hotmail.com
(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		x	☐	41.4094N	104.4150W
Solar Platforms		x	☐	41.4094N	104.4150W
Pipeline		☐	☐		
Tank		x	☐	41.4094N	104.4150W
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation		☐	☐		
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
17N	63W	27	NE ¼ SW ¼

Project Description:

This project involves the construction of a new well and solar platform to replace the existing Anderson No. 3 Well, WY SEO permit No. UW 9289. The current pump is a windmill and the well has a low yield. A new well will be drilled and a solar pumping system and tanks will be installed.

Specifically, the project will include:

- Drilling of a new well near the location of the existing well. The well will be approximately 400' deep.
- A new solar pumping system, including panels, solar pump, and cistern.
- Three 10' diameter by 2' deep stock tanks or a 20' bottomless tank to be installed near the well.
- Miscellaneous valves and floats.

Public Benefit:

____

____

____

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Dale Anderson

Who owns the land that the project is to be built on? Dale Anderson

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project? All 640 acres in Section 27 will benefit from this project.

What is the total estimated project cost? $47,500

Photo shows the Existing Anderson No. 3 well with windmill and bottomless tank.

SPRWS Project Cost Estimate

SPRWS Project No. **17-63-27.1**

Project Name Anderson Stock well, solar pump and tanks

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 3,733.75	$ 3,733.75
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF	400	$ 40.00	$ 16,000.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS	1	$ 9,875.00	$ 9,875.00
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	2	$ 2,900.00	$ 5,800.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	500	$ 3.50	$ 1,750.00
7	Miscellaneous Valves and piping at tank(s)	Ea	3	$ 500.00	$ 1,500.00
8	3 Wire Fence with wood posts	LF	120	$ 5.00	$ 600.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF	300.00	$ 3.00	$ 900.00
10	Site Revegetation and reclamation	Acre	0.25	$ 1,250.00	$ 312.50

Sub-Total Estimated Component Costs	$	41,071.25
Contingency - 15%	$	6,160.69
Budget for Project with Contingency	**$**	**47,231.94**

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Irrigation Ditch
- Existing Pipeline
- PLSS Sections
- Township and Range
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with Electric Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

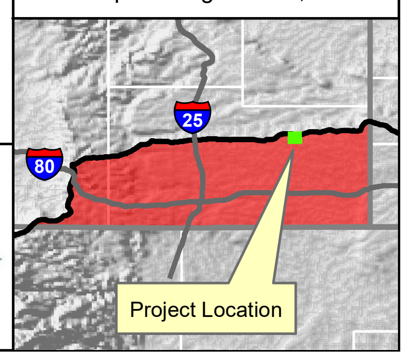
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T17N, R63W



Project 17-63-27.2: Dale Anderson, Contour Ditch Rehabilitation

Document Name: Anderson_17-63-27.2
Date Saved: 8/4/2017

SPRWS PROJECT NUMBER: 17-63-27.2

Contour Ditch Rehabilitation
NE ¼ Section 27, T17N, R63W
Site Visit Date: Nov. 3, 2016

PROJECT NAME: Dale Anderson Section 27 Contour Ditch Rehabilitation

Dale Anderson (Applicant – Name of Entity)

Dale Anderson (Contact)

4618 State Hwy 213 Burns, WY 82053

Laramie 307-640-3268 dhawyo@hotmail.com

(County) (Phone) (Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		☐	☐		
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation – Contour Ditch Rehabilitation		☐	X	41.418N	104.4132W
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
17N	63W	27	NE ¼

Project Description:

This project involves the rehabilitation of a contour ditch system located primarily in the NE ¼of Section 27, T17N, R63W. This ditch system starts at Highway 85 and flow generally east from the highway. These ditches divert water from Bushnell Creek. This project is in the mapped FEMA 100 year flood plain.

One 24” CMP culvert and one 36” CMP culvert conveys water beneath Highway 85 and the ditch system starts just below the culverts. This project will involve cleaning and minor re-grading of the ditches. This work will be done with a track hoe, backhoe, small cat or grader, and compactor.

Public Benefit:

Project Participants:
Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Dale Anderson

Who owns the land that the project is to be built on? Dale Anderson

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project?
This project provide "passive" irrigation of approximately 40 acres in the NW ¼ of Section 28. In addition, the project could provide flood control and groundwater recharge benefits.

What is the total estimated project cost? This project will be a time and materials type project where the contractor will be paid by the hour for equipment and an operator. The project estimated to take approximately 40 hours to clean and re-grade the ditches. The total project cost will be $6000 - $8000.

Photographs:
Location: NE ¼ Section 27 T17N R63W

Photo is taken from Highway 85 looking generally south east. The photo shows Bushnell Draw and the diversion dam for the contour ditches.

Photo shows the lower end of contour ditch. Looking generally north west.

Existing

- SEO Existing Stock Well
- SEO Existing Irrigation Well
- Existing Permitted Stock Reservoir
- Existing Stock Tank
- Existing Irrigation Ditch
- Existing Pipeline
- PLSS Sections
- Township and Range
- Parcel Boundary

Proposed

- Stock Reservoir
- Spring
- Headgate
- Well with Electric Pump System
- Well with Solar Pump System
- Stock Tanks
- Pipeline
- Sprinkler System
- Environmental Project

N

Feet

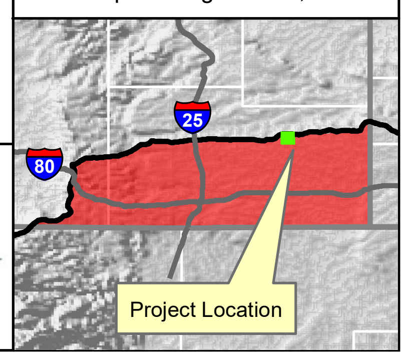
0 500 1,000

1 in = 1,000 Feet

Service Layer Credits: USDA 2015 NAIP
Created by: InfoMaption, Inc.

Dahlgren Consulting, Inc.

Township & Range: T17N, R63W



Project 17-63-28.1: Dale Anderson, Contour Ditch Rehabilitation

Document Name: Anderson_17-63-28.1
Date Saved: 8/4/2017

SPRWS PROJECT NUMBER: 17-63-28.1

Contour Ditch Rehabilitation

Section 28, T17N, R63W

Site Visit Date: Nov. 3, 2016

PROJECT NAME: Dale Anderson Section 28 Contour Ditch Rehabilitation

Dale Anderson (Applicant – Name of Entity)

Dale Anderson (Contact)

4618 State Hwy 213 Burns, WY 82053

Laramie	307-640-3268	dhawyo@hotmail.com
(County)	(Phone)	(Email)

Type*	Quantity	New Development	Rehabilitation	Latitude (Required)	Longitude (Required)
Small Reservoir		☐	☐		
Well		☐	☐		
Solar Platforms		☐	☐		
Pipeline		☐	☐		
Tank		☐	☐		
Spring Development		☐	☐		
Wetland		☐	☐		
Environmental		☐	☐		
Irrigation – North Ditch		☐	x	41.4186N	104.4407W
Irrigation – South Ditch			x	41.4149N	104.4407W
Windmill		☐	☐		

* The project types listed in the above table will be considered eligible as defined by the Small Water Projects Program Criteria. Environmental projects are defined as those that provide for stream bank stability, water quality improvements, or erosion protection.

Legal Description

Township	Range	Section	Quarter-Quarter
17N	63W	28	NW ¼

Project Description:

This project involves the rehabilitation of a series of contour ditches located in the NW ¼of Section 28, T17N, R63W. There are two related ditch systems – one to the north and one to the south. Both ditch systems start at County Road 144 and flow east from the road. These ditches divert water from Bushnell Creek. This project is just upstream of the FEMA 100 year flood plain.

24” CMP culverts convey water beneath County Road 144 and the ditches start just below the culverts. This project will involve cleaning and minor re-grading of the ditches. This work will be done with a track hoe, backhoe, small cat or grader, and compactor.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District

Who is the owner of the project? Dale Anderson

Who owns the land that the project is to be built on? Dale Anderson

Which WWDC Watershed Study Boundary is this project within?
South Platte River Watershed

How many acres will be benefited by this project?
This project provide “passive” irrigation of approximately 40 acres in the NW ¼ of Section 28. In addition, the project could provide flood control and groundwater recharge benefits.

What is the total estimated project cost? This project will be a time and materials type project and the contractor will be paid for the equipment and operator. The project estimated to take approximately 60 hours. The total project cost will be $9000 - $12,000.

Photographs:
Location: NW ¼ Section 28 T17N R63W

Photo shows Bushnell Draw looking generally south.

Photo shows the contour ditch. Looking generally north east with County Rd 144 visible in the photo.

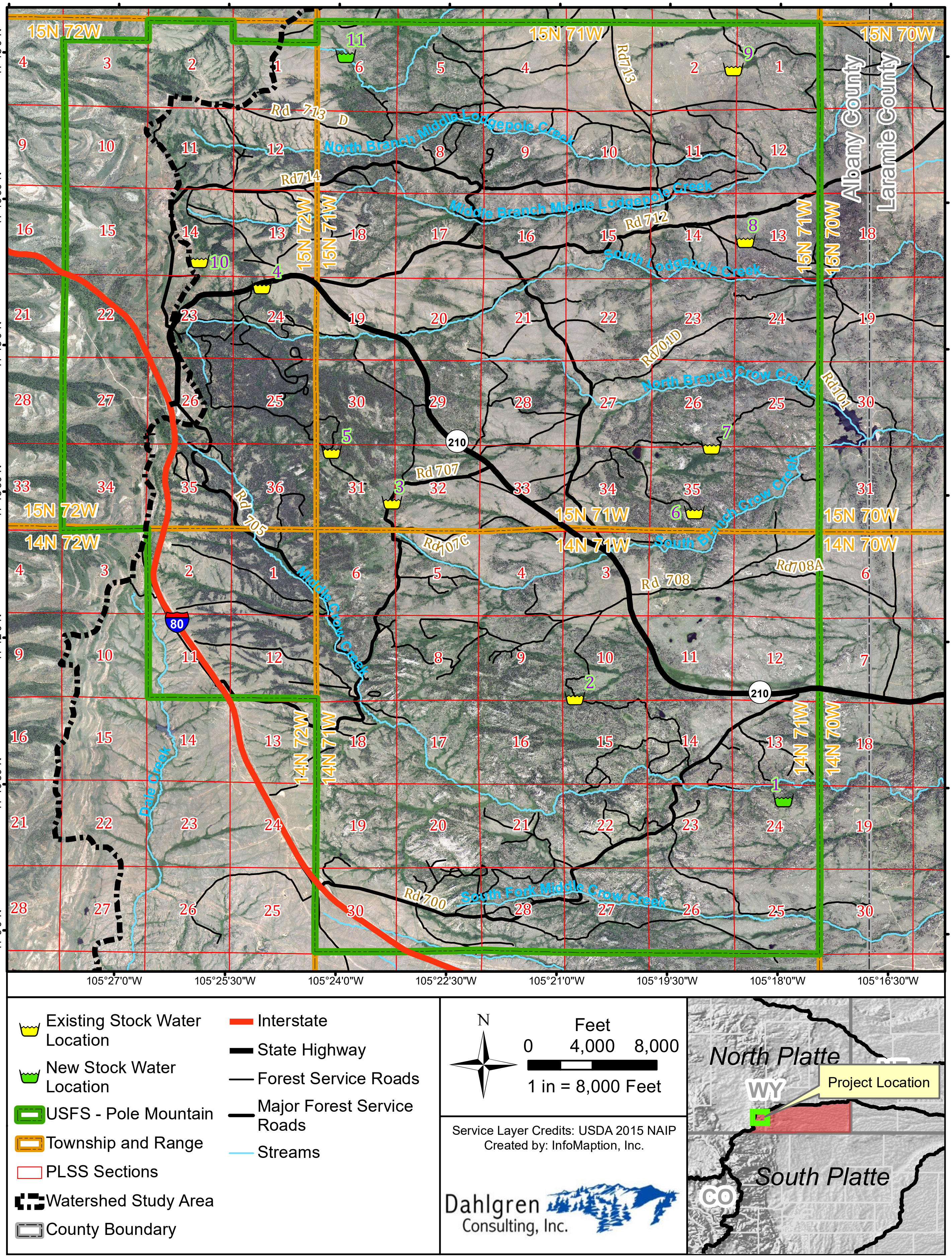


Figure 5.2 USFS Pole Mountain Stock Water Locations

Document Name: USFS_PoleMtn_StockWater Fig 5.2
Date Saved: 10/16/2017

SPRWS PROJECT NUMBER: USFS Stock Water projects

Spring Developments and Stock Tanks
11 Projects within the Pole Mountain Area

PROJECT NAME: USFS Stock Water projects – Pole Mountain Area

Medicine Bow National Forest (Applicant – Name of Entity)

Jackie Roaque (Contact)

2468 Jackson Street

Laramie, WY 82070

Albany 307-745-2300 jroaque@FS.Fed.us

(County) (Phone) (Email)

The USFS has 11 stock water projects in the South Platte River Watershed. Nine of the projects involve rehabilitation of existing facilities and two projects involve construction of new facilities. Each facility will involve development (or redevelopment of a spring), installation of a spring box, a short pipeline, and installation of a stock tank (or tanks). The approximate locations of the projects are listed in the following table and are shown on Figure 5.2 of this report.

Map No.	New or Rehab	Location (Sec, Township, Range)	Lat	Long
1	New	Sec 24, T14N, R71W	41.1728N	105.2987W
2	Rehab	Sec 15, T14N, R71W	41.1900N	105.3460W
3	Rehab	Sec 31, T15N, R71W	41.2234N	105.3876W
4	Rehab	Sec 24, T15N, R72W	41.2600N	105.4174W
5	Rehab	Sec 31, T15N, R71W	41.2320N	105.4013W
6	Rehab	Sec 35, T15N, R71W	41.2219N	105.3192W
7	Rehab	Sec 35, T15N, R71W	41.2330N	105.3154W
8	Rehab	Sec 13, T15N, R71W	41.2685N	105.3043W
9	Rehab	Sec 2, T15N, R71W	41.2977N	105.3107W
10	Rehab	Sec 14, T15N, R72/W	41.2645N	105.4316W
11	New	Sec 6, T15N, R71W	41.3000N	105.3986W

Project Description:

Conceptually, each of the USFS Stock water projects will involve developing a spring, a short pipeline, and installation of a tank. A fence will be installed around each of the springs. The exact details of each project will be determined during final design of the project and prior to submittal of an application for it. For cost estimating purposes, the following work was assumed for each project:

- A spring development with perforated pipe, gravel, and spring box.
- 400’ of 2” pipe downhill (east) from the spring box to the tanks.
- A new 10’ diameter tire tank with miscellaneous valves.
- 400’ of fence with a gate around the spring would be constructed.

Public Benefit:

Project Participants:

Please list all project participants (District, NRCS, WWNRT, BLM, Landowner, etc.), and their type of participation (Technical, Financial, project oversight, etc.).

Laramie County Conservation District, USFS

Who is the owner of the project? US Forest Service

Who owns the land that the project is to be built on? US Forest Service

Which WWDC Watershed Study Boundary is this project within?

South Platte River Watershed

How many acres will be benefited by this project?

What is the total estimated project cost? The preliminary cost estimate for each project is $15,500. Final designs and updated costs estimates will be submitted with each of the final project applications.

Photographs:

Photo shows the remains of the existing tank and spring at Site No. 4, located in Sec 24, T15N, R72W. The project at this site would include a new spring development, pipeline, stock tank, miscellaneous valves and fencing.

This photo shows the spring and remains of the existing fence at Site No. 8, located in Sec 13, T15N, R71W. This photo is taken looking upstream or generally west. The pipeline will run from the spring in the fenced around toward the bottom of the photo to a new tank, which will be located behind this view.

This photo shows the remains of the spring box and fence at Site 8. Arrow points to the existing spring box. This photo is looking generally east or downstream. The tank site is toward the east of in the back ground of this photo.

SPRWS Project Cost Estimate

SPRWS Project No. **USFS Pole Mountain Area Stock water projects**

Project Name USFS Stock Water Projects - Typical Costs

Bid Item	Description	Unit	Quantity	Unit Price	Item Total
1	Mobilization - Assume 10% of other costs	LS	1	$ 1,222.50	$ 1,222.50
2	Well - Drill, Case, and Develop Stock Well. Assume 10" borehole and 5" SDR-17 PVC Casing	LF		$ 40.00	$ -
2a	Spring Development	LS	1	$ 3,800.00	$ 3,800.00
3	Solar Pump System - less than 250' TDH	LS		$ 9,650.00	$ -
3a	Solar Pump System - 250 - 400' TDH	LS		$ 9,875.00	$ -
3b	Solar Pump System > 400' TDH	LS		$ 14,500.00	$ -
4a	1 HP Single Phase Electric Submersible pump set at 320'	LS		$ 2,500.00	$ -
4b	Electrical work for well	LS		$ 3,500.00	$ -
4c	Powerline extension	MI		$ 20,000.00	$ -
5a	1100 gallon 10' diameter by 2' deep galvanized Stock Tank	Ea		$ 1,200.00	$ -
5b	4500 gallon 20' diameter by 2' deep bottomless tank	Ea		$ 12,000.00	$ -
5c	800 gallon 8' diameter tire tank	Ea		$ 2,360.00	
5d	1100 gallon 10' diameter tire tank	Ea	1	$ 2,900.00	$ 2,900.00
6	2" Class 200 HDPE pipeline installed at 4'	LF	400	$ 4.50	$ 1,800.00
7	Miscellaneous Valves and piping at tank(s)	Ea	1	$ 500.00	$ 500.00
8	3 Wire Fence with wood posts	LF	400	$ 5.00	$ 2,000.00
8a	12' Wire Gate	LS	1	$ 600.00	$ 600.00
9	Plug and Abandon existing well	LF		$ 3.00	$ -
10	Site Revegetation and reclamation	Acre	0.50	$ 1,250.00	$ 625.00

Sub-Total Estimated Component Costs	$	13,447.50
Contingency - 15%	$	2,017.13
Budget for Project with Contingency	**$**	**15,464.63**