BLM

UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Land Management

Pine Valley Water Supply Project

Draft Environmental Impact Statement

DOI-BLM-UT-C010-2020-0012-EIS

January 2022

Location:
Beaver County and Iron County, Utah

Applicant:
Central Iron Water Conservancy District
88 East Fiddlers Canyon Road, #220
Cedar City, Utah 84721

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BUREAU OF LAND MANAGEMENT
Color Country District Office
176 East DL Sargent Drive
Cedar City, UT 84721

In Reply Refer To:
DOI-BLM-UT-C010-2020-0012-EIS

Dear Reader:

Attached for your review and comment is the Draft Environmental Impact Statement (Draft EIS) for the Pine Valley Water Supply Project (Project). The Bureau of Land Management (BLM) prepared this document in consultation with cooperating agencies and in accordance with the National Environmental Policy Act of 1969, as amended; the Federal Land Policy and Management Act of 1976, as amended; implementing regulations, the BLM's Land Use Planning Handbook (H-1601-1), and other applicable laws and policies.

The Central Iron County Water Conservancy District (CICWCD) applied for a right-of-way (ROW) across BLM Cedar City Field Office-administered lands in Iron and Beaver counties, Utah. The proposed Project would consist of the construction, operation, maintenance, and termination of groundwater wells, water pipelines, and appurtenant facilities, some of which would be constructed on BLM-administered lands. The applicant's objectives for the Project are to put water rights owned by the CICWCD within Pine Valley to beneficial use through extraction and transportation of groundwater to their customers. A temporary ROW grant has also been requested to accommodate construction of the facilities. Operation, maintenance, and termination of the facilities would be issued under a long-term ROW grant.

In coordination with the CICWCD and U.S. Geological Survey and in consideration of the issues raised during public scoping, the BLM developed two action alternatives and a No Action Alternative that are evaluated in the Draft EIS. These alternatives are described in Chapter 2 of the Draft EIS.

The BLM encourages the public to provide information and comments pertaining to the analysis presented in the Draft EIS. We are particularly interested in feedback concerning the adequacy and accuracy of the proposed alternatives, the analysis of their respective environmental impacts, and any new information that would help the BLM in its management decision. As a member of the public, your timely comments on the Draft EIS will help formulate the Final EIS. Comments will be accepted for 45 calendar days following the Environmental Protection Agency's publication of its Notice of Availability in the *Federal Register*. The BLM can best utilize your comments and resource information submissions if received within the review period.

Comments may be submitted by emailing to pvwsproject@gmail.com.

Comments may also be submitted by mail to:

Attn: Pine Valley Water Supply Project Draft EIS
Bureau of Land Management
Cedar City Field Office
176 East DL Sargent Drive
Cedar City, UT 84721

To facilitate analysis of comments and information submitted, we strongly encourage you to submit comments in an electronic format.

Your review and comments on the content of this document are critical to the success of this effort. If you wish to submit comments on the Draft EIS, we request that you make your comments as specific as possible. Comments will be more helpful if they include suggested changes, sources, or methodologies and reference a section or page number. Comments containing only opinion or preferences will be considered and included as part of the decision-making process, although they will not receive a formal response from the BLM.

Before including your address, phone number, email address, or other personal identifying information in your comment, be advised that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

The documents are available for review on the BLM ePlanning website at https://eplanning.blm.gov/eplanning-ui/project/1503915/510. Information about public meetings and other public involvement opportunities will be posted at least 15 days in advance on the ePlanning website.

If you do not have digital access to the documents and would like to request to view a copy, please call the Cedar City Field Office for more information at 435-865-3000, Monday through Friday, except holidays.

Thank you for your continued interest in the Pine Valley Water Supply Project. We appreciate the information and suggestions you contribute to the process. For additional information or clarification regarding this document or the process, please contact Brooklynn Cox, realty specialist, at 435-865-3000 or e-mail bcox@blm.gov.

Sincerely,

Gloria Tibbetts
District Manager

EXECUTIVE SUMMARY

Introduction

The Central Iron County Water Conservancy District (CICWCD) has applied for two right-of-way (ROW) grants from the Bureau of Land Management (BLM) to construct, operate, maintain, and decommission groundwater production wells within Pine Valley, a transportation pipeline to convey the water to the existing CICWCD water system in Iron County, and appurtenant Project facilities, including storage tanks, a solar field (private land), and power transmission lines. These proposed developments are collectively known as the Pine Valley Water Supply Project (PVWS Project). One temporary ROW grant would be issued for Project construction and the other ROW grant would be issued for long-term operation, maintenance, and decommissioning.

The BLM is considering two action alternatives and a No Action Alternative as part of this Draft Environmental Impact Statement (Draft EIS) in response to the CICWCD application. Through the National Environmental Policy Act (NEPA) of 1969 process, the BLM is evaluating the potential impacts of all PVWS Project alternatives.

Background and Applicant Interest and Objectives

The CICWCD's objective in applying for the ROW grant is to develop and convey acquired and permitted water rights issued by the State of Utah (Water Right 14-118) to supply water to Iron County users that existing aquifers in Cedar Valley cannot provide in perpetuity. The CICWCD applied for the water rights in 2006, with the final settlement completed in 2019.

The need for additional water arises from the lack of sufficient existing water resources within the overdrawn Cedar Valley basin to respond to growing population needs and the gradual implementation of a groundwater management plan that will affect the CICWCD's ability to extract groundwater from the basin. The Cedar Valley basin is currently overdrawn, and the Utah state engineer has adopted a groundwater management plan that will slowly rescind water rights until the basin is back within safe yield estimates. Based on an analysis of the Cedar Valley basin demand and projected savings from conservation efforts by the CICWCD, conservation alone cannot overcome the current Cedar Valley basin deficit.

Agency Purpose and Need for the Federal Action

The purpose of the federal action is to respond to the ROW application for the proposed PVWS Project. The need for the federal action is established by the BLM's responsibility to respond to a ROW application under the Federal Land Policy and Management Act (FLPMA) of 1976 (43 U.S.C. 1701), as amended, and the ROW regulations contained in 43 Code of Federal Regulations (CFR) 2800 Title V. The FLPMA provides the BLM discretionary authority to grant ROWs on public lands with consideration of potential impacts on natural and cultural resources.

The BLM will decide whether to authorize, authorize with modifications, or deny the issuance of the ROW grants to the CICWCD. In doing so, the BLM will incorporate all practicable means to avoid or minimize environmental harm through appropriate mitigation measures (40 [CFR] 1505.2(c)).

Issues and Areas of Controversy

The BLM has identified issues to be addressed in the Draft EIS through public and internal scoping and through outreach to cooperating agencies and Native American Tribes. Comments were documented, reviewed, and organized into issue categories, which were either analyzed in the Draft EIS or were beyond the scope of the Draft EIS and therefore, not analyzed in the document. When deciding which issues to address in detail, the following criteria from the BLM NEPA Handbook (H-1790-1) were utilized:

- Analysis of the issue is necessary to make a reasoned choice between alternatives. That is, does it relate to how the Proposed Action or alternatives respond to the purpose and need?
- The issue is significant or where analysis is necessary to determine the significance of impacts.

Issues and resource impacts that did not meet these criteria were addressed in the NEPA checklist (**Appendix B**). Issues addressed in either the checklist or the body of the Draft EIS are listed in Chapter 1.

The primary issues and resources of concern based on scoping feedback centered on water, special status wildlife, rangeland use, and vegetation. A total of 175 of the 436 individually categorized comments within the 98 comment documents received pertained to water resources.

The ongoing groundwater withdrawal proposed under either action alternative is a central issue to the PVWS Project. Therefore, the BLM enlisted the U.S. Geological Survey (USGS) as a cooperating agency to assist in the development and review of a groundwater model as a means of estimating predicted groundwater impacts over time.

Summary Comparison of Alternatives

The BLM has developed two action alternatives for analysis in addition to the No Action Alternative. Several other alternatives were considered based on scoping comments; however, these were not carried forward and analyzed in detail as they either did not meet the Project purpose and need or have technical feasibility challenges. These are discussed in Chapter 2 of the Draft EIS. A summary the comparison of the alternatives is included in **Table 10** of the Draft EIS.

Alternative 1—No Action Alternative

Under the No Action Alternative, the BLM would deny the CICWCD's application for a ROW across BLM-administered lands. The CICWCD would be unable to put their acquired water rights to beneficial use and would need to pursue other means of acquiring additional water supply to meet future customer needs within the Cedar Valley basin.

Alternative 2—Proposed Action

The BLM would approve the CICWCD's application for a ROW across BLM-administered lands based on the original CICWCD proposal. This includes a total of 15 production wells within Pine Valley, 10 of which would be located on BLM-administered lands; 70 miles of lateral pipeline and main pipeline; a 200-acre solar field; 11.7 miles of power transmission lines; 6.1 miles of access roads; and a 10-million-gallon water storage tank site. These proposed facilities are described in Chapter 2 of the Draft EIS.

Alternative 3—Adaptive Northern Well Sites Alternative

The BLM would approve an alternative well layout from the CICWCD's application to address the uncertainty surrounding the potential groundwater impacts to the northern Beryl-Enterprise hydrologic area. Under this alternative, the well field layout would be determined by the initial pumping data. A total of six production wells would be initially sited, and the remainder would be sited later based on a comparison of the initial drawdown data to the PVWS Project groundwater model. A total of 9 alternative well sites have been identified, and this alternative would require up to 7.3 additional miles of pipeline. A total of 15 production wells would still be developed; only the well siting would change. This alternative would use the same main pipeline alignment, solar field site, and storage tank site as the Proposed Action.

Summary of Coordination and Consultation

The scoping period began with the publication of the Notice of Intent in the *Federal Register* on July 15, 2020, and the scoping period closed on August 19, 2020. A public scoping meeting was held virtually via Zoom on August 5, 2020. Approximately 40 attendees participated in the meeting presentation and question-and-answer period. A total of 98 comment documents were received during the scoping period and were broken into 436 individual substantive comments.

The following federal and state agencies contributed to the development of this EIS: the USGS, the U.S. Fish and Wildlife Service (USFWS), Utah's Public Lands Policy Coordinating Office, the Utah State Historic Preservation Office (SHPO), and the Utah School and Institutional Trust Lands Administration. Local cooperating agencies include Enoch City, Iron County, Beaver County, Millard County, White Pine County, and the Nevada Department of Wildlife. The USGS participated heavily in the inter-agency groundwater resources technical team throughout the NEPA process.

Section 7(a)(2) of the Endangered Species Act (ESA) requires that each federal agency ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. The BLM consulted with the USFWS after the preparation of a PVWS Project Biological Assessment (available on ePlanning) that analyzed potential effects of the Project on Utah prairie dog. The USFWS concurred with a Not Likely to Adversely Affect determination for Utah prairie dog.

The potential issuance of a ROW by the BLM is a federal undertaking and therefore, is subject to Section 106 of the National Historic Preservation Act (NHPA). A Class III cultural resources inventory was conducted for the PVWS Project, and the findings were submitted to the SHPO. The SHPO responded with letters concurring with the determinations of site eligibility and the finding of No Adverse Effect for the action alternatives.

Tribal Consultation

Federal law requires the BLM and USFWS to consult with American Indian Tribes during the planning and NEPA process. Fifteen Tribes or Bands were sent letters inviting them to participate in government-to-government consultation. The Hopi Cultural Preservation Office and the Navajo Nation Heritage and Historic Preservation Department replied to the scoping letter with no concerns and without further consultation requested. The Paiute Indian Tribe of Utah initially stated in writing that they had no objections to the Project moving forward but later stated opposition to the Project. Details of the consultation process are contained in Chapter 4 of the Draft EIS.

Distribution of the Draft Environmental Impact Statement

An administrative Draft EIS was prepared by the BLM and distributed to cooperating agencies for review in January 2021. The BLM made changes to the Draft EIS in response to comments received from the cooperating agencies. The BLM has prepared the Draft EIS for public comment and is publishing a Notice of Availability in the *Federal Register*. The Draft EIS will be available for public review and comment for a period of 45 days.

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LIST OF ASSOCIATED PROJECT PLANNING DOCUMENTS

Acoustic Bat Survey Report

Biological Assessment

Greater Sage-Grouse Net Conservation Gain Analysis

Groundwater Resources Impact Assessment

Habitat Suitability Modeling for Kit Fox Report

Habitat Suitability Modeling for Pygmy Rabbit Report

Springsnail Survey Report

Scoping Report

These documents can be found on the Bureau of Land Management's ePlanning site: https://eplanning.blm.gov/eplanning-ui/project/1503915/510

CHAPTER 1 INTRODUCTION

1.1 Overview

The Central Iron County Water Conservancy District (CICWCD) is responsible for supplying water for municipal and other water uses within its service area boundaries, which consist of the Cedar Valley, located in the central part of Iron County, Utah, and the communities of Cedar City, Enoch, and Kanarraville. Decades of groundwater extraction within the Cedar Valley basin have resulted in storage decline. The ongoing groundwater deficit is currently estimated at 7,000 acre-feet per year (afy) (UTDNR 2020). To meet both growing demand and the current deficit, the CICWCD obtained Water Rights 14-118 (A76676) in Pine Valley, located in adjoining western Beaver County, Utah. The CICWCD's decision to obtain Pine Valley water rights was made after exploring several options for minimizing water usage or sourcing additional water (see Chapter 2). The CICWCD has applied for two right-of-way (ROW) grants from the Bureau of Land Management (BLM) to develop production wells within Pine Valley under these water rights and to transport the water into the existing CICWCD water system in Iron County. One ROW grant would be a 30-year grant for the operation and maintenance of the facilities; the second would be a temporary construction ROW.

The CICWCD's proposed Pine Valley Water Supply Project (PVWS Project) would consist of the construction, operation, maintenance, and termination of production wells, monitoring wells, main and lateral water pipelines and related appurtenances, pumping facilities, well houses, a storage tank site, a solar power generation facility, power transmission lines, staging areas, and a water storage facility at the terminus of the pipeline. Operation and maintenance of all facilities would be issued under the long-term ROW grant. The temporary ROW grant would be for additional space during construction. The monitoring wells were previously permitted and installed under BLM ROW grant UTU-91292. Most of the production wells, all monitoring wells, and large portions of the proposed pipeline would be located on BLM-administered land. Other appurtenant facilities are proposed on both private, state, and BLM-administered lands. The proposed Project is in west-central Iron County and southwestern Beaver County, Utah (**Appendix A, Figure 1**). The BLM is the lead agency for the preparation of this Draft Environmental Impact Statement (Draft EIS).

1.2 Applicant's Objectives

The CICWCD's objective in applying for the ROW grant is to develop and convey acquired and permitted water rights in Pine Valley to supply water to Iron County users that existing aquifers in Cedar Valley cannot provide in perpetuity. The CICWCD applied to the State of Utah for the water rights in 2006, with final settlement completed in 2019.

The need for additional water arises from the lack of sufficient existing water resources within the overdrawn Cedar Valley basin to respond to growing population needs and the gradual implementation of the Cedar City Valley groundwater management plan (GMP), adopted in January 2021, that will affect the CICWCD's ability to extract groundwater from the basin (Ensign 2018). Most consumptive water use within the CICWCD service area consists of irrigation and municipal demands, and water conservation strategies focus on reducing these uses. The CICWCD delivers an average of 262 gallons per capita per day, which exceeds the state average by 9 percent. Water consumption in the Cedar Valley has been reduced by 18 percent since 1995 (CICWCD

2020a). The Utah Department of Natural Resources has proposed per capita municipal water reduction targets under their conservation plan "Utah's Regional M&I Water Conservation Goals 2019." A 19-percent usage reduction is proposed by the year 2030, increasing to a total reduction of 28 percent from baseline by 2070 (Carollo 2020). Based on an analysis of the Cedar Valley demand and projected savings from conservation efforts to meet or exceed these targets, conservation alone cannot overcome the current Cedar Valley deficit (CICWCD 2020b). During the period from 2020 to 2030, none of the Cedar City or CICWCD water rights would be rescinded (Carollo 2020).

1.2.1 CICWCD Conservation Programs

The CICWCD provides its customers with a variety of programs and information regarding conservation, including the Low Energy Precision Agriculture/Low Elevation Sprinkler Application (LEPA/LESA) Program, new development ordinance, free water checks, WaterSense rebate program, and programs that focus on informing citizens on landscape practices and water conservation.

The LEPA/LESA Program addresses agricultural water conservation. These technologies retrofit center-pivot sprinkler system application by doubling the number of sprinklers per pivot and applying water much closer to the ground. This results in a reduction in evaporation losses and reduces pump power consumption. As of 2019, the CICWCD has upgraded approximately 25 percent of the agricultural irrigation land in the Cedar Valley (CICWCD 2020b).

The CICWCD has also established a water right exchange rate that promotes water conservation efforts by new development. Developers can reduce the amount of water rights per household if they include in the subdivision covenants, conditions, and restrictions limits on turf size and greenspace per household to a specified square foot amount. The CICWCD also passed a conservation rate structure that incentivizes conservation using a tiered rate system (CICWCD 2020a).

Municipal conservation efforts focus on helping residents reduce their water consumption through a variety of means. The free water checks offered by the CICWCD evaluates each client's irrigation systems and their turf and are used to schedule and maintain the correct watering requirements. The WaterSense rebate program reimburses residents with up to 50 percent of the cost of an eligible WaterSense smart controller that adapts the watering schedule based on the weather and landscape needs. An estimated 8,800 gallons per household could be saved by replacing standard controllers (CICWCD 2020b). The CICWCD also proposes promoting xeriscaping or localscaping for landscapes, open spaces, and yards (CICWCD 2020a).

The CICWCD has also developed several recharge basins as part of aquifer recharge efforts, which were approved by the state engineer in 2016 (CICWCD 2020c). These projects will be implemented under all alternatives (CICWCD 2020d). In addition to the CICWCD conservation programs, Cedar City limits turf watering using culinary water to the time between 6:00 PM and 8:00 AM by city ordinance.

A turf rebate program has been considered by the CICWCD but has not yet been pursued as an option for reducing consumption. Turf rebates generally do not cover the entire cost for turf conversion, and the size of the rebate (cost per square foot of turf) is what generally incentivizes homeowners to pursue turf removal (UTDNR 2019). A high rebate will therefore have a much greater impact on water savings, but it comes at a much higher cost to water suppliers. If the CICWCD offered a rebate of $3 per square foot of turf removal, a high enough incentive so that a larger number of homeowners would convert turf to less water-intensive landscape, this would come at a cost of approximately $56,800 per acre-foot of annual water savings (UTDNR 2019). For comparison, the cost of development for each acre-foot of annual water supply under the PVWS Project is approximately $17,400 (Carollo 2020).

After studying several potential alternative water sources, the CICWCD determined that the proposed PVWS Project would provide the necessary water at the least cost and least environmental impact (Ensign 2018). Other proposed projects for providing additional water are discussed in Section 2.2.5 *Alternatives Considered but Eliminated from Detailed Study*.

1.3 Purpose and Need for the Federal Action

The purpose of the federal action is to respond to the ROW application for the proposed PVWS Project. The need for the federal action is established by the BLM's responsibility to respond to a ROW application under the Federal Land Policy and Management Act (FLPMA) of 1976 (43 U.S.C. 1701), as amended, and the ROW regulations contained in 43 Code of Federal Regulations (CFR) 2800 Title V. The FLPMA provides BLM discretionary authority to grant ROWs on public lands with consideration of potential impacts on natural and cultural resources.

The BLM will decide whether to authorize, authorize with modifications, or deny issuance of the ROW grants to the CICWCD. In doing so, the BLM will incorporate all practicable means to avoid or minimize environmental harm through appropriate mitigation measures (40 [CFR] 1505.2(c)).

1.4 Conformance with BLM Resource Management Plans

The proposed Project would be primarily located on lands managed by the BLM Cedar City Field Office (CCFO). Authorized activities on BLM-administered public lands are directed by land use plans that establish goals and objectives for the management of resources that would be affected by implementation of a given activity. The relevant management plans for this Proposed Action are as follows:

- Cedar/Beaver/Garfield/Antimony Resource Area Resource Management Plan (RMP) (BLM 1986), as amended
- Pinyon Management Framework Plan (MFP) (BLM 1983), as amended

The implementation of the proposed PVWS Project would be in conformance with both management plans. Decision 3.1 in the Cedar Beaver Garfield Antimony RMP provides that applications for use authorizations, such as ROWs, leases, and permits, be processed on a case-by-case basis. Additionally, Plan Objective II.A states, "The objectives of the lands program are to provide more effective public land management and to improve land use, productivity, and utility through: a) accommodation of community expansion and economic development needs, b) improved land ownership patterns, and c) providing for the authorization of legitimate uses of public lands by processing use authorizations such as ROWs, leases, permits, and state land selections in response to demonstrated public need."

The Pinyon MFP Lands Objective L-2 directs that BLM make sufficient public lands in the planning unit available for ROW purposes in designated corridors or sites. The lands management recommendations do not require utility systems to use designated corridors. Mitigation of conflicts with range improvements can be handled on a case-by-case basis. Based on a review of the Pinyon MFP, there are no observed conflicts between the Project and the land use or other resource management objectives outlined in the plan.

Portions of the proposed PVWS Project are within greater sage-grouse (GRSG) priority habitat management areas (PHMAs) as detailed in the 2015 Utah GRSG Approved RMP Amendment (2015 ARMPA) and Record of Decision (BLM 2015). The PVWS Project must comply with the applicable plan objectives and management decisions, including but not limited to Objective SSS-2, MA-SSS-3, MA-SSS-6, MA-LR-1, and MA-LR-2. Objective SSS-2 of the 2015 ARMPA requires that the BLM manage activities that result in habitat loss or degradation to provide a net conservation gain of GRSG habitat. The PVWS Project approach, which is in compliance with the 2015 ARMPA and includes applicant-committed design features to enhance GRSG habitat, is discussed in detail in the *Greater Sage-Grouse Net Conservation Gain Analysis* associated Project planning document available at the BLM ePlanning site for the Project (see page vi).

1.5 Relationship to Other Plans, Laws, Regulations, Policies, and Programs

Table 1 outlines major federal laws, regulations, and guidelines affecting the proposed Project. The Notice of Intent to prepare an EIS for the Project was published in the *Federal Register* on July 15, 2020, prior to the new Council on Environmental Quality (CEQ) regulations which became effective September 14, 2020. Consequently, this EIS is subject to the CEQ regulations in place before the change.

Table 1. Relationship to Other Plans, Laws, Regulations, Policies, and Programs

Law, Regulation, or Guideline	Reference	Relationship to the Project
Archaeological Resources Protection Act of 1979	16 U.S. Code (U.S.C.) 470aa to 470ee	The Project has the potential to disturb archaeological resources through ground-disturbing activities.
NHPA of 1966	16 U.S.C. 470 et seq	The Project has the potential to disturb historic resources through ground-disturbing activities.
Bald and Golden Eagle Protection Act	16 U.S.C. 668-668d	The Project occurs in areas where bald eagles are encountered, and it must be shown that the Project would not lead directly or indirectly to take of eagle species.
Migratory Bird Treaty Act of 1918	16 U.S.C. 703–711 Executive Order 13186	The Project occurs in areas where migratory birds are encountered, and it must be shown that the Project would not lead directly or indirectly to take of protected species.

Law, Regulation, or Guideline	Reference	Relationship to the Project
ESA, as amended	16 U.S.C. Annotated §§ 1531 et seq	The ESA requires federal agencies, in consultation with the U.S. Fish and Wildlife Service (USFWS), to ensure that actions they authorize are not likely to jeopardize any listed species.
FLPMA of 1976	U.S.C. 1701 et seq	The Project ROW grant would be issued under the authority granted the BLM under FLPMA.
BLM ROWs Regulations	43 CFR 2800	The Project ROW grant would be issued under the BLM regulations developed under FLPMA.

Iron County has developed both a General Plan and an RMP. The Iron County General Plan encourages coordination with federal agencies in decisions affecting the management of the public lands. The Iron County RMP was completed in June 2017 and outlines Iron County positions and policies regarding resource management and coordination with resource management agencies (Iron County 2017). The plan specifically supports the "West Desert Pipeline Project," which is a precursor to the PVWS Project proposal.

The Beaver County, Utah, RMP outlines land use policies and serves "as a basis for communicating and coordinating with the federal government on land and resource management issues" (Beaver County 2019). In adopting the RMP, Beaver County seeks to ensure the customs, culture, history, and economy of Beaver County are considered and protected by land use decisions (Beaver County 2019). The Beaver County Plan objectives regarding land use seek to ensure federal lands are managed for multiple uses, striking a balance between competing planning values (Beaver County 2019). Beaver County's Land use policy guideline 18.h states that BLM land use planning should "provide for the protection of existing water rights and the reasonable development of additional water rights" (Beaver County 2019).

1.5.1 Project Water Rights under Utah Water Law

On October 17, 2006, CICWCD filed Application to Appropriate Water Number 14-118 (A76676) with the Utah Division of Water Rights (DWRi) to appropriate 15,000 afy of groundwater from the aquifer underlying Pine Valley. After a lengthy hearing process, the application was approved by the DWRi in an Order dated May 13, 2014 (DWRi 2014b). The Order says the state engineer believes 16,650 afy of groundwater are available for appropriation in the Pine Valley water right area (Water Right Area 14), including the 15,000 afy appropriated under CICWCD's water right. It further states this estimate is based on currently available data. The Order requires that a permanent record of the diversions from each well be maintained by CICWCD and that CICWCD develop and implement a monitoring program that ensures no prior water rights are impaired and the aquifer system in the Pine Valley is not exceeding safe yield. If in the future Pine Valley groundwater should prove to be over-appropriated because of CICWCD or other water rights exercised in the basin, the state engineer would be required to address the issue based on the requirements of Utah Code §73-5-15. This could include revising the safe yield estimate and adopting a GMP. The Utah Code defines safe yield as "the amount of groundwater that can be withdrawn from a groundwater basin over a period of time without exceeding the long-term recharge of the basin or unreasonably affecting the basin's physical and chemical integrity" (Utah Code §73-5-15(1)(b)). The state engineer is the regulatory authority for determining a basin's safe yield, implementing a GMP within a basin, and reviewing the monitoring program that ensures no prior water rights are impaired.

A lawsuit challenging the Order was filed in Utah State Court by Beaver County, the Utah Alunite Corporation, and the Utah School and Institutional Trust Lands Administration (SITLA). On February 27, 2019, the District Court issued a Stipulated Judgment approving the water right for permanent appropriation of 15,000 afy of groundwater from Pine Valley for 100 percent consumptive use (Fifth Judicial District Court, State of Utah 2019a), and the parties to the lawsuit entered into a Settlement Agreement (Fifth Judicial District Court, State of Utah 2019b). The 2019 Stipulated Judgment and Settlement Agreement acknowledged and left intact the above findings and requirements of the 2014 Order.

The DWRi is the agency with the sole authority to regulate the appropriation and administration of water rights within the State of Utah. Groundwater rights established after 1935 must be established through the appropriation process administered by the DWRi. The BLM has the responsibility to "ensure that third-party uses of appropriated water on BLM-administered lands that operate under BLM permitting authority shall comply with applicable state water right laws" (BLM 2013). The BLM has the authority and responsibility to manage public lands in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values by designing and implementing reasonable and relevant mitigation as part of the National Environmental Policy Act (NEPA) process.

1.6 Scoping

The Notice of Intent to prepare an EIS for the PVWS Project was published in the *Federal Register* on July 15, 2020. This began the formal NEPA process and opened the public scoping period. The BLM published Project information and maps on the ePlanning website (https://eplanning.blm.gov/eplanning-ui/project/1503915/510). An online public scoping meeting for the PVWS Project was held on August 5, 2020, and included approximately 40 attendees. Scoping officially closed on August 19, 2020. The BLM received a total of 98 comment letters. The scoping report is available at the ePlanning website: https://eplanning.blm.gov/eplanning-ui/project/1503915/510.

1.6.1 Issues Analyzed in the Environmental Impact Statement

Issues were identified through public scoping and by the CCFO interdisciplinary team (IDT). Many resources and resource uses were found to not be present in the PVWS Project area. Others were found to be present, but impacts would only be minor and temporary. These resources and resource uses are contained in the Interdisciplinary NEPA Checklist attached as **Appendix B** but will not be discussed in detail in Chapter 3. To be analyzed in detail, an issue must meet the following criteria (H-1790-1 BLM NEPA Handbook, page 41):

- Analysis of the issue is necessary to make a reasoned choice between alternatives. That is, does it relate to how the Proposed Action or alternatives respond to the purpose and need?
- The issue is significant or where analysis is necessary to determine the significance of impacts.

Issues analyzed in detail are described in Chapter 3.

Table 2 presents a summary of the issues identified and where they are addressed.

Table 2. Summary of Issues Identified During Scoping

Resource Topic	Issues	Location
Air Quality and Climate Change	• How would the Proposed Action impact air quality, including fugitive dust impacts from construction and fugitive dust from the potential drying of lakes, reservoirs, and playas? • How would the Proposed Action affect the creation or reduction of greenhouse gases?	Chapter 3 Appendix B Appendix C
Alternatives	• Could the BLM consider a reasonable range of alternatives that meet the purpose and need and that include alternatives beyond the legal authority of the BLM to implement? • Could the BLM consider conservation, recycling, reclamation, and recharge strategies as an alternative to the Proposed Action? • Could the BLM consider using the State Route 21 utility corridor, as designated on the Beaver County RMP, for the proposed pipeline? • Could the CICWCD interconnect with the Lake Powell Pipeline as an alternative to the Proposed Action? • Would the BLM consider using a “phase-in approach” to managing the pumping for the Proposed Action? • Would the BLM consider an alternative with a lower pumping volume? • Would the BLM consider a “temporary use” alternative for the Proposed Action that would allow for pumping until equilibrium is achieved for the Cedar Valley basin? • How would the CICWCD incorporate water conservation to reduce water demand and reduce the need for the Proposed Action? • How could water reclamation and efficiency methods be incorporated into the Proposed Action?	Chapter 2

Resource Topic	Issues	Location
Cultural Resources and Native American Concerns	• How would the Proposed Action impact tribal water rights and groundwater-dependent tribal resources? • How would the Proposed Action affect historic cultural resources, and would it comply with the National Historic Preservation Act (NHPA)? • How would the Proposed Action affect tribal cultural resources and sacred sites? • How would the Proposed Action affect the Old Spanish Trail?	Appendix B Appendix C
Cumulative Impacts	• Would the BLM consider the additional water rights held by the CICWCD in Wah Wah and Hamlin valleys and how the Proposed Action may lead to additional projects in the future? • Would the BLM consider the potential pumping in Snake and Hamlin valleys due to the Southern Nevada Water Authority Pipeline Project? • Would the BLM consider long-term impacts beyond the 30-year ROW term, as it is assumed the CICWCD would pursue ROW renewal? • How would the Proposed Action address other groundwater withdrawals and water projects in neighboring basins?	Chapter 3
Greenhouse Gases	• How would the Proposed Action consider the future effects of climate change?	Chapter 3 Appendix B
Fuels/Fire Management	• How would the Proposed Action affect fuel levels or otherwise affect fire risk?	Appendix B Appendix C
Land Use Planning and Regulations	• How would the Proposed Action conform with the BLM CCFO RMPs? • How would the Proposed Action conform with the Beaver County RMP? • How will the new CEQ regulations apply to the development of the EIS for the Proposed Action?	Chapter 1
Purpose and Need	• How is the BLM "purpose and need" defined, and how is it sufficiently broad to allow for a reasonable range of alternatives?	Chapter 1

Resource Topic	Issues	Location
Rangeland	• Would the Proposed Action potentially result in lessened availability of livestock water, changes to the Animal Unit Months (AUM) of the livestock allotments on BLM lands, and disturb or adversely impact rangeland facilities (e.g., cattle guards, fences, pipelines, troughs, etc.)? • Would rangeland management and livestock use potentially be impaired by the proposed Project?	Chapter 3
Recreation	• How would the Proposed Action impact recreational land uses, including hunting and camping, within Pine Valley?	Appendix B
Socioeconomics and Environmental Justice	• How would the Proposed Action impact growth and development in Cedar City? • How would the Proposed Action affect rural communities in western Utah and eastern Nevada? • Would the Proposed Action disproportionately affect disenfranchised communities and Tribes in western Utah? • What would the effect of the Proposed Action be on rate payers within the CICWCD's service territory, and how would low-income populations be affected?	Chapter 3
Special Designations	• How would the Proposed Action impact lands with special designations (e.g., Wilderness Study Areas, Areas of Critical Environmental Concern?)	Appendix B
Soils	• How much soil would be disturbed by the Proposed Action and how would disturbed soils be reclaimed?	Chapter 3
Vegetative Communities, including Noxious Weeds	• How would the Proposed Action impact invasive plants and noxious weed species? • How would the Proposed Action affect vegetation communities and sensitive plant species in the Project area?	Chapter 3 Appendix C
Visual Resources	• How would the Proposed Action affect BLM visual resource management designations or otherwise have impacts to visual resources?	Appendix B Appendix C

Water Resources	• How would the Proposed Action affect springs, seeps, streams, wetlands, and other surface waters? • How would the Proposed Action affect groundwater wells within the analysis area? • How would the Proposed Action affect senior water rights holders? • How would the Proposed Action affect groundwater aquifer balance? • How would the Proposed Action affect phreatophytes and other groundwater-dependent vegetation? • How would the Proposed Action affect intra-basin transfer of water across the Utah-Nevada state line? • Would the Proposed Action impact groundwater resources in Lincoln County, Nevada; White Pine County, Nevada; and Millard County, Utah? • How would the Proposed Action affect the long-term water supply in Beaver County, Utah? • How would the Proposed Action affect groundwater resources in Tule Valley, Fish Springs National Wildlife Refuge, and Sevier Lake? • How would the Proposed Action affect downgradient groundwater basins and the Greater Salt Lake Desert regional groundwater flow system? • How would the Proposed Action draw down or otherwise affect groundwater resources in and around Pine Valley over a long period, such as the next 200 years? • How would the Proposed Action affect federally reserved water rights? • How could the Proposed Action include the data and analysis of previous U.S. Geological Survey (USGS) studies, reports, and models, including the Great Basin Carbonate-Alluvial Aquifer System regional model? • How would the Proposed Action affect water quality in neighboring basins within the analysis	Chapter 3 Appendix B Appendix C *Groundwater Resources Impact Assessment* (available on ePlanning) *Technical Memorandum – Supplemental Analysis of Drawdown, Spring Flow Depletion and Wellfield Effects Assuming a Theoretical 200-Year Project Pumping Duration* (available on ePlanning)

Resource Topic	Issues	Location
	areas: Snake Valley basin, Tule Valley basin, Sevier Desert basin, Wah Wah Valley basin, Milford Area basin, and Beryl-Enterprise area basin? • How would the Proposed Action impact the proposed draft GMP for the Cedar Valley basin? • How would the Proposed Action interact with other water management plans for Pine Valley and the surrounding basins, including the Beryl-Enterprise GMP? • How would the potential for land subsidence due to extraction of groundwater by the Proposed Action be addressed? • How would impacts to surface water and groundwater be monitored and mitigated and the Proposed Action adaptively managed to prevent or reduce impacts to water-dependent resources? • How would impacts to springs due to the Proposed Action be addressed? • How would impacts to other water rights holders due to the Proposed Action be addressed? • How would the Proposed Action affect groundwater quality? • How would the Proposed Action affect surface water quality? • How would the potential for sedimentation from runoff in disturbed areas be addressed? • How would streambank integrity be maintained and restored at drainage crossings?	
Wild Horses	• How would surface disturbance affect forage for wild horses? • How would the Proposed Action's human presence during construction and maintenance affect wild horses? • How would the Proposed Action affect springs, potentially affecting wild horses?	Appendix B Appendix C

Resource Topic	Issues	Location
Wildlife	• How would the Proposed Action impact federally-listed wildlife species, candidate special status wildlife species, and BLM sensitive species and their habitat? • How would the Proposed Action impact migratory bird species known to nest within the Project area? • Would the proposed Project adversely impact migratory bird species that winter (i.e., forage) within the Project area? • How would the Proposed Action impact general wildlife species and their habitat, especially those dependent on springs? • How would the Proposed Action affect GRSG PHMAs, populations, leks, and habitat? • How would the Proposed Action impact riparian habitat? • How would the Proposed Action affect species with habitat in Fish Springs National Wildlife Refuge and the Clear Lake, Topaz Slough, and Topaz Marsh waterfowl management areas?	Chapter 3 Appendix B Appendix C

CHAPTER 2 PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

This chapter provides a description of the No Action Alternative, the Proposed Action, the Adaptive Northern Well Sites (ANWS) Alternative, and the alternatives that were considered but eliminated from detailed analysis.

2.2 Alternatives

2.2.1 No Action Alternative

Under the No Action Alternative, the BLM would not issue ROW grants for the construction and operation of the Project. There is no way for the CICWCD to develop its approved water rights in Pine Valley and transport water to Cedar City without a ROW authorization from the BLM. The CICWCD would need to pursue other additional water source alternatives to developing and using their Pine Valley water rights. The CICWCD is implementing the water conservation measures described in Section 1.2.1 regardless of the approval of the Proposed Action or another Action Alternative.

Under the No Action Alternative, the most reasonable course of action would be for Cedar City and the CICWCD to acquire senior water rights within the Cedar City Valley groundwater basin to provide additional water supply. By 2050, Cedar City water rights are projected to decrease by 4,653 afy (39.4 percent reduction), while CICWCD are projected to decrease by 562 afy (42.3 percent reduction) due to the implementation of the Cedar City Valley GMP (Carollo 2020). The most likely scenario reviewed by the CICWCD includes purchase of senior water rights from local wells in the Cedar City Valley as additional supply along with continuing to implement conservation measures. The water rights in the Cedar City Valley aquifer (Basin 73) are subject to the approved Cedar City Valley GMP which was adopted in January 2021. Under this plan, the DWRi would begin to curtail the use of water rights, starting with the most junior, to bring the basin back to safe yield. Cedar City has many junior water rights that would be curtailed soonest under the GMP. Due to the imminent implementation of the GMP, Cedar City is currently acquiring senior water rights as they become available.

Currently, water rights in the Cedar Valley are selling for an average of $6,500 per afy for rights of less than 10 afy and $5,525 per afy for rights of more than 10 afy (Hymas & Associates 2021). The price per afy has the potential to increase substantially as the Cedar City Valley GMP gradually rescinds junior water rights. Water rights are assumed to become available gradually over time, at which point they would be purchased preemptively by either the CICWCD or Cedar City. An analysis based on the 50-year planning horizon projects a cost of $420 million for acquiring the 12,000 afy of water rights needed to cover an anticipated water deficit of 10,946 afy by 2070 (Carollo 2020).

2.2.2 Action Alternatives

There are two action alternatives being considered: the Proposed Action and the ANWS Alternative. Many proposed features are common to both action alternatives, including the main pipeline between Cedar City and Pine Valley, the storage tank site, and the solar field on private land owned by the CICWCD. Facilities common to both alternatives are described first, followed by sections describing the differences between the Proposed Action and ANWS Alternative.

Features Common to Both the Proposed Action and ANWS Alternative

Both the Proposed Action and the ANWS Alternative include the development of up to 15 production wells and 70 total miles of pipeline alignment, including both main lines and lateral pipelines, plus other appurtenant Project facilities (**Appendix A, Figures 1 and 4**). A summary of anticipated short- and long-term ROW (miles or acres) associated with the Project is presented in **Table 3**. ROW calculations for pipeline construction are based on a 50-foot-wide long-term ROW with an additional 70-foot-wide temporary construction ROW. The total ROW width during construction would be 120 feet.

Table 3. Action Alternative Rows Common to Both Proposed Action and ANWS

Facility	Total Quantity		BLM Quantity		Non-BLM Quantity	
	Quantity	**Area**	**Quantity**	**Area**	**Quantity**	**Area**
Pine Valley Lateral Lines—Long-term ROW	5.3 miles	32.4 acres	1.6 miles	9.8 acres	3.7 miles	22.6 acres
Pine Valley Lateral Lines—Temporary ROW	5.3 miles	45.2 acres	1.6 miles	13.7 acres	3.7 miles	31.5 acres
Pine Valley Main Line—Long-term ROW	33.8 miles	204.8 acres	31.1 miles	188.7 acres	2.7 miles	16.1 acres
Pine Valley Main Line—Temporary ROW	33.8 miles	286.7 acres	31.1 miles	264.2 acres	2.7 miles	22.5 acres
Avon Road Corridor Main Pipeline—Long-term ROW	30.9 miles	187.5 acres	9.9 miles	60.2 acres	21.0 miles	127.3 acres
Avon Road Corridor Main Pipeline—Temporary ROW	30.9 mile	262.5 acres	9.9 miles	84.3 acres	21.0 miles	178.2 acres
Production Wells	15	15 acres	10	10 acres	5	5 acres
Monitoring Wells	8	8 acres	8	8 acres	0	-
Sentinel Wells	8	8 acres	8	8 acres	0	-
Solar Power Generation Sites	1	200 acres	0	0 acres	1	200 acres
Power Lines*	11.7 miles	0 acres	11.0 miles	0 acres	0.7 miles	0 acres
Mountain Springs Water Storage Tank Site	1	10 acres	1	7.6 acres	1	2.4 acres
Pressure-reducing Station	1	1 acre	0	0 acres	1	1 acre

Facility	Total Quantity		BLM Quantity		Non-BLM Quantity	
	Quantity	Area	Quantity	Area	Quantity	Area
Staging Areas—Temporary ROW	18	48.6 acres	13	32.9 acres	5	15.7 acres
Access Roads—Permanent ROW	21.4 miles	18.2 acres	17.5 miles	14.9 acres	3.9 miles	3.3 acres
Wildlife Watering Areas**	-	273.6 acres***	-	273.6 acres***	0	-

*Included within the pipeline long-term ROW, so no additional acreage is required.

**Not included in the PVWS Project ROW grant. Exclosure areas would be authorized separately but are included in this NEPA analysis.

***Affected acreage determined by the *Greater Sage-Grouse Net Conservation Gain Analysis* (available on ePlanning).

Short-term (less than 5 years) and long-term (5 years or greater) surface disturbance resulting from the Proposed Action is detailed in **Table 4**. This is different from the temporary versus long-term ROW areas. Most areas included within the long-term ROW grant, including the pipeline ROW, would only experience short-term ground disturbance. Following completion of construction activities, these areas would be reclaimed by recontouring and reseeding. Facilities that would result in long-term surface disturbance include fenced well houses, the fenced Mountain Springs water storage tank site, the existing monitoring well pads, the fenced solar field, and power poles. Refer to **Appendix D** for more information on the assumptions for determining the total short-term and long-term surface disturbance.

Table 4. Proposed Action Long-Term Surface Disturbance

Facility	Total Area	BLM Area	Non-BLM Area
Production Well Houses	15 acres	10 acres	5 acres
Existing Monitoring Well Pads	400 square feet (ft^2)	400 ft^2	0 ft^2
Sentinel Well Pads	400 ft^2	400 ft^2	0 ft^2
Solar Power Generation Site	200 acres	0 acre	200 acres
Power Poles	0.23 acre	0.23 acre	0 acres
Mountain Springs Water Storage Tanks	1 acre	0 acres	1 acre
Pressure-reducing Station	160 ft^2	0 ft^2	160 ft^2
Manholes (to access isolation valves)	975 ft^2	650 ft^2	325 ft^2
Unimproved Access Roads within Long-term ROW	18.2 acres	14.9 acres	3.3 acres
TOTAL	**234.5 acres**	**25.2 acres**	**209.3 acres**

Well Construction and Operation

Up to 15 production wells would be developed, up to 10 of which would be located on BLM-administered land (**Appendix A, Figure 2**). The total number of wells would be dependent on the water production rates of the initial wells constructed, but it is likely that a minimum of 10 wells would be constructed. Each production well site would be contained within a 1-acre ROW area where all well-drilling activity would occur. Vegetation would be sufficiently removed within the well pad area, typically an area measuring about 200 feet by 200 feet, for well construction and construction of the well housing. Well-drilling activities would include temporary equipment and materials staging areas and room for personnel parking and may require digging pits for drilling mud and space for personnel and equipment trailers. All temporary disturbance would be reclaimed following completion of well drilling and development.

Wells would be drilled to a depth at which water production is optimal. Drilling, logging, insertion of the well casing and screen, and placement of annular seals and filter packs typically takes 1 to 2 months. The drilling process involves use of drilling mud to help stabilize the borehole. Nontoxic and biodegradable National Sanitation Foundation-approved Baroid-type products are typically used to condition the drilling mud to the proper weight and viscosity for site-specific conditions during water well drilling operations. Once the hole is drilled, a perforated or screened casing is installed to the depth required and embedded in a gravel filter pack. The casing extends above the natural ground level and provides a base on which the well pump is mounted. A surface seal, typically consisting of bentonite grout, is installed to a minimum depth of 30 feet from the surface. The grout used is required to be nontoxic by the State of Utah Water Well Handbook (UTDNR 2018). Size of the casings and well pumps would be determined based on conditions and water production at each well site.

After casing and sealing are complete, the wells would be “developed” by air lifting, pumping, surging, bailing, or other suitable methods to remove drilling mud and fine-grained materials from the borehole wall and the formation around the well and to optimize well performance. After development, the wells would be pump-tested to determine the well’s production capacity, efficiency, aquifer characteristics, and optimal pump selection. Well development and test pumping typically take 1 to 2 weeks. After construction and development, well construction would be completed at the surface with concrete pads fitted with electrical line-shaft turbine pumps and connected to a lateral well field collection pipeline. Electrical service would be extended to the well locations via overhead distribution lines. To protect the production wells and provide easier maintenance, each well would be housed in a secure well house which would either be constructed of masonry block or wood framed. Well housing would range from 1,000 to 3,000 square feet in area and up to 12 feet in height from finished floor to roof peak. Access to the well site and well house would be restricted by a fence and gate enclosing the 1-acre ROW. Well houses would be painted BLM shadow gray in sagebrush habitats and BLM covert green in pinyon-juniper habitats.

Drilling equipment consisting of a drilling rig, pipe truck, water truck, forklift, excavator or backhoe, compressors, pumps, light stands, desander, mud pit, and support trucks would be mobilized for approximately 1 to 2 months at each drilling location. Work during drilling of the wells may be conducted utilizing shift work, 24 hours per day, 7 days per week, depending upon conditions. Well development, pump testing, pump installation, and surface construction would be conducted over the course of an additional 1 to 2 weeks during regular working hours. Equipment would include development rigs, cranes, and work trucks.

Water extracted during well development and pump testing would be discharged to the ground surface in the well site ROW. Water used for well testing may be used to begin development of mesic meadow habitat as part of the GRSG net conservation gain approach. Control and dispersal measures such as water cannons, riprap, check dams, and tarps would be used based on site-specific conditions to prevent erosion during discharge.

Monitoring Wells

There are eight monitoring wells already drilled under a previous authorization that would be included in the new 30-year ROW grant. These wells are 6 inches in diameter and drilled 1,000 feet deep. Additional near-field and far-field sentinel monitoring wells may be placed within or outside of Pine Valley to monitor groundwater drawdown over time as required under the 2014 Order approving CICWCD's water right. At this time, it is anticipated that three new well field monitoring wells and four new sentinel monitoring wells would be constructed adjacent to existing unimproved dirt roads. It is assumed that four additional existing wells can also be retrofitted with sounding tubes and added to the monitoring network. Any new features would be subject to additional NEPA compliance. The locations of the proposed new monitoring/sentinel wells, existing monitoring wells, and nearby existing access roads are shown on Figures 2-4, 2-5 and 2-6 of the *Groundwater Resources Impact Assessment* (available on ePlanning).

Procedures for construction and development of new monitoring wells would be identical to the construction and development procedures for production wells, except that work at each site would be completed in a period of approximately 2 to 4 weeks. Surface completions would consist of concrete pads measuring approximately 3 feet by 3 feet. The well casings would be enclosed in locking steel pipe vaults that protrude about 1 to 3 feet above the ground surface and protected from potential collision hazards by three or four 6-inch-diameter steel bollards painted bright yellow and protruding at least 4 feet above the ground surface.

Solar Field and Power Transmission Lines

Power to the well pumps would be provided by an approximately 35-megawatt (MW) solar field that would be constructed in Pine Valley on approximately 200 acres within the southern half of a 640-acre section of CICWCD-owned land. None of the solar field would be on BLM-administered land (**Appendix A, Figure 3**). The solar field would use photovoltaic technology and be monitored and managed remotely. Panels would use a 2-axis rotation design. The structures and facilities would be inspected visually at least every 6 months and cleaned as needed. The solar field would be fenced for security. Final solar design has not been completed and would be based on the available technology at the time and the final power needs of the well pumps.

Power from the solar field would be transmitted to the well pumps via an aboveground transmission line of less than 100 kilovolts. Up to 23.3 miles of transmission line would be constructed, including aboveground spur lines to wells located off the main pipeline alignment. No belowground electrical transmission lines are proposed. Power poles would be approximately 34 feet tall and have an approximate footprint of 6 square feet. The poles would be a monopole design without crossarms and with perch deterrents to avoid avian perching and nesting. The poles would be co-located within the same long-term ROW as the water pipelines and spaced approximately every 300 feet. Guy-wires would likely be needed at bends and ends of the power line. Although the final design voltage is not determined at this time, the power lines would be well under 100 kilovolts. This is less than the “high-voltage” designation by the BLM.

Power from the solar field would be strictly for Project use and would not be connected to the grid. The anticipated design output of the solar field is 35 MW, which assumes that pumps placed in the well shaft would need to pump water from approximately 1,000 feet belowground to the 10-million-gallon storage tank located approximately 600 feet higher than most of the well houses. The solar field would be sized to meet these Project demands.

Pipeline Design

There are three sections of pipelines that would be constructed for the Project under either action alternative. Smaller *lateral*, or *collection*, lines would extend from each of the production wells to the *main* line. A *main* line (Pine Valley pipeline) would convey the water from the *lateral* lines to a point 4.7 miles west of Lund, and a larger *main* line (Avon Road main pipeline) would convey the water from 4.7 miles west of Lund to Cedar City. The pipeline design common to both action alternatives would require an estimated total of 70 miles of pipe. Of this total, up to 42.6 miles would be located on BLM-administered land. All pipelines would be buried.

Several different types of pipe materials are proposed to be used, as determined by final engineering: high-density polyethylene (HDPE), ductile iron, and steel, with the majority being HDPE or steel. The pipe materials are nontoxic and noncorrosive in the ground. Pressure ratings for HDPE and 30-inch steel pipes are 267 and 250 pounds per square inch (psi), respectively. HDPE pipe is usually not manufactured larger than 30 inches in diameter. Proposed Project pipelines less than 24 inches in diameter would typically be constructed of HDPE, while pipelines between 24 and 30 inches in diameter would be either HDPE or steel, as determined by final engineering. Engineering would consider local soil and geotechnical considerations and the potential for differential settlement within Pine Valley. Pipelines greater than 30 inches in diameter would be constructed of steel. The larger mainline steel pipe would be rated at a higher pressure of 450 psi. Pipelines co-located with power lines would be constructed of HDPE so that cathodic protection would not be required.

Lateral pipelines would convey water from the wells under pressure lower than in the main pipelines. Lateral pipeline diameters would range from 16 to 30 inches, varying based on the anticipated water volume, grade from each well, and distance to the main line. Lateral pipelines would be made of HDPE or steel. The diameter of the Pine Valley pipeline would range from 30 to 40 inches, and the diameter of the Avon Road main pipeline would range from 42 to 54 inches. Steel pipeline would be used to construct both main pipeline sections. All pipelines would be buried to a minimum depth of 40 inches. Ground disturbance associated with pipeline installation would be temporary and would be reclaimed and seeded with a BLM-approved seed mix (**Appendix C**).

Estimated pipeline length and pipeline type and specifications proposed to be used for each pipeline section are summarized in **Table 5**.

Table 5. Estimated Pipe Specifications

Pipeline	Length (feet)	Diameter (inches)	Material	Wall Thickness (inches)	Pressure Rating (psi)	Friction Coefficient
Pine Valley Lateral	8,512	16–30	HDPE	2.3–3.8	250	135–150
Pine Valley Main	178,418	30–42	Steel	0.45	450	140
Avon Road Main Pipeline	162,993	42–54	Steel	0.52	450	140

Several types of valves would be installed along the pipelines to prevent damage to the pipelines and to facilitate optimal movement of water. Air vacuum valves release air pressure and allow air to enter and exit the system. Approximately seven air vacuum valves are anticipated to be installed. These valves would typically be located at the high points, grade breaks on steep slopes, and long downward-sloping pipe segments of the alignment. Air vacuum valves would connect directly to the top of the pipeline through check valves so air can pass above ground. The air release and air vacuum valves would be housed belowground, with a 24-inch gooseneck pipe extending approximately 2 to 3 feet above ground level. Locations would be determined during design, but it is anticipated approximately 12 air vacuum valves would be installed.

Drain valves would be located at low points and are used to drain the pipeline if required. Draining may be done during hydrostatic testing after construction and if maintenance is required on the pipeline. Drain valve piping would be connected to the bottom of the pipeline at a low point and extend to a discharge location within the ROW, typically a dry wash channel. The water would pass through an energy dissipater consisting of a channel lined with riprap at the discharge point to mitigate erosion. A detailed hydrologic study would be conducted during design to determine the proper locations to discharge drained water from the pipeline. Additionally, flow rates and volumes would be identified during design, and best management practices and other measures would be implemented to minimize erosion. It is anticipated that flow rates would not exceed the 2- to 5-year storm event for each drainage channel.

Isolation valves are used to isolate certain sections of pipeline. They would typically be located near air vacuum valves and drain valves but also along the pipeline in case of a pipe break or other maintenance that could be required. These valves would be placed approximately every 5,000 feet. Valves are typically housed underground or within concrete vaults which would be constructed around the water pipeline. These would be surface accessible using 4-foot-diameter manholes. All valves would be located within the permanent ROW requested for the pipelines.

Buried tracer wire, used for locating the underground piping, meter vaults, and other control vaults utilizing aboveground Supervisory Control and Data Acquisition (SCADA) equipment, would be placed on top of the pipeline at some locations. SCADA equipment would also be installed at the wells to monitor performance, track groundwater level and pumping trends, and allow appropriate management of the well field as part of the adaptive management plan.

Mountain Springs Water Storage Tanks

Water from the Pine Valley main pipeline would be collected into storage tanks located within a 10-acre site at the high point of the alignment. The tank structure would be approximately 200 feet by 200 feet by 35 feet tall and would contain up to 10 million gallons of water cumulatively among all the tanks. The tanks would be located within 2.5 acres of SITLA land, with pipes extending across BLM-administered land to/from the mainline located along Pine Valley Road. The tank site on both the well pumps would provide sufficient pressure to transport water to the storage tanks. The head available at these tanks would be sufficient to convey water by gravity feed to the Cedar City system. Construction of the 10-million-gallon storage tanks would include excavation of the tank area, construction of tank walls, and installation or attachment of supply, drain, and overflow pipes buried a minimum of 40 inches below ground surface (bgs). The 35-foot-tall tank would be partially buried with approximately 15 feet visible above ground. Tanks and other aboveground Project facilities would be inspected on a weekly basis as a limited "windshield" survey. The area containing the tank would be fenced for safety and security. Fences would exclude wildlife. The tanks would be painted either BLM covert green or BLM shadow gray.

Pressure-Reducing Station

One underground pressure-reducing station may be required near Lund to reduce the pipeline pressure at this location. Gravity feed from the high point at the storage tanks may result in greater pressure than what is required to convey the water to Cedar City. This pressure-reducing station would be constructed as an underground concrete vault approximately 40 feet by 40 feet in size located on a 1-acre site. The proposed station location near Lund, Utah, was determined based on the high amount of pressure that is anticipated at this location, and it would be used to reduce the pressure, if needed, and prevent any pressure spikes from causing pipe failure. This would extend the life of the pipes and prevent damage to the pipeline and any appurtenances. The pressure-reducing station would be constructed on private land. Pressure sensors would be installed in the pipeline at strategic locations to warn of loss of pressure (a leak) or of excess pressure in the pipeline. Triggering of pressure sensors in the system would also initiate a sequenced shutdown of wells and isolation valves. The wells would be shut down before the isolation valves to reduce water loss, prevent further damage to the pipeline, and minimize erosion that could result from a leak.

Access Roads

Approximately 6.1 miles of access roads would be utilized to access Project monitoring wells under either the Proposed Action or ANWS Alternative. ROW access to production wells would use the "drive and crush" method beyond any currently existing dirt or gravel access roads. Unimproved "drive and crush" access is typically no more than 7 feet wide, the width of a pickup truck. Access would consistently be via the same route when traveling overland beyond existing roads. Where the pipeline alignment is located within the ROWs for existing public roads (Pine Valley Road, Mountain Springs Road, and Avon Road), the Project main access road would be the existing roads, with no new disturbance proposed (e.g., on BLM-administered land).

Temporary construction access would be via public roads and/or contained within the temporary 120-foot-wide ROW. Two sections of the Avon Road main pipeline alignment, with accompanying temporary access road, would need to be constructed on BLM-administered, private, and SITLA land outside existing road ROWs. All temporary access roads would be re-graded and reclaimed post-construction.

Access to monitoring wells, subsidence monuments, and springs being monitored long-term would be via existing roads and the 6.1 miles of unimproved access roads described above that would receive this occasional light traffic, typically an annual monitoring visit but with potential for additional visits during early Project operation.

Some inspections of the well and pipeline system would be conducted by commercial camera drones (unmanned aerial vehicles), reducing use and wear on access roads to some extent (see below subsection *Operation and Maintenance*).

Rights-of-Way

ROWs are required for wells and well housing, lateral lines, access roads, pipeline construction, storage tanks, and other facilities. Two ROW grants would be issued. One would be a temporary construction ROW that would authorize the CICWCD to construct the pipeline and complete reclamation activities. The ROW width along the pipeline corridor during construction would be a total of 120 feet. A second long-term ROW grant would be issued for operation and maintenance of the pipeline, wells, and other facilities. The ROW width along the pipeline corridor after construction would be a total of 50 feet. The term of the BLM long-term Project ROW would be 30 years. The impact analysis in Chapter 3 assumes a probable 20-year extension. After a total of 50 years, additional NEPA analysis would be reevaluated to consider further renewal of the long-term ROW grant.

If the CICWCD wishes to continue the use of the wells and pipelines after 30 years, renewal of the ROW would need to be requested by the CICWCD and approved by the BLM. The Project area is defined as the temporary and permanent ROWs as well as areas of temporary, long-term, and permanent Project disturbances or where effects can be associated with the Project.

Construction of Facilities

<u>*Survey and Protection*</u>

Additional surveys beyond those performed for this EIS would be required before and during construction and are the responsibility of the CICWCD. Boundary surveys would establish parcel ownership along the proposed temporary and permanent alignment ROW and around the well site ROWs and would be conducted prior to beginning construction. Parcel boundaries would be marked with rebar or wooden stakes, and benchmark monuments would be set throughout the ROW. A topographic and site survey utilizing the benchmarks would provide information needed to design the pipeline and may be completed before, during, or after the boundary survey. A construction survey would be conducted at the beginning of and during well site and pipeline construction to mark pipeline center locations and to outline the temporary ROW areas. Environmental or cultural sites requiring protection and/or avoidance would also be surveyed and marked with appropriate buffers. No disturbance would occur outside of the marked boundaries of the temporary ROW. Any disturbance within marked boundaries of protected environmental or cultural sites would be in accordance with resource protection or mitigation measures. All vehicular traffic required for surveying would remain on established roads or within the temporary ROWs.

Pipeline Construction

Construction of the pipelines would follow standard waterline construction techniques. The Project would largely utilize cut and cover with an open trench, including where the alignment crosses minor paved roads or unimproved roads. A different technique would be used for the one railway crossing required for the Project. The cut and cover process would involve the following steps:

- Clearing, Grubbing, and Grading: Vegetation, other materials such as rocks and boulders, and topsoil would be removed where needed to conduct construction activities. Vegetation disturbance would be kept to the minimum needed. Grading as needed to develop level working surfaces may be conducted concurrently with grubbing to remove stumps and roots. Approximately the top 1 to 6 inches of topsoil would be salvaged during construction and windrowed along the ROW edge or stockpiled to be used during reclamation
    - After site clearing and grading, berms and drainage ditches may be constructed to contain runoff and divert floodwaters from the construction area. Berms and ditches would be incorporated into the final grading of the facility sites where necessary
- Trenching: Excavators, backhoes, track hoes, and other similar equipment would be used to dig the trench. Spoils from the trench would be temporarily windrowed along the ROW edge (separate from top spoil) or stockpiled no more than 6 feet in height. The trench width would be a minimum of twice the outside diameter of the pipe. Depending on the condition of the soil, it may be necessary to expand the trench width to provide stability and safety. The depth of the trench would depend on the grades and size of the pipe. Excavation of the trench should extend a minimum of 12 inches below the bottom of the pipe and would allow for a minimum cover of 40 inches over the pipeline. Trench depth would typically be 10 feet or less
- Bedding: Engineered bedding materials would be laid in the bottom of the trench for a minimum depth of 8 inches as necessary for providing a stable base. This material is typically some sort of gravel. The remaining depth of bedding would be sand or gravel compacted to 90 percent minimum modified proctor density as determined by ASTM D-1557. If stabilization is not required, the sand defined above would be used for bedding purposes. The material would not exceed the Number 4 sieve. Bedding would be developed from the spoils from trenching or brought in by truck if native material is not suitable for bedding. This would be accomplished with an excavator and large trucks as needed
- Pipe Laying and Welding: Pipe sections would be transported to the construction site via truck and strung along the trench within the ROW. The pipe sections would be lowered into the trench by crane or excavator. HDPE pipe sections would be fused utilizing a fusion machine. Once the fusion is properly set, the pipe can then be laid into the trench using a track hoe. HDPE fusion does not require the use of toxic chemicals and does not produce toxic fumes. Steel pipes would be welded together on-site within the trench. All welds would be visually inspected and tested. Welds that do not meet specifications would be repaired or removed. Once the welds are approved, the joints would be wrapped in tape and mortar coated. If there are any appurtenances within a section of pipe, they would be installed and affixed to the pipe
- Pipe Zone Backfill—Trench Backfill: Pipe zone backfill would be placed along the pipeline at a minimum of 12 inches over the top of the pipe. Backfill material would be sand or gravel that does not exceed 0.75 inch and would be laid in 12-inch lift sections. Each section would be compacted to 90 percent minimum modified proctor density.

Backfill would be laid with an excavator. If native soil does not meet these backfill specifications, appropriate material would be delivered to the site from borrow sources. The CICWCD intends to source borrow material from within the identified staging areas. The remainder of the trench over the pipe zone backfill would be backfilled to the approximate finished grade using material less than 2 inches in diameter. The material would be laid in a maximum of 12-inch lifts and compacted to 95 percent of minimum modified proctor density. Warning tape would be installed in this backfill 18 inches above the pipeline. Backfill would be laid with an excavator. If native soil does not meet these backfill specifications, appropriate material would be delivered to the site from borrow sources

Railway Crossing

The alignment would cross the Union Pacific Railroad (UPRR) rail line about 3.75 miles southwest of Lund, Utah. The pipeline would be laid in a bore run beneath the railway. The bore would be a minimum of twice the diameter of the pipeline and would require a minimum of 6 feet of cover over the pipeline. The crossing would require a bore hole that would stage the boring equipment plus a receiving pit on the other side of the railroad. UPRR may have additional requirements for the bore and pipeline. The CICWCD would coordinate with the UPRR to receive authorization for the bore and complete it to their standards and specifications. There may be other buried utilities at each crossing, and coordination with the owner of the facilities would be required. The depth of buried pipeline could change depending on UPRR railroad requirements at the time of construction.

Staging and Support Areas

Staging areas outside the temporary alignment ROW would be required in various areas for Project construction. Eighteen temporary staging areas have been identified along the Pine Valley main pipeline and Avon Road main pipeline corridors. These are generally flat, cleared areas that would experience new temporary surface disturbance during construction. These staging areas would be used for equipment parking, equipment maintenance, vehicle parking, storage of materials and fuel, and construction office trailers. Fourteen of these staging areas (a total of approximately 35 acres) would be located on BLM-administered land. The remaining four staging areas (a total of approximately 13.6 acres) would be placed on other land jurisdictions.

Borrow Pits

Borrow pits are anticipated to be developed to provide appropriate bedding and backfill material when trench spoils do not meet engineering specifications. The CICWCD intends to source borrow material from the identified staging and support areas.

Reclamation

All temporary disturbance would be recontoured and reseeded to match the surrounding landscape. Topsoil saved during construction would be spread back over all subsoil exposed during construction. Weed-free seed mixes approved by the BLM would be used during reclamation activities. For areas within GRSG PHMAs, use of native seeds would be prioritized to meet BLM GRSG 2015 ARMPA objectives (BLM 2015). For areas within Utah prairie dog habitat, the mix detailed in the *Interim Vegetation Composition Recommendation for Utah Prairie Dog Habitat* or most recent applicable guidance would be used for reclamation.

Hydrostatic Testing

Hydrostatic testing would be conducted on pipeline segments during construction to assess the ability of the pipe and steel welds or plastic fusion welds to meet the operational or emergency design pressures expected in various sections of the pipeline. Water used for testing would be obtained from Project production wells and would be released post-testing into a downstream pipeline section or discharged from the pipeline through a drain valve. Drain valves would release water at a discharge location, which is typically a dry wash channel. The channel would be lined with riprap at the discharge point to prevent erosion. Drain valves and lined channels would be contained entirely within the long-term ROW.

Construction Schedule and Anticipated Equipment Use

Construction of either the Proposed Action or ANWS Alternative would take approximately 3.5 years. Equipment expected to be used during construction of wells and housing, access roads and road improvement, and pipeline and storage tank construction are listed in **Table 6**. These are estimates of what would be used, as the final equipment needs would be based on the final Project plans and would be up to the construction contractor(s). Construction for some of the Project facilities would occur simultaneously. Construction is currently projected to commence at the beginning of 2025 with well drilling and pipeline construction. Construction is projected to terminate in the middle of 2028.

Table 6. Construction Duration and Approximated Equipment Needs

Construction Phase	Duration*	Equipment	Anticipated Quantity
Surveying and Staking	12 months	Pickup trucks	1
Clearing and Grading	3 months	Bulldozers	4
		Excavators (track hoes)	3
		Pickup trucks	12
		Tractor trailers for transporting heavy equipment and materials	3
		Water trucks	1
Trenching	8 months	Excavators (track hoes)	4
		Backhoes	3
		Dump trucks	2
		Pickup trucks	12
		Tractor trailers for transporting heavy equipment and materials	3
		Water trucks	1
Bedding	6 months	Excavators (track hoes)	3
		Backhoes	2
		Dump trucks	2
		Front-end loaders	2

Construction Phase	Duration*	Equipment	Anticipated Quantity
		Pickup trucks	12
		Tractor trailers for transporting heavy equipment and materials	3
		Water trucks	1
Pipe Laying and Welding	8 months	Excavators (track hoes)	2
		Side-boom counter-weighted tractors	2
		Welding equipment and trucks	2
		Boring machines	1
		Front-end loaders	2
		Pickup trucks	16
		Fusion machines for HDPE pipe	1
		Tractor trailers for transporting heavy equipment and materials, including pipe trucks	6
		Water trucks	1
Pipe Zone Backfill	6 months	Excavators (track hoes)	2
		Backhoes	2
		Dump trucks	2
		Front-end loaders	2
		Compactors, hand and/or as track hoe attachments	2
		Pickup trucks	12
		Tractor trailers for transporting heavy equipment and materials	3
		Water trucks	1
Trench Backfill	6 months	Excavators (track hoes)	2
		Backhoes	2
		Dump trucks	2
		Front-end loader	2
		Compactors, hand and/or as track hoe attachments	1
		Pickup trucks	12
		Tractor trailers for transporting heavy equipment and materials	3
		Water trucks	1
	12 months	Excavators (track hoes)	1
		Crane trucks	1

Construction Phase	Duration*	Equipment	Anticipated Quantity
Solar Field and Power Line Construction		Pickup trucks	12
		Tractor trailers for transporting heavy equipment and material	3
		Water trucks	1
Well Drilling and Development	18 months	Well-drilling rigs	2
		Excavators or backhoes	2
		Cranes	2
		Pipe trucks	2
		Forklifts or skip-loaders	2
		Pickup trucks	6
		Tractor trailers for transporting heavy equipment and materials	1
		Water trucks	1
Well House Construction	12 months	Pickup trucks	8
		Tractor trailers for transporting heavy equipment and materials	2
		Water trucks	1
Tank Construction	12 months	Excavators	4
		Front-end loaders	2
		Dump trucks	4
		Pickup trucks	16
		Tractor trailers for transporting heavy equipment and materials, including concrete trucks	4
		Water trucks	1

*Note that construction phase durations overlap and are not additive.

Operation and Maintenance

Operation and maintenance activities would be the same for both the Proposed Action and ANWS Alternative. Routine operation of facilities would include remote and on-site monitoring of system functions and inspection of the pipelines and facilities. Maintenance would include regular upkeep of equipment, repairs conducted as needed, and responses to emergency conditions. All operation and maintenance activities would be confined to the permanent ROW.

Inspection and maintenance of all facilities would occur periodically post-construction. Weekly inspections of the well locations would be conducted. Overall inspections would be conducted along either public roads or the unimproved access roads within the long-term ROW. Routine inspection by aerial observance using drones (unmanned aerial vehicles) would also be conducted. Drone use would follow requirements in the Federal Aviation Administration small, unmanned aircraft regulations in effect at the time.

Operation of the production wells includes a "pump to waste" that occurs during pump startup for a short period of time. Water would be discharged into a catch basin and would disperse through an underground, perforated pipe within each well site. The pipe would have a flared end that discharges onto riprap for erosion control. The amount of water wasted is approximately 5,000 gallons per well per startup.

Operation and maintenance activity on the pipeline would include general maintenance of the ROWs and inspection, repair, and cleaning of the pipeline and appurtenances. Required maintenance on HDPE and steel pipe is typically low due to the fusion of HDPE joints, use of welds for steel pipe, and the high strength of both kinds of pipe. Typical life expectancy of HDPE and steel pipe is 50 years before major pipeline repair would be required.

Sediment that may accumulate in low areas of the pipeline and lead to increased pressure in the pipeline would need to be cleaned annually or as needed with a poly pig. Pipeline air valves and pressure-reducing valves would be inspected at least annually to ensure proper function.

Periodic aerial and ground inspections within the ROWs would identify areas of exposed pipeline, erosion, unauthorized ROW encroachment, or other conditions that could present a safety hazard or require repair or preventive maintenance.

Triggering of pressure sensors in the event of a pipeline rupture would initiate a sequenced shutdown of wells and isolation valves. The wells would be shut down before the isolation valves to reduce water loss, prevent further damage to the pipeline, and minimize erosion that could result from a leak. The cause of rupture would be investigated and rectified. The ruptured sections would be replaced with new pipe. All replacement construction would occur within the permanent ROW. If a rupture occurred on BLM-administered land or if effects of a rupture would impact BLM-administered land, the CCFO would be immediately notified of the situation, and repairs would be conducted in close coordination with the CCFO.

Solar field and well inspections would occur at least every 6 months. Well sites would be monitored remotely to ensure proper operation and verify production. Solar panels would be cleaned as needed, approximately once per year, using a commercial service. All maintenance would occur within the ROW for the well sites.

The access roads and ROWs would be inspected at least annually and repaired as needed to maintain proper drainage and prevent erosion. Non-county access roads are all two-track type within the long-term pipeline ROW. Access to monitoring wells and springs being monitored would be via existing roads or two-tracks that are publicly accessible.

Small unmanned aerial systems (i.e., drones) may be used to perform some inspection activities. Drone usage would observe the seasonal restrictions for GRSG within PHMA.

Decommissioning

When the proposed Project is no longer authorized by the BLM, the pipeline, wells, and all other related facilities would be decommissioned. Decommissioning of the pipeline would include abandonment in place of belowground structures, such as wells, pipelines, and water tanks. Wells would be grouted in place, and pipelines would have grout plugs installed. All aboveground structures, including well houses, fences, solar fields, valves, and power lines, would be removed, and the ground would be graded to natural contours and restored to prior existing conditions. Any long-term "drive and crush" access roads would be seeded and restored to conditions prior to Project implementation.

Design Features

Specific resource protection measures to reduce impacts are included in the CICWCD Project Plan of Development (POD) and listed in **Appendix C**. These measures include protections for air quality, cultural resources, fire protection and prevention, hazardous materials and wastes, human health and safety, livestock management, special status plants, vegetation, visual resources, water resources, wildfire, wildlife, and wild horses. Measures required to address the requirements of Utah DWRi's 2014 Order (DWRi 2014b) would be implemented as part of the Project to verify the basin's safe yield is not being exceeded (see **Appendix F**). Standard ROW Stipulations are included in **Appendix E**.

Mesic Meadow Wildlife Watering Area Development

As part of the Project under both the Proposed Action and ANWS Alternative, the CICWCD has worked with the BLM and Utah Division of Wildlife Resources (UDWR) to develop a strategy to provide a net conservation gain to GRSG under the 2015 ARMPA. This is a specific design feature that warrants being discussed in detail in this chapter. Specific measures discussed here are also included in **Appendix C**. Analysis of the mesic meadow wildlife watering development and integration of requirements of the 2015 ARMPA are addressed in the stand-alone planning document *Greater Sage-Grouse Net Conservation Gain Analysis* (available on ePlanning).

The total disturbance to GRSG PHMA under either the Proposed Action or ANWS Alternative is approximately 536 acres (see *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]). The ANWS Alternative could potentially require slightly less pipeline and power line placement within PHMA, depending on how the well field is developed. Neither alternative results in an exceedance of the total disturbance cap of 3 percent within PHMA.

Typical mitigation for PHMA disturbance includes treatment of pinyon-juniper woodlands, improvement or restoration of GRSG habitat, creation of corridors linking occupied habitats, and protection of occupied habitats through a conservation bank. However, the PVWS Project proposes the development of mesic meadow wildlife watering areas as a benefit for the GRSG (and other species). The UDWR has expressed a preference for a strategy that focuses on creating and improving mesic meadow habitat and pipeline/trough development to provide wildlife water. The proposed mesic meadow habitat development is consistent with ARMPA Management Action VEG-3 and would provide habitat consistent with what is needed for GRSG late brood-rearing habitat.

The mesic meadow wildlife watering areas would be fenced exclosures to prevent use by cattle and wild horses. A total of 14 mesic meadow locations, one pipeline to an existing pond, and one trough have been identified for development. These developments would require a total of 6.42 miles of pipeline and 9.88 miles of fencing. The total exclosure area for all these developments would be approximately 274 acres. Exclosures average 18.2 acres in area (see *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]). The wildlife exclosures would be closed to livestock unless authorized by an authorized officer. Not all mesic meadow areas may be developed; BLM staff identified more than would be needed to maintain the ability to adaptively develop these areas. The amount of mesic meadow area that would be developed is approximately 150 acres within the identified exclosure areas (see *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]).

Mesic meadow areas were identified in areas with suitable habitat, soil conditions, and topographic conditions. The BLM would construct Zeedyk structures or bentonite-lined pools to help retain water in areas where soils are sandier. Water would be provided to the locations through tap lines off the proposed pipeline. The CICWCD would install tap lines terminating in a water meter. The BLM would be responsible for developing the lines and structures within the identified mesic meadow areas. The BLM has made the choice to construct the exclosures and mesic meadows to allow for Project decisions, features, and coordination with the UDWR to be directly within their control. The mesic meadow areas would be seeded by BLM staff with desirable forage species for GRSG once the water lines and fencing are in place. The CICWCD would make an ongoing commitment to provide up to 300 afy to support the mesic meadow development or for use in other off-site water sources.

The development of mesic meadow wildlife watering areas and an ongoing water provision of up to 300 afy would be identical for either the Proposed Action or ANWS Alternative. This water would be provided out of the total allocation of 15,000 afy available for consumptive use under the CICWCD's Pine Valley water rights. Consumptive use within Pine Valley is allowed under the CICWCD's water rights. The BLM estimates that it would take 2 to 3 years for the mesic meadow areas to be established.

2.2.3 Proposed Action

The Proposed Action includes all the facilities described above in *Features Common to Both the Proposed Action and ANWS Alternative*. This alternative consists of what is proposed by the CICWCD in their POD for the PVWS Project. It includes the development of 70 miles of pipeline, up to 15 production wells, and all the appurtenant facilities described in **Table 4** and ROW authorizations described in **Table 3**. Design features for the Proposed Action are included as **Appendix C**. The Proposed Action includes the mesic meadow wildlife watering development described in the previous subsection. The estimated cost of the Proposed Action is $254 million.

2.2.4 Adaptive Northern Well Sites Alternative

The ANWS Alternative was developed as a means of addressing some of the uncertainty surrounding potential groundwater impacts by decreasing aquifer stress in the southern portion of Pine Valley by constructing the Project with a more northerly well field configuration. This would reduce groundwater drawdown and well drawdown interference impacts south of the Project area within southern Pine Valley and the northern Beryl-Enterprise hydrologic area. The ANWS Alternative represents the endpoint of the Well Field Construction Adaptive Management Program described in the *Groundwater Resources Impact Assessment* (available on ePlanning), which is intended to decrease aquifer stress in this area if groundwater flow impediments or aquifer boundary conditions result in greater drawdown for the Proposed Action than was predicted by groundwater modeling. This is proposed to be accomplished by shifting up to nine wells from their originally proposed locations to alternative locations further north in Pine Valley. Under the Well Field Construction Adaptive Management Program, a sufficient number of wells would be shifted further north to maintain drawdowns within the values predicted by the model. Under the ANWS Alternative, all but the first six wells would be shifted further north to decrease aquifer stress in southern Pine Valley and potential groundwater impacts to the Beryl-Enterprise area. The well field configuration for this alternative is shown in the maps in **Appendix A, Figure 2**. The alternative includes the bulk of the same Project pipeline layout as the Proposed Action but with changes in the well field layout, additional power lines, additional main pipeline, and potential changes to the lateral pipelines. The intent behind the ANWS Alternative is to reduce the long-term pumping impacts and keep Project impacts within what are described in the *Groundwater Resources Impact Assessment*. See the *Groundwater Resources Impact Assessment* (available on ePlanning) for additional details.

The ANWS Alternative would use the same main pipeline alignment from a point approximately 0.46 mile south of the northernmost well location under the Proposed Action southward all the way to the terminus near Cedar City (**Appendix A, Figure 1**). The solar field, tank site, staging areas, and pipeline interconnection would all be the same as in the Proposed Action.

The primary difference between the ANWS Alternative and the Proposed Action is in the well field siting and layout (**Appendix A, Figure 2**). A total of six production wells would initially be sited as proposed under the Proposed Action. These wells would be operated for a period of months, during which groundwater drawdown data would be collected. Once this data is analyzed and understood, the remaining nine production wells would potentially be sited at alternative locations along Pine Valley Road farther north in Pine Valley. This is provided as APM-2: Well Field Construction Monitoring and Adaptive Management Program in the Adaptive Management, Monitoring, Mitigation Measures, and Reporting program (**Appendix F**), which is the only part of the program that would apply to just the ANWS Alternative; the remaining features of the Adaptive Management, Monitoring, Mitigation Measures, and Reporting program apply to both the Proposed Action and the ANWS Alternative. There are a total of nine alternate well sites (**Appendix A, Figure 2**). Well development that moves wells from the 15 locations identified in the Proposed Action to alternate locations would be minimized to only the number necessary to keep Project groundwater drawdown impacts to the level analyzed in the *Groundwater Resources Impact Assessment* (available on ePlanning) while fully developing the approved water rights.

The ANWS Alternative would require up to 7.3 additional miles of pipeline and 7.4 additional miles of power transmission line compared to the Proposed Action. This would bring the total pipeline required under the ANWS Alternative up to 77.3 miles. The additional pipeline in the northern section of Pine Valley would be constructed of HDPE and/or steel. It is possible that as some wells are shifted north, some lateral collection pipelines would not be necessary; however, the total pipeline length is the maximum that could be installed under this alternative. ROW requirements for the ANWS Alternative are provided in **Table 7**. ROW disturbance calculations for pipeline construction are based on a 50-foot-wide permanent ROW with an additional 70-foot-wide temporary ROW. The total ROW width during construction would be 120 feet. A total of 24 well locations would be issued under the ROW, although only up to 15 would be developed under the adaptive management plan. Unused well locations would be later removed from the long-term ROW grant.

Table 7. ANWS Alternative—ROWs

Facility	Total Quantity		BLM Quantity		Non-BLM Quantity	
	Quantity	Area	Quantity	Area	Quantity	Area
Pine Valley Lateral Lines—Long-term ROW	5.3 miles	32.4 acres	1.6 miles	9.8 acres	3.7 miles	22.6 acres
Pine Valley Lateral Lines—Temporary ROW	5.3 miles	45.2 acres	1.6 miles	13.7 acres	3.7 miles	31.5 acres
Pine Valley Main Line—Long-term ROW	41.1 miles	248.8 acres	37.4 miles	226.6 acres	3.7 miles	22.2 acres
Pine Valley Main Line—Temporary ROW	41.1 miles	392.4 acres	37.4 miles	361.3 acres	3.7 miles	31.1 acres
Avon Road Corridor Main Pipeline—Long-term ROW	30.9 miles	187.5 acres	9.9 miles	60.2 acres	21.0 miles	127.3 acres
Avon Road Corridor Main Pipeline—Temporary ROW	30.9 miles	262.5 acres	9.9 miles	84.3 acres	21.0 miles	178.2 acres
Production Wells (# of Well Sites Evaluated)	15 (24)	15 acres	10 to 13 (19)	10 to 13 acres	2 to 5 (5)	2 to 5 acres
Existing Monitoring Wells	8	8 acres	8	8 acres	0	0 acres
Sentinel Wells	8	8 acres	8	8 acres	0	-
Solar Power Generation Sites	1	200 acres	0	0 acres	1	200 acres
Power Lines*	18.3 miles	0 acres	17.3 miles	0 acres	1 mile	0 acres
Mountain Springs Water Storage Tank Site	1	10 acres	1	7.6 acres	1	2.4 acres
Pressure-Reducing Station	1	1 acre	0	0 acres	1	1 acre
Staging Areas—Temporary ROW	18	48.6 acres	13	32.9 acres	5	15.7 acres
Access Roads—Permanent ROW	21.4 miles	18.2 acres	17.5 miles	14.9 acres	3.9 miles	3.3 acres

Facility	Total Quantity		BLM Quantity		Non-BLM Quantity	
	Quantity	Area	Quantity	Area	Quantity	Area
Wildlife Watering Areas**	-	273.6 acres ***	-	273.6 acres ***	0	0 acres

*Included within the pipeline long-term ROW, so no additional acreage is required.

**Not included in the Project ROW authorizations. Exclosure areas would be authorized separately.

***Affected acreage determined by the *Greater Sage-Grouse Net Conservation Gain Analysis* (available on ePlanning).

A summary of anticipated short- and long-term surface disturbance amounts (miles or acres) associated with the ANWS Alternative is presented in **Table 8**.

Table 8. ANWS Alternative—Long-Term Surface Disturbance

Facility	Total Area	BLM Area	Non-BLM Area
Production Well Houses	15 acres	13 acres	2 acres
Existing Monitoring Well Pads	400 ft^2	400 ft^2	0 ft^2
Sentinel Well Pads	400 ft^2	400 ft^2	0 ft^2
Solar Power Generation Site	200 acres	0 acre	200 acres
Power Poles	0.34 acre	0.34 acre	0 acres
Mountain Springs Water Storage Tanks	1 acre	0 acre	1 acre
Pressure-reducing Station	160 ft^2	0 ft^2	160 ft^2
Manholes (to access isolation valves)	1,014 ft^2	676 ft^2	338 ft^2
Unimproved Access Roads	18.2 acres	14.9 acres	3.3 acres
TOTAL	**234.6 acres**	**28.3 acres**	**206.3 acres**

Table 9 compares the difference in Project features between the Proposed Action and ANWS Alternative. The solar power generation site, existing monitoring wells, mountain springs water storage tanks, pressure-reducing station, and unimproved access roads would all be identical for both alternatives and are not included in the table.

Table 9. Comparison of Proposed Action and ANWS Alternative—Row Authorization and Surface Disturbance

Facility	Proposed Action	ANWS Alternative	Difference
Pipeline and Staging—Temporary ROW	643 acres	749 acres	106 acres

Facility	Proposed Action	ANWS Alternative	Difference
Total—Long-term ROW	664 acres	708 acres	44 acres
Well Sites Evaluated	15	24	9
Production Well Houses	15 acres	15 acres	0 acres
Power Poles	0.23 acre (282 poles)	0.34 acre (410 poles)	0.11 acre (128 poles)
Manholes (to access isolation valves)	975 ft^2	1,014 ft^2	39 ft^2

Construction and operation of all facilities would remain the same as described in the *Construction of Facilities* subsection above. The difference between the ANWS Alternative and the Proposed Action includes the siting of nine supply wells, some of the lateral pipelines, main pipelines, and power transmission lines. See **Appendix A, Figures 1 to 4** for detailed maps showing the Proposed Action and ANWS Alternative facilities.

The ANWS Alternative would cost an estimated $296 million.

2.2.5 Alternatives Considered but Eliminated from Detailed Analysis

The CICWCD and BLM considered and eliminated a few alternate pipeline routes primarily due to engineering constraints. Other alternatives considered, including those raised during the scoping process, are addressed below.

The BLM NEPA Handbook (H-1790) states that a considered alternative may be eliminated from detailed analysis if:

- It is ineffective (it would not respond to the purpose and need)
- It is technically or economically infeasible (consider whether implementation of the alternative is likely given past and current practice and technology; this does not require cost-benefit analysis or speculation about an applicant's costs and profits)
- It is inconsistent with the basic policy objectives for the management of the area (e.g., not in conformance with the Land Use Plan)
- Its implementation is remote or speculative
- It is substantially similar in design to an alternative that is analyzed
- It would have substantially similar effects to an alternative that is analyzed

A NEPA document should identify and assess reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions (40 CFR 1501.1) and describe alternatives that involve unresolved conflicts concerning alternative uses of resources (43 CFR 1501.2). The Interior Board of Land Appeals (IBLA) has determined that "Appropriate alternatives are those that will accomplish the project's intended purpose, are technically and economically feasible, and will avoid or minimize adverse environmental impacts" (IBLA 2020–403 and 2020–404). Alternatives which would not resolve a resource conflict and would not avoid or minimize adverse impacts to resources are not considered reasonable alternatives.

Table 10 provides a comparison of key factors among the two action alternatives, the No Action Alternative, and the alternatives considered but eliminated from detailed analysis. The two alternatives that were considered but eliminated from detailed study in this EIS are discussed in detail further below. A discussion of the refinement process for the Proposed Action over time is also included.

Table 10. Comparison of Alternatives—Summary of Effects

Alternative	Water Provision (afy)	Pipeline Length (miles)	Disturbance (total acres/ PHMA acres)	Resource and Design Factors	Meets Purpose and Need?	Estimated Cost ($ million)
No Action Alternative	-	-	-	-	No	$420
Proposed Action	15,000	70.0	1,307 / 536	Minimizes total ground disturbance	Yes	$254
ANWS Alternative	15,000	77.3	1,457 / 536	Minimizes groundwater drawdown impacts	Yes	$296
Phased-In Pumping or Lower Pumping Volume	<15,000	70.0	1,307 / 536	Already a feature of the action alternatives as part of the Adaptive Management, Monitoring, Mitigation Measures, and Reporting	Yes	$254
Temporary Use Until Equilibrium	15,000	70.0	1,307 / 536	Economic infeasibility due to need to still purchase water rights	Partial	Over $254
Wah Wah Main Pipeline Alternative (Beaver County State Route 21	15,000	131.5	1,904 / 429	Additional tanks (total 60 acres), booster pumping stations (30 acres), and	Yes	$450

Alternative	Water Provision (afy)	Pipeline Length (miles)	Disturbance (total acres/ PHMA acres)	Resource and Design Factors	Meets Purpose and Need?	Estimated Cost ($ million)
Utility Corridor)				(solar field (300 acres)		
Lake Powell Pipeline Inter-connection	13,000	50	750 / 0	High development cost per acre-foot of water; high ongoing operational costs	No	$418

Alternatives Beyond the Legal Authority of the BLM to Implement

The BLM could consider an alternative that is beyond its legal authority if it is reasonable and meets the criteria listed above. However, no such alternatives were suggested by the public or identified during the process of developing alternatives or analysis.

Phased-in Pumping or Lower Pumping Volume

The option to reduce pumping volume is incorporated as part of the action alternatives. The ROW grant would authorize pumping up to the maximum allowable withdrawal rates set by the Utah DWRi; however, the monitoring and mitigation plan described in **Appendix F** includes measures that would reduce the pumping rates or decrease the number of wells used to minimize or mitigate impacts, if necessary. Data from the monitoring wells would shift the timing, location, or volume of total pumping if the observation data show that actual drawdown exceeds what was modeled. This approach allows the CICWCD to utilize the full allocation of their state-issued water right while allowing for a lowering of the pumping volume to mitigate against environmental harm through adaptive management of the well field.

The monitoring and mitigation plan also includes the PVWS Project Well Field Construction Monitoring and Adaptive Management Program that would allow the well field to be developed in a way that would minimize groundwater drawdown impacts (**Appendix F**). This is a phasing in of pumping that is incorporated into the ANWS Alternative, although it is over a brief timeframe.

Temporary Use Until Cedar Valley Equilibrium is Achieved

An alternative raised during public scoping would involve the BLM granting a temporary ROW to allow Project pumping until groundwater equilibrium is achieved within the Cedar Valley. The Cedar City Valley GMP implemented by the State of Utah will gradually rescind water rights over the coming decades. Currently, the Cedar Valley aquifer is overutilized. As water rights are regulated under the GMP, additional sources of water will be necessary to provide for CICWCD demand, which will make the need for the Project greater. For the Cedar City Valley to achieve equilibrium without additional sources of water, Cedar City and the CICWCD would need to pursue purchasing water rights within the basin over the coming decades, which would likely occur if the No Action Alternative is selected. A temporary use alternative would essentially require two separate courses of action simultaneously: bringing in water from Pine Valley and purchasing existing Cedar City Valley water rights until the Project water is no longer needed (i.e., until the Cedar City Valley aquifer is in equilibrium). It would be economically infeasible for the CICWCD to both purchase many Cedar City Valley water rights and finance the PVWS Project, as the impact to Cedar City ratepayers and other customers served by the CICWCD would be extreme.

Wah Wah Main Pipeline Alternative (Use of State Route 21 Utility Corridor)

Using the State Route 21 utility corridor as designated in the Beaver County, Utah, RMP was an alternative suggested during public scoping. This corridor is designated by county ordinance with a width of 500 feet on either side of State Route 21 from where it intersects with the TransWest Express power line westward to the Millard County line (Beaver County 2019). Using this corridor would require the pipeline alignment to run north along Pine Valley Road until it intersects State Route 21. From there, the alignment would run along State Route 21 through Wah Wah Valley to just west of Milford where the TransWest Express transmission line crosses State Route 21. The pipeline would head south using rural roads, staying west of the railroad, until arriving at the intersection of 14400 N and Avon Road at the railroad crossing. From there, it would continue along the same alignment as the Proposed Action until the terminus near Cedar City. This pipeline alignment totals 131.5 miles. This is 61.5 miles (88 percent) longer than the Proposed Action alignment and 54.2 miles (70 percent) longer than the ANWS Alternative alignment. A map of the Wah Wah Main Pipeline Alternative alignment is available in **Appendix A**, **Figure 5**. Although this alternative is longer than continuing to follow State Route 21 to Minersville and then State Route 130 south to Cedar City, the described route avoids additional PHMA impacts and a higher elevation rise along State Route 130.

This alternative would require that water be pushed from Pine Valley over three rises, leading to a significant increase in energy needs and more solar power development compared to developing either the Proposed Action or ANWS Alternative main pipeline alignment. The summit along State Route 21 at the west side of Wah Wah Valley is 6,466 feet above sea level. The summit on the east side is 6,464 feet. These are 167 feet and 165 feet, respectively, above the current high point at the south end of Pine Valley, which is 6,299 feet above sea level. Water pressure would also have to potentially be boosted along the remainder of the route due to its length. This alignment would likely require a total of three booster pumping stations and tank sites plus an additional 300 acres of solar field to power the booster pumping stations. The total disturbance for the pumping stations and tanks would be approximately 90 acres. This alignment would cost an approximate $450 million.

Ultimately, this route would not alleviate any of the long-term resource impacts of the action alternatives analyzed in detail, as there would be no substantive reduction to the amount of long-term disturbance within Pine Valley PHMA (approximately a 1-acre difference). There would be a net reduction in the amount of temporary disturbance (approximately 100.3 acres), but this option would also reduce the ability to develop the proposed mesic meadow developments to provide for the net conservation gain for GRSG due to lack of pipeline to tap from through the southern section of Pine Valley. The total soil disturbance and impacts to vegetation would increase due to the 47 percent longer pipeline route. The potential for economic infeasibility is also high, as it is approximately twice the cost of the Proposed Action and ANWS alternatives. As this route would have substantially similar effects to the action alternatives, it has been dismissed from detailed analysis.

This alternative was also suggested as an alternative to allow consideration of potential future groundwater development within Wah Wah Valley by the CICWCD. This would reduce the amount of pipeline needed for well development within Wah Wah Valley in the future and make interconnection with the proposed Project easier. However, while the CICWCD owns water rights in Wah Wah Valley, no application or potential timeline for development of these water rights has been submitted to the BLM, nor is there a commitment of resources or funding. The feasibility of the PVWS Project does not depend on the development of a pipeline to put the Wah Wah water rights to use. The current situation does not meet the criteria of either a reasonably foreseeable future action or a connected action as discussed in the BLM NEPA Handbook (see sections 6.8.3.4 and 6.5.2.1). As the implementation of well and pipeline development in Wah Wah Valley is remote or speculative, the State Route 21 corridor alternative is eliminated from detailed analysis on this basis as well.

Lake Powell Pipeline Interconnection

An alternative was requested during scoping which would require the CICWCD to connect to the proposed Lake Powell Pipeline instead of developing their water rights in Pine Valley. The CICWCD began participating in the Lake Powell Pipeline Project back in 2006. The plan would have provided 13,000 afy of water and would have required a 50-mile interconnection pipeline along Interstate 15. In 2012, Cedar City and Enoch City voted unanimously by resolution to discontinue participation in the Project, and the CICWCD board followed suit. The 2,600-foot climb up to Cedar City added feasibility constraints and operations and maintenance costs, estimated to be 60 percent greater than the annual costs of operating the PVWS Project. The Lake Powell Pipeline would have had an estimated $418 million capital cost for the interconnection between Washington County and Cedar City for an estimated 13,000 afy of water (CICWCD 2013). This is a capital cost of over $32,000 per afy. The capital cost and ongoing costs were major considerations for Iron County municipalities in their discontinuation of participation in the Lake Powell Pipeline. Additionally, the CICWCD does not have any water rights associated with the Lake Powell Pipeline Interconnection.

The purpose of the Proposed Action is to convey water from existing water rights held by the CICWCD in Pine Valley to Cedar Valley. Only alternatives which meet this purpose are analyzed in this document. The Lake Powell Pipeline Interconnection is eliminated from detailed analysis, as it is ineffective in responding to the purpose and need.

Adjustments Made to Proposed Action to Avoid Resource Impacts

Pre-application discussions were initiated between CICWCD and the BLM in January 2015. Through this process, the initial proposed pipeline route was adjusted over time as resource constraints were identified and addressed. Issues contributing to route adjustments include avoiding Utah prairie dog colony sites, avoiding the Old Spanish Trail, and minimizing ground disturbance by locating Project infrastructure along established roads to the extent feasible. The CICWCD, coordinating with the BLM, refined the Project alignment as resource issues were identified and data were reviewed and evaluated. **Table 11** illustrates the changes made along the way to the Proposed Action main pipeline alignment. These changes also became part of the ANWS Alternative as it was developed.

Table 11. Considered Alignments and Facilities

Project Alignment or Facility Considered	Rationale
Railroad Alignment Alternative Main Line	This alignment would have required additional authorization from the railroad and private landowners. It would not have the benefit of using a disturbed corridor (i.e., road), as the alignment would be outside the disturbed railroad alignment. It would be 0.3 mile shorter than the Proposed Action alignment.
Lund Highway Alignment Alternative Main Line	This alignment would have resulted in a 3-mile longer pipeline alignment than the Proposed Action and would have required the pipeline to cross a slight rise. This is a technical challenge, as one engineering constraint is the desire to use gravity flow to transport the water to Cedar City.
Jockey Road Alignment Alternative Main Line	This alignment would have resulted in a 4.6-mile longer pipeline route than the Proposed Action or ANWS Alternative. The Jockey Road alignment would require the groundwater well pumps to overcome an additional 400 feet of elevation, resulting in additional power needs which would require a larger solar development.
Solar Field Installation versus Transmission Line	An early iteration of the POD included the installation of a power transmission line between existing utility infrastructure and the Project facilities within Pine Valley. This design would not have required the solar field within Pine Valley, but it would have included approximately 55 additional miles of power poles and power transmission line along Mountain Springs Road and Pine Valley Road. Impacts to avian species and visual resources would have been greater under this design. The Project design was changed to include the development of a solar field within Pine Valley as the power source for the Project needs and less than 12 miles of power lines under the Proposed Action.
Old Spanish Trail Avoidance Adjustment	The original proposed alignment west of Iron Springs Road where it intersects Antelope Springs Road was adjusted to avoid a newly recorded segment of the Old Spanish Trail, an important historic resource in the greater southwestern United States, and other cultural sites. The alignment was adjusted in consultation with the Old Spanish Trail Association, and the new alignment was surveyed in a supplemental cultural resource survey. The resulting alignment change would avoid the site by 10 meters and eliminate the potential for adverse impacts to the Old Spanish Trail.
“Greenfield” Adjustment to Avoid Utah Prairie Dog	During biological surveys, the alignment was adjusted to avoid mapped Utah prairie dog colonies between the railroad crossing near Lund and the intersection with Mountain Springs Road. This is a section of approximately 2.5 miles. The alignment was adjusted to avoid mapped colonies by more than 1,000 feet. This change minimizes the potential for adverse impacts to Utah prairie dog, a threatened species under the ESA.

CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

This chapter describes the biological, cultural, physical, social, and economical resource values and uses that could be affected by implementation of the proposed Project or alternatives.

3.2 Scope of the Analysis

Resources which were considered for analysis are listed in the IDT NEPA Checklist (**Appendix B**). Resources which are not present or would not be impacted to a degree requiring detailed analysis will not be discussed further in this document. Only resources that need detailed analysis for an informed decision to be made and/or could potentially rise to the level of significance are included in this chapter. Issues related to environmental justice, livestock grazing, migratory birds, socioeconomics, soils, special status wildlife, vegetation, and water resources are analyzed below.

3.2.1 Cumulative Impact Analysis

Cumulative impacts result when the effects of an action are added to or interact with effects from other actions in a particular place and within a particular time. The cumulative impacts of an action can be viewed as the total effects of that action on a resource, ecosystem, or human community and all other activities affecting that resource regardless of what entity (federal, non-federal, or private) is taking the actions (CEQ 1987).

Considerations that go into evaluating cumulative effects include the following: 1) whether the resource is especially vulnerable to incremental effects, 2) whether the Proposed Action is one of several similar actions in the same geographic area (including the pipeline route and immediately surrounding area from Pine Valley to the Cedar Valley), 3) whether other activities in the area have similar effects on the resource, 4) whether these effects have been historically significant for this resource, and 5) whether other analyses in the area have identified a cumulative effects concern (CEQ 1987).

Projects Identified

Past and present projects and uses contribute to the current condition of each of the resources considered for analysis and are described as part of the affected environment throughout this chapter. Most of these uses are anticipated to continue into the foreseeable future. The following additional projects have been identified as reasonably foreseeable future actions for consideration within the cumulative impact analysis:

- Current pumping and reasonably foreseeable increases in pumping within neighboring hydrographic areas (HAs):

    - Projected drawdown from groundwater withdrawal in Snake Valley HA and Hamlin Valley HA that is cumulatively considerable with the Proposed Action and ANWS Alternative[1]
    - Drawdown within the northern portion of the Beryl-Enterprise area HA and the southern Sevier Desert HA that is cumulatively considerable with the Proposed Action and ANWS Alternative[1]
    - There are currently no proposals to develop the water rights held by CICWCD in Wah Wah Valley or its water right application in Hamlin Valley; therefore, these are not considered in the cumulative impact analysis.
    - Similarly, Southern Nevada Water Authority's groundwater supply development project in Clark, Lincoln, and White Pine counties in eastern Nevada has been withdrawn and therefore, is not considered in the cumulative impact analysis
- Crystal Peak Minerals Mine Development
    - Crystal Peak Minerals has secured water rights around Sevier Lake and the Sevier Lake Playa. These are within the geographic scope of the estimated groundwater impacts of the Proposed Action

Other activities that are considered within the cumulative effects analysis area include the ongoing use of Pine Valley Road and Avon Road at the current traffic levels for livestock and recreational uses. Livestock grazing use is an established land use for consideration in cumulative impact analysis on BLM-administered lands. Renewable energy development has previously been considered for both Pine Valley and Wah Wah Valley. However, there are no current proposals for renewable energy development that would be in close proximity to the Proposed Action or ANWS Alternative. The Project would not preclude the future development of renewable energy and is not anticipated to have any net negative effect on renewable energy development.

The Project was initially proposed as part of a larger "West Desert Pipeline Project" that included additional well and pipeline developments in Wah Wah Valley and Snake Valley. These future projects are excluded as reasonably foreseeable future actions because there is no existing proposal, no permit applications have been submitted to the BLM, and no commitment of resources has been made for these projects. The location and timeframe for developing this infrastructure is completely speculative at this point; if considered, it would likely occur later than the 50-year planning horizon of the PVWS Project. The BLM is not required to analyze speculative developments.

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[1] As discussed in the Groundwater Resources Impact Assessment for the Project (Formation, 2020), although it is likely that groundwater extraction to support agricultural development in the Hamlin Valley, Snake Valley and Beryl-Enterprise HAs will continue for the foreseeable future, forecasting withdrawal rates becomes increasingly uncertain over time. Current groundwater demand and drawdown trends in these areas indicate that curtailment of pumping is reasonably foreseeable under existing State requirements in the next few decades to avoid significant adverse impacts to spring discharge and groundwater-dependent ecosystems. For this reason, the analysis of potential cumulative impacts is based on simulating pumping at the current rates for the PVWS planning horizon of 50-years. This is deemed sufficient to analyze whether there is a potential for significant cumulative impacts associated with implementation of the PVWS Project together with reasonably foreseeable pumping in the surrounding HAs.

3.2.2 Incomplete or Unavailable Information

As part of the NEPA analysis, several other technical reports were prepared in support of the impact analysis and findings. A groundwater model was developed from the best available USGS science that includes the Great Basin Carbonate and Alluvial Aquifer System (GBCAAS) model and hydrogeologic study of Pine Valley. Every effort has been made to develop a robust groundwater model based on the best available science by thoroughly reviewing published geologic sections, reviewing previous studies and water chemistry analysis, reviewing available well logs, incorporating precipitation and evapotranspiration data, and making appropriate refinements to the water budget and other model parameters based on this analysis. Therefore, the resulting GBCAAS-PV groundwater model used for the Project can be reasonably used to predict Project impacts as a credible research method accepted by both BLM and USGS staff. However, it is still a model with all inherent limitations. Some of the data necessary to fully understand Project impacts will not be known until the aquifer has been stressed for a number of months or years after groundwater withdrawal commences. The monitoring and mitigation plan (**Appendix F**) includes measures to limit the groundwater impacts to what have been modeled by the GBCAAS-PV model in lieu of the incomplete and unavailable information at this time. As additional data becomes available, this will be used to adjust and refine the groundwater model.

3.2.3 Project Planning Horizon

During the initial stages of the environmental planning process, the BLM and USGS decided to move forward with a planning horizon of 50 years of project groundwater pumping followed by 200 years of aquifer recovery. Other timeframes considered included scenarios of up to 200 years of groundwater pumping followed by 200 years of recovery. A 200-year scenario was deemed to rely upon assumptions and information that are unavailable or highly uncertain and therefore not essential to a reasoned choice among alternatives. The PVWS Project is subject to adaptive management, the DWRi water right order for the Project, and the Utah State Code. These would curtail pumping if the safe yield of the basin is exceeded or prior water rights are impaired (Section 1.5.1). Consequently, the assumption that pumping can continue at the same rate for more than 50 years was determined to be speculative.

The CEQ regulations require the BLM to obtain information if it is "relevant to reasonably foreseeable significant adverse impacts," if it is "essential to a reasoned choice among alternatives," and if "the overall cost of obtaining it is not exorbitant" (40 CFR 1502.22). BLM NEPA Handbook (H-1790-1), Section 6.7.2. states that the following information should be provided in a NEPA document when this is the case:

1. A statement that such information is incomplete or unavailable.

2. A statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment.

3. A summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment.

4. The agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if

their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason [40 CFR 1502.22(b)].

A detailed 200-year pumping analysis is not included in this document because modeling a 200-year pumping scenario relies upon assumptions and information that are unavailable or highly uncertain. Nevertheless, a scoping-level analysis was completed for a 200-year pumping scenario to provide perspective on the kinds of impacts that could occur if pumping were to continue at the same rates by the PVWS Project and in the surrounding hydrologic areas. More information about a 200-year pumping scenario is contained in Section 3.11 and in the *Technical Memorandum–Supplemental Analysis of Drawdown, Spring Flow Depletion and Wellfield Effects Assuming a Theoretical 200-Year Project Pumping Duration, Pine Valley Water Supply Project, Iron, Beaver and Millard Counties, Utah* (hereafter *Supplemental 200-Year Analysis*) available on the ePlanning project website.

3.3 Environmental Justice

This section identifies minority and low-income populations and analyzes the effect of the Proposed Action and alternatives on these populations. The area of effects analyzed includes Iron and Beaver counties.

3.3.1 Issues to be Addressed in the Analysis

The following environmental justice issues were identified in public and agency scoping:

- How would the Proposed Action affect rural communities in western Utah and eastern Nevada?
- Would the Project disproportionately affect disenfranchised communities and Tribes in western Utah?
- What would the effect of the Proposed Action be on rate payers within the CICWCD's service territory, and how would low-income populations be affected?

3.3.2 Affected Environment

Evaluating the potential environmental justice effects of projects requires specific identification of low-income and minority populations when either 1) a low-income or minority population exceeds 50 percent of the population of the affected area or 2) a low-income or minority population represents a meaningfully greater increment of the affected population than of the population of some other appropriate geographic unit as a whole. For the purposes of this analysis, 10 or more percentage points above the reference population is a meaningfully greater increment to satisfy the guidelines in Section 3-3 of Executive Order 12898.

In addition, a Native American environmental justice population is present if there are one or more concentrated populations of American Indians living within one or more of the geographic polygons (block-groups) included in the analysis. Census block-groups generally contain between 600 and 3,000 people, with an optimum size of 1,500 people. There are about 39 blocks per census group. Block-groups never cross the boundaries of states, counties, or statistically equivalent entities, except for a block-group delineated by American Indian tribal authorities.

Using the Environmental Protection Agency's (EPA) Environmental Justice Screening and Mapping Tool, a total of four block-groups were found to intersect the Proposed Action and alternatives (EPA 2019) (**Table 12**). The Project would affect three counties in Utah, so the reference population is the population of the state of Utah.

Table 12. Groups Intersecting the Proposed Action and Alternatives (EPA 2019)

Population Examined	Low Income (%)	Minority (%)	Native American (%)
Block-group 490211105002	44	35	5
Block-group 490211104001	69	30	2
Block-group 490211104002	46	9	2
Block-group 490211106004	74	10	8
State of Utah	10	21	1

Based on the two factors above for identifying low-income and minority populations, a low-income environmental justice population is present, a minority environmental justice population is present, and a Native American environmental justice population is present. The percentage of the population identified as belonging to either a low-income or minority group in some of the block-groups analyzed is more than 10 percentage points higher than the reference population. Additionally, there are concentrated populations of American Indians living within some of the block-groups included in the analysis.

Block-groups that represent rural Iron County (490211103001), rural Beaver County (490011002001), rural Millard County (490279742003), and rural Lincoln County (320179501001) that are within the potential area of effect of the groundwater drawdown due to the action alternatives have a maximum of 30 percent low-income population.

3.3.3 Environmental Consequences

Impacts from the Proposed Action

Under the Proposed Action, construction costs would be spread over water bills and impact fees. The CICWCD has prepared a Financial Business Plan and Water Needs Assessment that outlines the amount and timing requirement for additional water supply needed to address the supply gap in the Cedar Valley basin (Carollo 2020). This plan reviews six options for providing additional water and what the impacts would be on rate payers within Cedar City and other customers served by the CICWCD. For the Proposed Action (Scenario 5 in the report), Cedar City rate payers are anticipated to see a monthly bill increase of $54 above the current $17 average by 2030 (Carollo 2020). This is a 320-percent increase over current water rates. Since the rate increases would be spread evenly across all users, low-income populations would be disproportionately affected by regressive nature of the increase. A 320-percent increase in water rates would be more difficult for low-income Cedar City customers to bear compared to residents with higher incomes. A $54 monthly bill increase represents 0.13 percent of the median annual income in Cedar City, which was $48,346 in 2019, averaged over 2015 to 2019 (Census Bureau 2020c). For a family of four with an income at the 2019 weighted-average poverty threshold of $26,172 (Census Bureau 2021), the $54 monthly bill increase translates to 2.5 percent of annual income. By addressing the current water deficit by making more water available, the volatility of water bill changes would be more predictable, as Cedar City and the CICWCD would have a reduced need to purchase senior agricultural water rights to convert to municipal use. Water rights purchased to meet growing demand would likely be in a sellers' market, and the financial impact of purchasing these rights and converting them to CICWCD use is discussed under the No Action Alternative. Under the action alternatives, impacts to water bills would happen sooner as a discrete jump in price, as the Project would be financed up front.

Effects from pipeline construction may also impact rural environmental justice populations. The pipeline would pass through block-groups in western Beaver County and northwestern and central Iron County, all with exceptionally low population densities. Neither of the block-groups through which the pipeline passes have a low-income population over the 50th percentile. Environmental justice concerns from construction are negligible for the 90 percent of the pipeline outside the vicinity of Cedar City due to the rural location of the Project and lack of population that could be affected. Closer to the city, solicited commentary indicates worries that noise, dust, and inconvenience would be worse under the Proposed Action than under the No Action Alternative. Block-groups in this area have comparable proportions of low income and minority populations to those reported above, so differential impacts on environmental justice would be unlikely.

The block-groups that cover the area potentially affected by groundwater withdrawal do not have a low-income population higher than the 53rd percentile. The population density in these areas is very low. Groundwater withdrawal has the potential to affect aboveground and belowground water rights. It is unknown whether any of these rights are owned by low-income or disenfranchised individuals. In the event that any of these water rights are impacted due to groundwater drawdown, the Interference Drawdown Monitoring and Mitigation Program contained in the Adaptive Management, Monitoring, Mitigation Measures, and Reporting section would make these water rights holders whole (**Appendix F**). Potential impacts due to groundwater drawdown are not anticipated to reach the rural communities of Milford, Baker, and Beryl.

Further, while there is a concentrated Native American population in and around a reservation in Cedar City, its lands are far from planned construction. No Native American tribal lands are present in the vicinity of pipeline construction or within the area of potential effects of groundwater drawdown.

Impacts from the ANWS Alternative

Construction costs under the ANWS Alternative would be spread out in the same manner as under the Proposed Action. Due to the higher cost of this alternative, the effect on rate payers is estimated to be an increase of $63 monthly. This is a 370-percent increase over current rates. A $63 monthly bill increase represents 0.16 percent of the median annual income in Cedar City, which was $48,346 in 2019, averaged over 2015 to 2019 (Census Bureau 2020c). For a family of four with an income at the 2019 weighted-average poverty threshold of $26,172 (Census Bureau 2021), the $63 monthly bill increase translates to 2.9 percent of annual income. This increase would happen as a discrete jump in price as opposed to a gradual increase.

Additional environmental justice effects beyond what are described under the Proposed Action are not anticipated, since there is no population that would be impacted by the additional pipeline construction required under this alternative.

Impacts from the No Action Alternative

The primary environmental justice concerns are related to water availability and municipal water bills. The analysis shows that impacts under the No Action Alternative have the result to potentially result in higher costs to customers when compared to the action alternatives. Under the No Action Alternative, the CICWCD would be unable to develop its Pine Valley water rights, as there is no other feasible route for them to transport water back to their system that does not require crossing BLM-managed lands.

Considering this, under the No Action Alternative, the CICWCD and Cedar City would both have to acquire and develop existing senior water rights—likely agricultural water rights—within the Cedar City Valley basin, which is the basin on which several tribal members and the residents of Cedar City largely rely. As the Cedar City Valley GMP will slowly regulate water rights within the basin (from most junior to more senior), both the CICWCD and Cedar City would have to cover the costs of acquisition and abandonment of this agricultural water. The CICWCD would need to obtain water rights to meet their customers' needs, but the bulk of the need is for Cedar City, which has more junior rights. Acquisition and development of senior water rights within the Cedar City Valley is anticipated to be very expensive.

The cost of the strategy under the No Action Alternative is estimated to be $420 million over the next 50 years to provide up to 12,000 afy by 2070. The cost of water acquisition would come through water bill increases to Cedar City municipal customers that would disproportionately affect low-income populations. The estimated cost of the No Action Alternative is higher than the Proposed Action ($253.6 million) and ANWS Alternative ($295.5 million). By 2070, water bills would be expected to be higher under the No Action Alternative than under either of the action alternatives. This total increase could be more than 50 percent higher. However, the impact to water bills would be gradual over time as new water rights are acquired. It is important to note that the costs of acquiring future rights under the No Action Alternative could be high and volatile. The State of Utah cannot revoke water rights held for speculation. Water bills for residential customers in the Cedar City service territory would increase under the No Action Alternative, which would unduly affect low-income populations, potentially to a greater extent than the action alternatives.

The ability of Cedar City or the CICWCD to obtain alternative water rights is not guaranteed. Water rights can only be purchased when they become available for sale. Without any other water source, Cedar City Valley would continue to be overdrawn and water rights would be rescinded based on the draft Cedar City Valley GMP. If Cedar City is unable to source additional water, the municipality would likely experience restrictions on new development and water usage by current residents. If the water supply becomes constrained by 2040, the total economic loss over the subsequent decade is estimated at $1 billion (Applied Analysis 2019b). This would have a negative economic effect on environmental justice populations.

Given the projected cost of acquiring water rights to meet projected demand by the CICWCD and Cedar City, the Cedar City Valley GMP to remedy the declining Cedar Valley aquifer has created conditions in which the Proposed Action or the ANWS Alternative would likely have lower environmental justice impacts than the No Action Alternative.

Cumulative Impacts from the Action Alternatives

The rural communities within the area of effect of groundwater drawdown would also experience drawdown from pumping in HAs around Pine Valley and the Crystal Peak Minerals Sevier Playa Potash Project (CPM Project). In some of these areas, the Proposed Action and ANWS Alternative would lead to cumulative drawdown, specifically within Hamlin Valley and the Beryl-Enterprise area. There are a number of wells that could be impacted due to well interference drawdown. It is unknown whether any of these rights are held by minority or environmental justice populations. However, the CICWCD would implement the Adaptive Management, Monitoring and Mitigation Program to address these impacts (see **Appendix F** and Chapter 5 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). No cumulative environmental justice impacts are identified due to the construction of the action alternatives along with other rural uses in Pine Valley.

Cumulative Impacts from the No Action Alternative

There would be no potential cumulative impacts to rural communities due to groundwater drawdown under the No Action Alternative, as the Project would not be constructed or operated. There could be cumulative impacts to rural communities in the Cedar Valley due to the purchase of agricultural water rights by either Cedar City or the CICWCD. These would be converted to municipal water rights, and any agricultural uses supported by these water rights would be retired. This would result in a net negative effect to the agricultural production in the Cedar City area. It is unknown what overall effect this would have on environmental justice populations.

3.4 Livestock Grazing and Rangeland Management

The area of effects analysis for livestock grazing and rangeland management includes all grazing allotments intersected by the Proposed Action and ANWS Alternative.

3.4.1 Issues to be Addressed in the Analysis

The following livestock grazing, and rangeland management issues were identified in public and agency scoping:

- Would the Proposed Action potentially result in lessened availability of livestock water, changes to the AUM of the livestock allotments on BLM lands, and disturb or adversely impact rangeland facilities (e.g., cattle guards, fences, pipelines, troughs, etc.)?
- Would rangeland management and livestock use potentially be impaired by the proposed Project?

3.4.2 Affected Environment

The carrying capacity of a livestock grazing allotment is defined in terms of AUMs. In general terms, an AUM is the amount of forage needed to sustain one cow and her calf for 1 month. Seventeen BLM-administered livestock grazing allotments are located within or near the proposed Project area, and livestock grazing occurs within the Project area during much of the year. Additional grazing occurs on private and SITLA lands in association with the BLM grazing allotments and is not discussed separately in this EIS. In the Project area, the BLM-administered grazing allotments have a total of 18,276 AUMs (BLM 2017). Most livestock grazing are cattle, with smaller numbers of sheep.

Several springs in the mountains surrounding Pine Valley have associated water rights and points of diversion for stock watering and represent an important water source for seasonal grazing activities. As discussed further in Section 3.10, Wah Wah Springs is the only spring within the area of potential Project drawdown effects that is thought to be connected to the regional aquifer system (Brooks 2017; Gardner et al. 2020; Stephens 1976). The best available geochemical and geologic data indicate that other springs in the mountains surrounding Pine Valley discharge groundwater from local perched or semi-perched aquifers and would not be affected by groundwater pumping from the regional aquifer system; however, this cannot be conclusively verified until the aquifer is significantly stressed by PVWS Project drawdown.

Land subsidence can occur where there are clay sediments. In the geologic setting of Pine Valley, clay deposits are most likely to be found in the northern portion of the valley. Extensive clay deposits susceptible to subsidence are unlikely to occur in the alluvial fans that ring the valley or in valley stream deposits that underlie the southern portion of the valley. In Escalante Valley and Cedar Valley, subsidence was reported to be associated with groundwater level drawdowns exceeding 100 feet (Forster 2006; Knudsen et al. 2014; Lund et al. 2005). The maximum subsidence reported in these valleys was about 3 feet, which is roughly 1 foot of subsidence per 30 feet of drawdown. The data are insufficient to establish a reliable correlation between predicted drawdowns and subsidence in Pine Valley. As such, correlations depend on local geologic and geotechnical conditions that vary between basins and from place to place within a basin. In addition, in Pine Valley the water table is much deeper, meaning that subsidence must be transmitted upwards through a greater thickness of sediment.

3.4.3 Environmental Consequences

Impacts from the Action Alternatives

Approximately 274 acres would be removed from livestock use by the GRSG and other wildlife mesic meadow exclosure areas across multiple allotments (see maps in the *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]). The construction of well houses would permanently reduce the total area by no more than a few acres. The pipeline alignment would be reclaimed. Given the substantial size of the allotments compared to the permanent Project footprint, it is not anticipated that construction and maintenance activities would result in any negative changes to the AUMs. There would be a loss of forage within the grazing allotments due to surface disturbance, most of which would be temporary. Livestock may be temporarily displaced in the vicinity of Project construction due to construction activities. This impact may last for several months up to multiple years, but the area impacted is relatively small compared to the total allotment acreage. See **Table 13** for the short-term and long-term impacts to grazing allotments.

Table 13. Surface Disturbance Acreage Within Grazing Allotments

Grazing Allotment	Allotment Acreage	Proposed Action		ANWS Alternative	
		Short-term	Long-term	Short-term	Long-term
Big Hollow Wash	8,405	69	-	69	-
Buckhorn	34,190	54	1	61	2
Butte	32,258	89	-	89	-
Dick Palmer Wash	16,659	101	-	101	-
Hardpan	45,450	0	-	-	<1
Jackson Wash	12,253	0	-	-	-
Iron Springs	29,012	11	-	11	-
Lindsay Mine	1,271	28	-	28	-
Lone Pine Spring	31,717	98	-	98	-
Lund	48,335	92	-	92	-
Mountain Spring	28,562	102	-	102	-
North Pine Valley	75,496	57	8	72	9
Pine Valley	6,650	39	10	39	10
South Pine Valley	71,316	<1	<1	84	7
Three Peaks	5,929	21	-	21	-
Tucker Point	7,554	4	-	4	-
Water Hollow	32,301	563	209	563	209
TOTAL	**487,358**	**1,328**	**228**	**1,434**	**237**

Less than 0.3 percent of the total acreage of the grazing allotments listed in **Table 13** would experience short-term loss of forage due to construction ground disturbance under either the Proposed Action or ANWS Alternative. The pipeline ROW, staging areas, and other temporarily impacted acres would be reclaimed following construction, so long-term loss of forage is not anticipated. Only two individual grazing allotments would experience short-term ground disturbance in excess of 1 percent of the allotment area. A total of 2.2 percent of the Lindsay Mine Allotment and 1.7 percent of the Water Hollow Allotment would experience temporary ground disturbance for pipeline construction followed by reclamation under the Proposed Action or ANWS Alternative. None of the Lindsay Mine Allotment would be affected in the long term; the allotment would only experience short-term forage loss due to construction. The Water Hollow Allotment acreage would be reduced by 0.65 percent over the long term by the construction of permanent aboveground facilities. The only other allotment with long-term reduction in area in excess of 0.1 percent due to the installation of aboveground Project facilities is the Pine Valley allotment; this allotment would be reduced by 0.15 percent. These short-term and long-term impacts are not anticipated to result in the loss of AUMs.

Project construction activities have the potential to impact rangeland facilities such as pipelines, fences, and troughs that are within the temporary and long-term ROW. As part of the Project design features, the CICWCD would be responsible to ensure improvements stay in serviceable condition, replacing or repairing any that are moved or damaged. This would minimize or avoid impacts to rangeland improvements.

The proposed wildlife watering areas for GRSG and other species includes a provision for additional stock water at two locations (see maps in the *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]). Both the Proposed Action and the ANWS Alternative would result in the development of wildlife mesic meadow areas and provision of available water for both wildlife and livestock. The provision of additional livestock water would be intended to mitigate any potential reduction in spring flows that could lessen availability of livestock water on the BLM allotments within Pine Valley, although this is not anticipated, as springs within the valley are understood to be disconnected based on the *Groundwater Resources Impact Assessment* (available on ePlanning). Based on previous USGS investigation, the springs in the mountains and valleys surrounding Pine Valley are believed to derive their discharge from perched mountain aquifers, with the exception of Wah Wah Springs, a spring believed to be connected to the regional aquifer. Nevertheless, because potential connection cannot be ruled out, a spring flow depletion monitoring and mitigation program would be implemented that includes monitoring several local springs (see *Groundwater Resources Impact Assessment* (available on ePlanning) Section 6.2.6). This program would monitor surface water sources and take corrective action that would mitigate any spring flow loss that may affect livestock water sources.

The new livestock water locations could potentially change livestock distribution across allotments. Livestock would potentially congregate in these areas, altering existing grazing patterns.

Subsidence similar to that reported in Escalante Valley and Cedar Valley is possible due to either the Proposed Action or ANWS Alternative, and the formation of local fissures could be a hazard to livestock and ranching operations. The Subsidence Monitoring and Mitigation Program contained in the Groundwater Monitoring and Mitigation Plan (**Appendix F**) would detect potential subsidence, adjust pumping strategies to minimize or avoid damaging subsidence, and repair potential damage caused by drainage changes, fissures, and damage to surface infrastructure. With the implementation of this program, potential adverse impacts to rangeland ranching operations, rangeland facilities, and livestock would be mitigated.

Increased vehicle traffic along Pine Valley Road due to Project operation and maintenance could result in an increase in livestock-vehicle collisions.

Because no AUMs would be lost and any damage to livestock-related structures would be repaired, projected effects resulting from Project implementation would be minor and short term. Provision of additional stock water would mitigate against any long-term impairment of livestock grazing and rangeland management.

Cumulative Impacts from the Action Alternatives

There are no other projects identified within Pine Valley that would cumulatively impact livestock use or the BLM AUMs. Either action alternative would temporarily impact livestock and rangeland infrastructure, as described above. A cumulative increase in vehicular traffic along Pine Valley Road due to Project operation and maintenance could result in an increase in livestock-vehicle collisions. Existing, planned, and reasonably foreseeable pumping within and around Pine Valley would not add measurably to drawdown in the valley and would not cumulatively add to the potential for subsidence or affect livestock water sources (see *Groundwater Resources Impact Assessment* [available on ePlanning]).

Impacts from the No Action Alternative

The pipeline and wildlife mesic areas would not be developed, so there would be no additional water provided to livestock troughs and no exclosures would be created within the grazing allotments. There would be no new impact to livestock grazing and rangeland management.

3.5 Migratory Birds

3.5.1 Issues to be Addressed in the Analysis

The following migratory bird issues were identified in public and agency scoping:

- Would the proposed Project adversely impact migratory bird species known to nest within the Project area?
- Would the proposed Project adversely impact migratory bird species that winter (i.e., forage) within the Project area?

3.5.2 Affected Environment

Within Beaver and Iron counties, the migratory bird nesting season can be divided into two major timeframes:

- Early Nesting Season: January 1 to March 31 (e.g., eagles, owls, falcons, and hawks)
- Primary Nesting Season: April 1 to July 31 (e.g., songbirds and the majority of other avian species)

The maximum period for the migratory bird nesting season can extend from January 1 through August 31. Various habitats used by migratory birds are present in the areas where Project actions are proposed. This includes primarily upland habitats used as migration stopover areas when species move through the area in the spring and fall as well as breeding areas during the spring and summer. Local vegetation provides necessary cover and foraging opportunities needed by migratory birds.

Twelve migratory bird species of concern were identified as having the potential to occur within in or adjacent to the Project area: bald eagle (*Haliaeetus leucocephalus*), burrowing owl (*Athene cunicularia*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chysaetos*), Brewer's sparrow (*Spizella breweri*), green-tailed towhee (*Pipilo chlorurus*), lesser yellowlegs (*Tringa flavipes*), olive-sided flycatcher (*Contopus cooperi*), pinyon jay (*Gymnorhinus cyanocephalus*), sage thrasher (*Oreoscoptes montanus*), Virginia's warbler (*Vermivora virginiae*), and willet (*Tringa semipalmata*) (UDWR 2019; USFWS 2019). Impacts to some of these species are directly addressed in Section 3.9.

Of these twelve species, three were observed during Project biological surveys: ferruginous hawk, golden eagle, and pinyon jay. Two others (sage thrasher and burrowing owl) are likely to occur within the Project area, as there is suitable habitat present.

3.5.3 Environmental Consequences

The analysis of potential impacts to migratory birds is evaluated quantitatively based on the number of acres of foraging habitat potentially impacted within the Escalante Desert and Pine Valley subbasins.

Impacts from the Proposed Action and ANWS Alternative

Long-term nesting and foraging habitat loss up to 211 acres under the Proposed Action would occur with planned permanent infrastructure (e.g., well houses, solar power generation sites, power poles, etc.). Additionally, short-term disturbance of nesting and foraging habitat of up to 1,153 acres would occur due to Project construction activities (i.e., pipeline ROWs). However, this represents less than 1 percent of the total acreage of habitat present within the Escalante Desert and Pine Valley subbasins and would not result in a substantial decrease of nesting and foraging habitat quality within these subbasins.

Project construction activities could also disturb nesting migratory birds in the immediate vicinity. Construction noise and activities and human presence could result in nest abandonment or neglect or disrupt foraging activity, reducing reproductive success. However, impacts to migratory birds are expected to be minimal if work activities are conducted outside the nesting seasons. If work must be conducted during the nesting season, resource protection measures to avoid or reduce impacts would be implemented (MB-1 through MB-3) (**Appendix C**).

The creation of mesic meadow areas has the potential to benefit migratory bird species. Up to 14 mesic meadow locations could be created, with up to 300 acre-feet of water provided annually by the CICWCD for wildlife. These mesic meadow areas could improve nesting or brood-rearing habitat for some species.

Cumulative Impacts

Other sources of potential impacts include disturbances from other regional activities (i.e., ranching), which may be cumulatively detrimental to migratory birds. However, as the long-term Project activities are restricted to established roads and routinely used two-track roads to several well houses, cumulative impacts to migratory birds are not anticipated.

Impacts from the No Action Alternative

No impacts to migratory birds would occur from construction of the pipeline. Pine Valley Road and other public roads would continue to be used at current traffic levels. The wildlife mesic area development that may be beneficial to migratory birds would not occur under the No Action Alternative.

3.6 Native American Religious Concerns

3.6.1 Issues to be Addressed in the Analysis

The following Native American Religious Concerns issues were identified in public and agency scoping:

- How would the Proposed Action affect tribal cultural resources and sacred sites?

3.6.2 Affected Environment

Archaeological evidence indicates that Native Americans have used the natural resources in the planning area for thousands of years for a wide variety of cultural traditions. Many contemporary Native American Tribes state they are descendants of the groups who once occupied this area, including but not limited to the Hopi Tribe of Arizona, Navajo Nation (Arizona, New Mexico, and Utah), San Juan Southern Paiute Tribe, Paiute Indian Tribe of Utah, Ute Indian Tribe, Ute Mountain Ute Tribe, and Confederated Tribes of the Goshute Reservation (Nevada and Utah). Many of the Tribes with traditional ties to lands in the planning area hold a deep interest in the resources under CCFO jurisdiction and the use of those resources. There are 2,503 acres of tribal land and one withdrawal of 4,844 acres on public lands held by the Paiute Indian Tribe of Utah in the planning area. Specific sites, large geographic areas, natural features, and historical objects in the planning area could be important to Tribes for their sacred or religious/spiritual association.

The BLM initiated government-to-government consultation prior to publication of the Notice of Intent. Preliminary Project information was provided to 15 Tribes to identify potential issues and concerns for the preparation of an EIS. The Confederated Tribes of the Goshute Reservation and the Paiute Indian Tribe of Utah submitted comments. A presentation was provided at the tribal council meeting of the Paiute Indian Tribe of Utah on February 1, 2021.

3.6.3 Environmental Consequences

Impacts from the Proposed Action and ANWS Alternative

The Paiute Indian Tribe of Utah stated in writing that the CICWCD "will siphon away water resources that are interwoven with our ancestral land, our culture, our religion, and our existence as native people." They have expressed concerns that the Project would affect their tribal water rights. Additionally, the Kanosh and the Cedar Bands stated the Project infringes on their unadjudicated reserved water rights established generally by the United Supreme Court in *Winters v. United States*, 207 U.S. 564 (1908). Both Bands also state that the temporary and permanent ROWs and the numerous buried facilities would disturb significant acreage within the Tribe's ancestral territory and ceded land and may disturb tribal graves, artifacts, ceremonial sites, and cultural resources. Additionally, the Cedar Band is concerned about recharging the aquifer near its reservation and ensuring that pipeline distribution facilities are designed and located in a manner that also serves Band statutory and reserved rights.

The Confederated Tribes of the Goshute Reservation believe the Project "could deprive tribal communities of environmental assets needed for their health, safety, and wellbeing." Additionally, the Tribes identified themselves as the senior water rights holder from the time of the Shoshoni-Goship Treaty, signed in Tuilla (Tooele) Valley on October 12, 1863, and ratified by Congress and signed into law on January 17, 1865, by President Lincoln. The Confederated Tribes are supportive of adaptive management if the Project is approved and want to be identified as a tribal stakeholder for any monitoring and mitigation plan.

The groundwater modeling conducted for the Project shows that the anticipated drawdown after 50 years of pumping and 200 years of recovery does not extend to the groundwater basins where tribal reservations are located. In addition, the federal reserved water rights associated with each reservation have not yet been quantified or adjudicated, so there is not a method to quantify impacts in the extremely unlikely event that unexpected drawdowns occur in the basins where the reservations are located.

If the Tribes conclude that there is a possibility that long-term operation of the proposed Project may affect their federal reserved water rights, the Tribes would have to bring a claim in the relevant court to request quantification, adjudication, and enforcement of their federal reserved water rights. Such a claim could be brought in the Utah State court that has jurisdiction over any water rights adjudication that is occurring in the basin where each reservation is located. Alternatively, if the State of Utah is not conducting an adjudication in the basin and declines to initiate adjudication proceedings, the Tribes have the option of filing a claim in federal district court.

Other than water rights concerns, the Class III (intensive pedestrian) survey of cultural resources conducted for the Project identified 15 previously recoded sites, 12 new sites, and 104 isolated occurrences, including prehistoric artifact and prehistoric lithic scatters. All sites that are eligible for listing on the National Register of Historic Places would be avoided by either realignment of the proposed pipeline or by using a specific construction technique (e.g., boring). Resource protection measures have been incorporated into the Project to ensure avoidance of cultural resources and provide for monitoring requirements in areas of high likelihood of encountering cultural resources (**Appendix C**). With these in place, the Project is not anticipated to adversely affect tribal cultural resources.

Cumulative Impacts

Many activities and developments on public land have affected cultural resources in the past. The BLM has, for at least the last 30 years, actively consulted with the Paiute Indian Tribe of Utah about projects which would take place in Beaver and Iron counties to ensure that sacred sites and resources are not affected or are mitigated appropriately and that the Tribe is aware of projects taking place on BLM-administered land.

Impacts from the No Action Alternative

The concerns of the Tribes regarding use of the water rights in Pine Valley associated with the action alternatives would no longer apply. The Cedar Band of the Paiute Indian Tribe of Utah could be affected by increased fees, which could result from CICWCD and Cedar City acquiring water rights from agricultural users in Cedar City Valley. The Band could also be affected by increasingly intensive use of the water basin adjacent to their reservation lands.

3.7 Socioeconomics

Socioeconomics refers to the coordinated data, analyses, and interpretations provided by a range of social science disciplines, including anthropology, demography, economics, geography, history, political science, and sociology. The socioeconomics analysis addresses effects of the Proposed Action and alternatives that are social or economic in nature, such as population, employment, housing, and public services.

3.7.1 Affected Environment

The vegetation study area includes the sub-watersheds that contain the proposed facilities and ROW under the Proposed Action and ANWS Alternative. The vegetation community types in the study area are indicative of the climate, geology, elevation, precipitation patterns, and other physical and biological features of the region. Vegetation communities provide aesthetic appeal as well as forage for wildlife, wild horses, and livestock and play a key role in water, energy, and nutrient cycling. The presence of vegetative cover is critical for soil stability.

An analysis was conducted of the proposed Project area and surrounding areas within a 0.25-mile buffer of Project facilities (i.e., study area) to determine the dominant vegetation community types that might be affected by Project activities.

Four general vegetation community types consisting of several sub-types were identified within the study area. These vegetation communities are summarized in **Table 14**, along with their percent cover of the analysis area, and are briefly described below.

Table 14. Vegetation Communities within the Analysis Area

Vegetation Community Type	**Percent Cover of Analysis Area (approximately 22,755 acres)**
Herbaceous/Other Communities	
Inter-Mountain Basins Semi-Desert Grassland	3.0
Invasive Annual/Perennial Grasslands and Forblands	1.5
Other (*Inter-Mountain Basins Active and Stabilized Dune, Inter-Mountain Basins Cliff and Canyon, Southern Rocky Mountain Montane-Subalpine Grassland*)	<1
Shrubland Communities	
Great Basin Xeric Mixed Sagebrush Shrubland	3.1
Inter-Mountain Basins Big Sagebrush Shrubland	60.1
Inter-Mountain Basins Greasewood Flat	2.0
Inter-Mountain Basins Mixed Salt Desert Scrub	9.4
Inter-Mountain Basins Semi-Desert Shrub Steppe	5.5
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	<1
Woodland Communities	
Great Basin Pinyon-Juniper Woodland	12.2
Developed/Disturbed	
Agriculture	<1
Developed, Low–High Intensity	<1
Recently Mined or Quarried	<1

Groundwater-dependent vegetation impacts in far-field areas outside Pine Valley (such as the Sevier playa) are addressed in Section 2.11.

3.7.2 Issues to be Addressed in the Analysis

The following socioeconomic issues were identified in public and agency scoping:

- Would the Proposed Action result in additional future growth and development in Cedar City?

3.7.3 Affected Environment

The geographic area of analysis of the Proposed Action and alternatives is Iron and Beaver counties in Utah. The southwestern portion of Millard County and a very small portion of Lincoln County within Hamlin Valley could be affected indirectly through the potential for drawdown (see *Groundwater Resources Impact Assessment*, Figure 3-1 [available on ePlanning]). Demographic data for Millard County and Lincoln County are not discussed in the affected environment since there are no communities or senior water rights within these counties that are within the area of potential effect of groundwater drawdown. White Pine County is not part of the affected environment since it is not within the area of potential effect of groundwater drawdown over the modeling period (see *Groundwater Resources Impact Assessment*, Figure 3-1 [available on ePlanning]).

Demographic data was collected for Iron County and Beaver County. Both counties have low populations and densities (Census Bureau 2020a, 2020b) (**Table 15**). While the counties have comparable areas, Iron County's population is about eight times that of Beaver County. Both counties have typical numbers of employment for their size, and unemployment was below the national average in 2019. Per capita incomes are below average in both counties, as are the percentage of the population with a bachelor's degree (the national average is 31.5 percent). Iron County has more people below the poverty line than the U.S. average, which has historically been between 10 and 20 percent.

Table 15. Geographic Analysis

Statistic	Beaver County	Iron County
Population (2019)	6,710	54,839
Population per Square Mile	2.6	14.0
Employment (2018)	4,206	27,432
Unemployment Rate (2019)	3.0%	2.9%
Per Capita Income as a Percent of U.S. Average	60%	59%
Bachelor's Degree or Higher (2019)	21.1%	29.8%
Population Below Poverty Line (2019)	8.9%	13.1%

Both counties lie at the southeastern edge of the Great Basin. Going north through Utah across the eastern edge of the Great Basin, Iron is the most populous county for almost 200 miles. Iron County has experienced an 18.8 percent population increase between 2010 and 2019 (Census Bureau 2020b). For this reason, the analysis assumes that Iron County will continue to grow, which is consistent with the CICWCD Financial Business Plan and Water Needs Assessment (Carollo 2020).

Demographically, both counties are predominantly white. Concentrations of Native Americans exist in both counties but are larger in Iron County. Those claiming Hispanic heritage are more common in Beaver County (**Table 16**).

Table 16. Demographic Data

Ethnicity	Beaver County	Iron County
White, non-Hispanic	83.8%	85.8%
Native American	1.0%	2.4%
Hispanic or Latino	11.3%	8.6%

Note: Total percent can be greater than 100 if participants indicated more than one ethnicity. Demographic data does not add to 100 percent. Not all race demographics are included.

While urban areas in both counties are quite small by national standards, both counties' populations are highly urban. In each, the three largest communities comprise over 80 percent of the population (Census Bureau 2020a) (**Table 17**). This is consistent with the low population density mentioned above.

Table 17. Population Density by Community

Place	County	Population	Percentage of County
Beaver	Beaver	3,185	48.4%
Milford	Beaver	1,394	21.2%
Minersville	Beaver	920	14.0%
Cedar City	Iron	34,764	65.9%
Enoch	Iron	7,180	13.6%
Parowan	Iron	3,165	6.0%

The largest community in either county is Cedar City. Again, going northward, Cedar City is the most populous community for roughly 200 miles. The city and most of its water resources lie in Cedar City Valley, and both overlap with the CICWCD.

Cedar City may ultimately be the largest wholesale customer of the Proposed Action. All alternatives are expected to have effects on municipal water customers. Construction of the Proposed Action or ANWS Alternative is expected to mainly impact minimally inhabited areas of both counties.

3.7.4 Environmental Consequences

Impacts of the Proposed Action and ANWS Alternative

The Proposed Action and ANWS Alternative both involve construction of a pipeline, wells, and appurtenant Project facilities. As part of the Project planning process, the CICWCD used an Impact Analysis for Planning (IMPLAN) economic model to estimate the positive and negative economic effects anticipated both from Project construction and operation of the proposed Project and from taking no action to develop the proposed Project. Development of new infrastructure has both one-time economic impacts as well as ongoing impacts. IMPLAN impacts are categorized as direct, indirect, or induced. Direct impacts are direct spending on the development activity. Indirect impacts are generated by businesses and vendors supporting the development. Induced impacts are those attributable to the spending of employees supported by the direct impacts.

The IMPLAN model for the Proposed Action produced these economic multipliers, provided in **Table 18** (Applied Analysis 2019a).

Table 18. IMPLAN Model Estimates

Multiplier Effect	Direct	Indirect	Induced	Total
Economic Output (per $1 of Direct Cost)	1.00	0.27	0.17	1.44

Multiplier Effect	Direct	Indirect	Induced	Total
Portion that is Wages and Salaries (per $1 of Direct Cost)	0.23	0.06	0.04	0.33
Employment (per $1 million of Direct Cost)	7.82	2.77	1.69	12.28

Direct costs (labor and materials) of the Proposed Action were estimated at $253.6 million in early 2019. The ANWS Alternative is anticipated to cost an additional $41.9 million, bringing the total cost of this alternative to $295.5 million. These estimates are the total capital construction cost. The Project would have additional mitigation and monitoring costs that have not been estimated. Additional economic effects were determined using the IMPLAN multipliers to estimate the total economic impact to the Cedar City area. **Table 19** details the estimated economic output from the Proposed Action.

Table 19. Estimated Economic Output from the Proposed Action

Effect	Direct	Indirect	Induced	Total
Economic Output (millions of dollars)	253.6	69.2	43.7	366.4
Labor Income (millions of dollars)	58.2	16.0	10.6	84.9
Employment (person-years)	1,982	702	428	3,113

It is expected that most effects would occur in Iron County, given its larger population and position as the terminus of the pipeline. The direct costs would be spent largely within the two counties. These would create indirect expenditures by vendors and would induce spending by local households and firms. However, direct costs would be financed primarily from local taxpayers and should not be viewed as a net benefit to the community. The beneficial economic impacts of the Proposed Action and ANWS Alternative would be felt mainly in the short term while water users served by the CICWCD would experience a net increase in their water bills (see Section 3.3), which would extend long term. As of 2018, the gross domestic product of Beaver County is estimated at $394.9 million, while that of Iron County is $1.69 billion. The IMPLAN one-time estimates suggest the Proposed Action would result in a major, short-term, net beneficial contribution to the local economy, but this would be offset by the long-term increase in water rates for Cedar City residents and other CICWCD customers.

Groundwater drawdown due to Project implementation is anticipated to result in negligible to minor socioeconomic impacts to communities in Beaver and Iron counties in Utah. There are 15 underground water rights that are anticipated to experience interference drawdown of greater than 15 feet under the Proposed Action. Under the ANWS Alternative, there are 10 underground water rights that are anticipated to experience interference drawdown of greater than 15 feet. The owners of these rights would be notified via mail to participate in the Adaptive Management, Monitoring, and Mitigation Program (**Appendix F**). These monitoring and mitigation measures would require the CICWCD to make all affected water rights holders whole (see **Appendix F**). This would be enforced by the terms of the 2014 DWRi Order approving Application to Appropriate Water Number 14-1118. Through this program, economic impacts to water rights holders due to well interference drawdown would be mitigated.

No socioeconomic impacts to Millard County, Utah, are anticipated under either action alternative. Groundwater drawdown would begin to reach Millard County within Pine Valley after approximately 40 years of Project pumping (see *Groundwater Resources Impact Assessment*, Figure 4-1 and 4-2 [available on ePlanning]). Drawdown effects would continue to propagate northward over time through the extent of northern Pine Valley, into Wah Wah Valley, and northward into portions of Tule Valley and the Sevier Desert within Millard County. There are no communities within these areas of Millard County. No underground senior water rights within Millard County would be impacted (see *Groundwater Resources Impact Assessment*, Chapter 4 [available on ePlanning]).

No socioeconomic impacts to Lincoln County, Nevada, are anticipated under either action alternative. The small portion of Lincoln County that would be affected is not anticipated to experience drawdown of more than 3 feet after a period of 250 years (see *Groundwater Resources Impact Assessment*, Figure 4-1 and 4-2 [available on ePlanning]). The extent of the 1-foot drawdown contour would begin to reach Lincoln County during the recovery phase, approximately 75 years after the cessation of Project pumping. Effects of this minimal amount of drawdown are not anticipated to result in any loss to existing water rights holders that would result in socioeconomic impacts. No wells in Nevada counties are projected to be impacted. No other socioeconomic impacts to Nevada communities are anticipated, including impacts to emergency services.

Wah Wah Ranch is anticipated to experience a spring flow reduction of up to 14 percent under the Proposed Action or 15 percent under the ANWS Alternative (see *Groundwater Resources Impact Assessment* [available on ePlanning]). This could potentially affect the water availability and micro-hydro power production for the Wah Wah Ranch. The ranch diverts approximately 600 afy. The Spring Flow Monitoring and Mitigation Program outlined in the *Groundwater Resources Impact Assessment* would be used to monitor Project effects on the spring flow at Wah Wah Springs.

Mitigation measures would be implemented if a Tier III trigger event occurs which would require the CICWCD to make Wah Wah Ranch whole in the event of any adverse impacts due to Project groundwater pumping. Actions may include providing replacement water, drilling a well to provide additional water supply, or supporting efforts to increase the efficiency of water use. These actions would be taken to prevent any economic loss to the ranch.

The Proposed Action and ANWS Alternative are not anticipated to have any growth inducement or growth reduction effects in Beaver County, Millard County, White Pine County, or Lincoln County. Groundwater drawdown effects would not reach the communities of Milford and Minersville, Utah, or Baker, Nevada. Rural aboveground economic interests, such as livestock grazing, are not anticipated to be affected by drawdown of the regional aquifer.

The Project would provide water supply to Cedar City and other communities in Iron County that would offset the anticipated loss of water due to the implementation of the GMP. The additional water is not anticipated to result in a growth-inducing effect in Iron County. Instead, it is consistent with projected needs over the coming decades, assuming a similar growth rate. The CICWCD economic analysis takes Iron County population trend projections into consideration, consistent with statutory direction for a 50-year planning horizon (Carollo 2020).

Impacts of the No Action Alternative

Under the No Action Alternative, no ROW grant would be issued, and the pipeline, wells, and ancillary facilities would not be constructed, operated, or maintained. There would be no capital expenditure that would affect Cedar City and other CICWCD rate payers. The local economic output benefits from the Proposed Action would not occur.

Assuming the CICWCD is not able to source additional water supply and the Cedar City Valley GMP slowly reduces the water rights held by the CICWCD, growth in the Cedar City area could eventually be limited due to a restriction of new construction. Although this effect is somewhat speculative, it would have the net effect of slowing population and economic growth. If the water supply becomes constrained by 2040, the total loss over the subsequent decade is estimated at $1 billion (Applied Analysis 2019b). If Cedar City or the CICWCD acquire additional water rights within the Cedar Valley basin, this action would increase water bills for Cedar City residents and other CICWCD customers. The cost of the No Action Alternative is estimated to be $420 million by 2070 (expressed in 2019 dollars, consistent with the costs of the action alternatives).

If the CICWCD is unable to obtain additional water supply, additional actions would need to be taken as water rights are rescinded due to the Cedar City Valley GMP. This could potentially include restricting new construction. Although this effect is somewhat speculative, it would have the net effect of slowing population and socioeconomic growth.

3.8 Soils

This section discusses potential Project impacts to soil resources. The area of effects analyzed includes the two sub-basins crossed by the temporary and permanent ROW for the Proposed Action and ANWS Alternative.

3.8.1 Issues to be Addressed in the Analysis

The following soils issues were identified in public and agency scoping:

- How much soil would be disturbed by the Proposed Action in both the short term and long term?
- How would disturbed soils be reclaimed?

3.8.2 Affected Environment

The predominant soil types in the Project area are primarily loams, gravelly loams, sandy loams, loamy fine sand, silt loams, silty clay, clay, clay loams, silty clay loams, gravelly clay loams, and unweathered bedrock. The soils are primarily alluvium, colluvium, residuum, or aeolian deposits derived from igneous or sedimentary rock and/or lacustrine deposits. The soils are generally well drained. For much of the Project area within Pine Valley in Beaver County, there is no soil survey data.

Small pockets of sensitive soils occur within the Project area. Sensitive soils are particularly susceptible to disturbance and more difficult to restore or reclaim after disturbance. Once disturbed, the impact is usually long term (BLM 2018a). Characteristics consist of moderate to high salinity, low nutrient levels, high runoff potential, susceptibility to high wind or water erosion, or very steep slopes that are susceptible to erosion. A sensitive soils designation generally refers to highly erodible soils, saline soils, drought-intolerant soils, sodic soils, shallow soils (limited rooting depth), alkaline soils, and biological soil crusts. Soils in the Project area with the greatest erosion potential are sandy loams. The Project area traverses a portion of the Escalante Desert near Lund, Utah. Soils in this area are particularly subject to water and wind erosion. Concentrations of saline and sodic soils that exist in the Escalante Desert are likely due to the presence and past occurrence of playa lakebeds in the area. Sensitive soils also are located at the extreme north end of the Project area in the Wah Wah and Pine valleys. These soils are also susceptible to wind erosion.

In the groundwater flow system that would be affected by pumping for the PVWS Project, groundwater discharge by evapotranspiration (ET) occurs around Sevier Lake and in Tule Valley. In these areas, USGS has mapped groundwater discharge areas (GDAs) with groundwater-dependent plant communities consisting of phreatophyte shrubs and, in a small portion of Tule Valley, alkali meadows. Soil erosion has the potential to occur if there is a reduction to phreatophytic vegetation.

3.8.3 Environmental Consequences

Impacts from the Proposed Action

Construction of the Proposed Action would result in both temporary and long-term impacts to soil resources. The area of both temporary and long-term disturbance is provided in **Table 4**; these numbers serve as the maximum potential soil disturbance that would result from Project construction. Up to 1,458 acres would be disturbed during construction as part of the temporary construction footprint and long-term ROW areas that would be fully reseeded and reclaimed. This represents less than 1 percent of the HUC-8 sub-basins in which Project infrastructure development is occurring. A total of 221.4 acres would be impacted long term by the placement of Project infrastructure.

Construction and maintenance of the pipeline would result in impacts to soils due to construction disturbance. In areas where excavation is necessary, the top 1 to 6 inches of topsoil would be removed and windrowed or stockpiled to be replaced. This would be replaced after construction as part of reclamation. Removal and replacement of the topsoil would negatively affect the soils in the Project corridor for a period of years. There is the potential for mixing of soil horizons during topsoil removal and replacement, which could result in a loss of production. Desert vegetation takes a substantial amount of time to reestablish. Grasslands may recover within a few years after disturbance, while salt desert scrub can take 10 to 20 years to recover. Sagebrush of the typical size observed within Pine Valley can take up to 40 years to reach this size. As long as grasses take hold within the first few years, erosion potential would be significantly reduced.

The pipeline corridor, staging areas, and areas around well houses, the tank site, and the pressure-reducing station would all be reclaimed. The only locations where soils would not be reclaimed are those where permanent facilities are installed, including well houses, the aboveground portion of the water storage tanks, a small portion of the pressure-reducing station, solar panels, and power transmission poles. Project design features include reclaiming all areas of soil disturbance with BLM-approved, weed-free seed mix of native species in the Project area.

There is the potential for increased soil erosion resulting from soil disturbance during and after Project construction. Wind erosion from stockpiled topsoil and disturbed surface soils could occur, resulting in soils being deposited off-site. Project design features include seeding of stockpiled topsoil and water application to reduce wind erosion during construction.

Based on the groundwater analysis, the probability that drawdown associated with the Proposed Action would result in a widespread measurable decline in groundwater-dependent vegetation is low. Correspondingly, adverse impacts to soils from increased wind and water erosion are unlikely.

Impacts from the ANWS Alternative

The ANWS Alternative would have impacts similar to the Proposed Action; however, this alternative includes an additional 7.3 miles of pipeline at the northern end, resulting in greater total soil impacts than the Proposed Action. A total of 221.6 acres of long-term disturbance to soils would result from the installation of aboveground Project facilities. A total of 1,563 acres of temporary soil disturbance would result, which would represent an impact to less than 1 percent of the HUC-8 sub-basins. There is no digitized soil survey data available describing these soils. The same Project design features would be implemented under the ANSW Alternative, including water application during construction, windowing and replacement of topsoil, and reclamation after construction.

Cumulative Impacts of the Action Alternatives

Cumulative direct impacts to soils are not anticipated along the pipeline corridor and within Pine Valley. There are no other development projects planned for the area. The other projects identified for cumulative impacts analysis are in adjacent basins and are included for cumulative groundwater analysis. Current livestock grazing and wildlife uses, as well as vehicular use of the Pine Valley Road, are not anticipated to cause appreciably more soil erosion beyond Project impacts.

Impacts from the No Action Alternative

Under the No Action Alternative, no ROW grant would be issued, and the proposed pipeline, wells, and ancillary facilities would not be constructed. No impacts to soil resources would occur on public lands in the Project area.

3.9 Special Status Wildlife

3.9.1 Issues to be Addressed in the Analysis

The following special status species issues that meet the criteria for analysis in the BLM NEPA Handbook were identified in public and agency scoping:

- How would the Proposed Action impact federally-listed species, candidate special status wildlife species, and BLM sensitive species and their habitat?
- How would the Proposed Action affect GRSG PHMAs, populations, leks, and habitat?

3.9.2 Affected Environment

The analysis area for construction impacts from both action alternatives is approximately the same. There are no major differences in habitat or species present. The ANWS Alternative includes an additional 7.3 miles of pipeline through central Pine Valley that was analyzed for special status wildlife impacts. The area of effect of groundwater drawdown differs slightly between the two action alternatives. Under the ANWS Alternative, the area of effect of drawdown extends further north into Tule Valley and Sevier Valley but less into southern Hamlin Valley and the Beryl-Enterprise area. There are no differences in the number of special status species affected between the two alternatives.

Special status species include those species that are federally-listed (threatened and endangered species and designated critical habitat), federally proposed species and proposed critical habitat, federal candidates and petitioned species, and BLM sensitive species. Utah prairie dog is the only federally-listed species identified as potentially impacted and carried through detailed analysis.

Utah Prairie Dog

The Utah prairie dog (*Cynomys parvidens*) is a federally threatened species typically inhabiting arid grasslands, desert rangelands, sagebrush steppes, edges of ponderosa pine stands, agricultural fields, and urban areas. While their historic range spanned much of southern Utah, they are currently limited to the central and southwestern quarter of Utah, occupying approximately 10 percent of their historic range. They are now found largely in Sevier, Wayne, Iron, and Garfield counties, with populations extending into small areas of Washington, Kane, and Beaver counties (USFWS 2012) (see *Biological Assessment*, available on ePlanning).

The 2012 revised Recovery Plan published by the UDWR and USFWS established three Utah prairie dog recovery units which continue to be recognized. One of these, the West Desert Recovery Unit, is located on lands administered by the BLM CCFO and encompasses the entirety of the proposed Project area. Critical habitat has not been designated for this species. Suitable habitat for Utah prairie dog does occur within portions of the Project area.

Listing factors and continuing threats to the species include the following: destruction, modification, or curtailment of habitat or range; overutilization of commercial, recreational, scientific, or educational purposes; disease or predation; off-highway vehicles/recreational uses; improper grazing; the inadequacy of regulatory mechanisms; and other natural or man-made factors that threaten the species' continued existence (USFWS 2012).

UDWR data indicate that 8 mapped prairie dog colonies occur within the 1,000-foot buffer of the Project area and 7 mapped prairie dog colonies occur beyond the 1,000-foot buffer but within the 730-foot foraging buffer described in USFWS Utah prairie dog survey protocol (Transcon 2020a; USFWS 2018). Colony 120i is the closest occupied colony (15 individuals documented in 2019), located approximately 0.22 mile from the Project ROW and approximately 0.06 mile outside of the 1,000-foot buffer.

Previously mapped colonies 127b and 120d, which are unoccupied and had no individuals counted during UDWR spring surveys for the previous 5 years, overlap with the temporary Project ROW. Colony 120d also crosses the permanent ROW. No sign of recent Utah prairie dog occupation was found at either of these colonies during surveys (see *Biological Assessment*, available on ePlanning).

Utah prairie dog habitat and occupancy surveys were conducted in July and August 2019. Supplemental surveys of the additional alignment for the ANWS Alternative were conducted in August and September 2020. The USFWS survey protocol was followed with the following adaptations, as proposed by the BLM and approved by the USFWS:

- High-intensity surveys (walking 30-meter transects) were conducted within 1,000 feet of known, previously mapped colonies and where any species or occupied burrows were observed outside of these areas during the habitat assessment
- Low-intensity surveys were conducted in all remaining areas of suitable habitat within 1,000 feet of the Project area. If Utah prairie dogs or recent sign were observed in low-intensity areas, surveys would shift to high intensity and be conducted within 1,000 feet of any Utah prairie dog or sign observed

In areas determined to be suitable habitat, low-intensity surveys were conducted every 0.25 mile. Wildlife biologists walked 200 meters off the center alignment to assess habitat suitability, look for sign, and listen for calls. No Utah prairie dogs or signs of occupancy were found within the Project area or the 1,000-foot buffer. Most previously mapped colonies have been overtaken by sagebrush and other vegetation that has become thick and tall, reducing visibility, decreasing habitat value, and deterring Utah prairie dog recolonization. Some historic Utah prairie dog mounds were found in suitable habitat that was not previously mapped; however, burrows were uninhabitable, either collapsed or filled, and there were no signs of recent activity (see *Biological Assessment*, available on ePlanning).

Greater Sage-grouse

The GRSG was originally identified as a candidate species for federal listing as threatened or endangered under the ESA in 2010. In 2015, the species was found by the USFWS to not warrant protection under the ESA due to proposed land use planning efforts undertaken by the BLM and U.S. Forest Service. These efforts, including the initial 2015 BLM Record of Decision and ARMPA (BLM 2015), included specific management direction for the GRSG and its habitat on lands managed by the BLM. In March 2019, the BLM published a subsequent Record of Decision and Approved Utah GRSG RMP Amendment (BLM 2019c) that refined the earlier 2015 plans. However, this amendment has been enjoined, and the BLM continues to manage according to the 2015 ARMPA (BLM 2015). Additionally, the State of Utah completed the Utah Conservation Plan for GRSG in 2019 (State of Utah 2019). Under the state plan, several population areas were established which represent the highest-priority areas in Utah for GRSG conservation. Further details on GRSG management requirements are provided in the *Greater Sage-Grouse Net Conservation Gain Analysis* (available on ePlanning).

The GRSG, the largest grouse in North America, is a sagebrush-obligate species. It requires large, interconnected expanses of sagebrush-dominated habitats with healthy, native understories as its primary habitat. Wet meadow habitats are also believed to be an essential seasonal habitat component, as some populations are known to seasonally migrate to these habitats. These mesic sagebrush and riparian habitats are ideal for late brood rearing (BLM 2015). GRSG breeding, which occurs between late February and early June, is centered around openings within low sagebrush known as leks. Male GRSG congregate in these leks and perform elaborate courtship displays as female GRSG observe to select a mate. Approximately 25 active leks are monitored annually on public lands administered by the CCFO. Several historic leks are also located on lands administered by the CCFO (BLM 2019).

Statewide threats include fire, invasive plants, and pinyon-juniper encroachment, and local threats include extractive mineral development and infrastructure, renewable energy development and infrastructure, transmission corridors and tall structures, excessive predation, improper grazing and vegetation management, and recreation and off-highway vehicle use (State of Utah 2019). Wildfire is the single greatest threat to GRSG habitat in Utah (State of Utah 2019).

Greater Sage-Grouse Populations and Priority Habitat Management Area

The Proposed Action is located within the Hamlin Valley population area (371,042 acres), within which there are three non-contiguous areas of designated PHMA identified as having the highest value to maintaining sustainable GRSG populations (BLM 2018b). These areas include breeding, late brood rearing, winter concentration, and migration corridors (BLM 2015). The areas designated as PHMA largely coincide with areas identified as priority areas for conservation by the USFWS and with state GRSG management areas (BLM 2015). The northern extent of the Project area in Beaver County is within an area designated as PHMA (see map in *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]).

The habitat within the Hamlin Valley Population Area is characterized by salt desert scrub and big sagebrush at the lower elevations and mountain shrub, big sagebrush, pinyon-juniper woodland, aspen, and white fir at higher elevations. Precipitation in the area ranges from 8 inches in the valleys to 16 inches in the upper elevations. Vegetation has been altered by wildfire, resulting in loss of sagebrush in portions of the area. Fire frequency has been increasing in the area primarily due to cheatgrass (*Bromus tectorum*) invasion. Historically, the area's primary land use has been livestock grazing.

The Hamlin Valley Population Area has a shared population with Nevada but is relatively isolated from other GRSG populations in Utah. UDWR lek counts over the past decade within the Hamlin Valley population area have observed 65 males per year among all leks (UDWR 2020). An average of 14 males per lek were observed, only including leks where at least 1 male was counted (UDWR 2020). The most recent counts conducted in 2020 observed a total of approximately 60 males (UDWR 2020).

Livestock grazing and wild horse management are principal land uses in the area. Primary threats to the GRSG include pinyon-juniper woodland expansion into sagebrush habitat and wildfire. Available habitat is limited to long, narrow valleys. Understory vegetation diversity is lacking in some areas as well.

Suitable habitat is present, especially from the Beaver/Iron County line to the northern end of the Project area within the PHMA. Two GRSG leks have been located near the northern terminus but outside of the area directly impacted by Project development within the permanent and temporary ROW areas. Both leks have been inactive for several years, with five recorded birds in 2014 and two recorded birds in 2015. As part of the 2015 ARMPA, the BLM has adopted lek buffer distances and lek impact evaluation for certain infrastructure development and activity types. Justifiable departures from these lek buffer distances are allowed if determined to be appropriate (BLM 2015). See the *Greater Sage-Grouse Net Conservation Gain Analysis* (available on ePlanning) for further discussion. No GRSG individuals were observed by wildlife biologists during preliminary Project reconnaissance surveys.

BLM Sensitive Mammals

Four BLM sensitive mammals have the potential to occur within the Project area: dark kangaroo mouse, kit fox, pygmy rabbit, and Townsend's big eared bat. Habitat modelling analyses were conducted for both kit fox and pygmy rabbit using a 0.25-mile buffer from the edge of the Proposed Action ROW (see *Habitat Suitability Modeling for Pygmy Rabbit* and *Habitat Suitability Modeling for Kit Fox* reports for the Project [available on ePlanning]). These modeling analyses determined that approximately 18,240 acres of potentially *good* or *very good* habitat suitable for kit fox and 18,160 acres of *good* pygmy rabbit habitat are present within the study area for these species. Additionally, an acoustic survey was conducted to document the presence of bat species within the study area. While Townsend's big-eared bat was not documented during the acoustic survey, other bat species known to occupy roosts within this area were documented, including Western small-footed bat and Mexican free-tailed bat (see *Acoustic Bat Survey Report*, available on ePlanning). Townsend's big-eared bat has the potential to occur within the study area.

Springsnails

Springsnails are small, aquatic, fresh- or brackish-water gastropods that, in the Great Basin region, generally require springs with clean and continuous flow. Since springs in the Great Basin are often separated by great distances and have unique physical and chemical environments, specific species of springsnail are often restricted to a single spring or small group of springs (Brown et al. 2008). While there are no springs in the immediate vicinity of the Project area, special status springsnails were included in this assessment due to potential groundwater drawdown impacts on regional springs from Project-related activities. A representative geographic sample of springs were identified within Pine Valley, eastern Hamlin Valley, and western Wah Wah Valley.

One BLM sensitive springsnail, the Hamlin Valley pyrg, was identified as having the potential to occur within springs that may be impacted by Project-related groundwater drawdown. This species is only known to occur in one small complex of springs less than 0.5 mile east of White Rock Cabin Springs in Hamlin Valley, Beaver County, west of the Project area (Hershler 1995). A survey for springsnails occurred at a subset of the springs that may be impacted from potential groundwater drawdown (Transcon 2020b). Surveys identified one unknown species of springsnail at an unnamed spring (79032388) southeast of Hamlin Valley. While no special status springsnails were definitively identified during these surveys, suitable habitat is present within the study area. This spring is located near the top of a drainage saddle in the Needle Range between Hamlin Valley and Escalante Valley at an elevation of 6,595 feet and is underlain by volcanic rocks. Based on the geologic setting of the spring in the volcanic rocks of the Needle Range and geochemical data gathered by USGS (Gardner et al. 2020), this spring is believed to discharge water from a local perched aquifer and would not be affected by pumping in the regional aquifer. A single bleached snail shell was also observed at Meadow Spring in the Pine Valley HA (81421743) on the eastern flank of the Needle Range, closer to the bedrock-alluvium contact.

Other Special Status Wildlife Species

Nine BLM sensitive species were identified as having the potential to occur in or adjacent to the Project area (USFWS 2019): GRSG, bald eagle, ferruginous hawk, burrowing owl, dark kangaroo mouse, golden eagle, kit fox, pygmy rabbit, Townsend's big-eared bat, and Hamlin Valley pyrg. GRSG, BLM sensitive mammals, and springsnails are discussed in greater detail below. **Table 20** summarizes the BLM sensitive species, their status, habitat requirements, occurrence data, and their potential to occur within the proposed Project area.

Table 20. BLM Sensitive Wildlife Species

Species	Status*	Habitat Requirements	Occurrence Information	Suitable Habitat in the Study Area
Bald eagle *Haliaeetus leucocephalus*	BGEPA	Bald eagles typically breed and winter in forested areas with large, mature trees and a reliable food source. While foraging habitat typically consists of open, fishable waters, bald eagles also use a variety of upland foraging habitats from mid-elevation canyons to low elevation valleys and deserts for carrion.	Rare breeding species in Utah, although more common during the winter months. Communal winter roosting, foraging, and nesting habitat within CCFO lands in Beaver and Iron counties. Wintering bald eagles were last documented in 2001 within 0.5 mile of the Project area (UDWR 2019). Project reconnaissance surveys did not document bald eagle within the study area, although this does not rule out their presence.	Suitable winter *foraging* habitat is present within the study area.

Species	Status*	Habitat Requirements	Occurrence Information	Suitable Habitat in the Study Area
Burrowing owl *Athene cunicularia*	BLM-S	Open, treeless areas such as deserts, grasslands, agricultural or disturbed areas. Often found near prairie dog colonies where they utilize abandoned prairie dog burrows. Can be found in a larger variety of habitats in the winter and during migration.	Occurs in scattered localities throughout Utah. Documented within 0.5 mile of the Project area (UDWR 2019). Project reconnaissance surveys did not document burrowing owls within the study area.	Suitable *nesting* and *foraging* habitat is present within the study area.
Dark kangaroo mouse *Microdipodops megacephalus*	BLM-S	Typically occurs in scrub brush habitats (i.e., sagebrush and shadscale) with fine, gravelly soils.	Known to occur in West Desert portions of Utah. Documented within 0.5 mile of the Project area (UDWR 2019).	Suitable habitat is present within the study area.
Golden eagle *Aquila chrysaetos*	BGEPA BLM-S	This species is typically found nesting in or adjacent to open habitats (i.e., shrubland, grasslands) that are used for foraging. While nest sites are most often located on cliffs, they may also use trees and man-made structures (i.e., transmission structures).	Year-round resident in much of southern Utah. Golden eagles often migrate into the Project area during the winter. Golden eagles (foraging only) were observed during Project reconnaissance surveys.	Suitable *nesting* and *foraging* habitat is present within the study area.

Species	Status*	Habitat Requirements	Occurrence Information	Suitable Habitat in the Study Area
Greater sage-grouse *Centrocercus urophasianus*	BLM-S	Sagebrush-obligate species. Occurs primarily in sagebrush-dominated habitats, especially big sagebrush (*Artemisia tridentata*).	Scattered populations occur throughout much of the state (excluding most of the Colorado Plateau in the southeast). The Project is within designated PHMA within the Hamlin Valley population area (BLM 2015), and leks have been documented within 0.5 mile of the Project area (see *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning] for details). Project reconnaissance surveys did not document GRSG within the study area.	Suitable *nesting* and *foraging* habitat is present within the study area (see *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning] for details).
Kit fox *Vulpes macrotis*	BLM-S	Typically found in open to sparsely vegetated arid habitats, primarily greasewood-, shadscale-, or sagebrush-dominated habitats.	Found in scattered localities throughout Utah but is absent from the higher-elevation, montane portions of the state. Documented (1979) within 0.5 mile of the Project area (UDWR 2019) but known to occur in Pine Valley and throughout the Lund area (Schaible 2020). Project reconnaissance surveys did not document kit fox within the study area.	Suitable habitat is present within the study area. Detailed habitat suitability data is provided in the *Habitat Suitability Modeling for Kit Fox Report* (available on ePlanning).

Species	Status*	Habitat Requirements	Occurrence Information	Suitable Habitat in the Study Area
Pygmy Rabbit *Brachylagus idahoensis*)	BLM-S	Sagebrush-obligate species. Preference for dense sagebrush canopy cover at or in excess of 25 percent with loose soils.	Distributed sporadically in western Utah, primarily in areas within the Bonneville basin (including Beaver and Iron counties). Documented within 0.5 mile of the Project area (UDWR 2019). Project reconnaissance surveys did not document pygmy rabbit within the study area.	Suitable habitat is present within the study area. Detailed habitat suitability data is provided in the *Habitat Suitability Modeling for Pygmy Rabbit Report* (available on ePlanning).
Townsend's Big-eared Bat *Corynorhinus townsendii*	BLM-S	Known to roost in caves, mines, man-made structures, and basal hollows of large trees.	Known to occur throughout Utah at elevations below 9,000 feet. Documented within 0.5 mile of the Project area (UDWR 2019). Acoustic surveys did not document Townsend's big-eared bat within the study area (see *Acoustic Bat Survey Report*, available on ePlanning).	Suitable habitat is present within the study area.

Species	Status*	Habitat Requirements	Occurrence Information	Suitable Habitat in the Study Area
Hamlin Valley pyrg *Pyrgulopsis hamlinensis*	BLM-S	Springsnail are dependent on persistent springs with high water quality, often occurring within a limited distance from the springhead.	Known only to occur in one small complex of springs 0.5 kilometer east of White Rock Cabin Springs, in Hamlin Valley, Beaver County (Hershler 1995). This species has not been documented within the 0.5 mile of the Project area. Surveys of springs were inconclusive and did not definitively confirm or deny the presence of Hamlin Valley pyrg within the study area (see *Springsnail Survey Report* [available on ePlanning]). Snails were documented at Unnamed Spring 79032388 to the southeast of Hamlin Valley.	Suitable habitat is present within the study area.

Note: BGEPA = Species protected under the Bald and Golden Eagle Protection Act; BLM-S = BLM sensitive species

3.9.3 Environmental Consequences

Impacts of the Action Alternatives

As the general analysis area for both action alternatives differs only slightly and there are no differences in the species known to be present, impact analysis of both alternatives is provided together.

Utah Prairie Dog

The 2020 Project *Biological Assessment* (available on ePlanning) provides a thorough analysis on any potential impacts the proposed Project may have on Utah prairie dog. The USFWS concurred with the finding that the Project "may affect but is not likely to adversely affect" Utah prairie dog.

Direct effects to Utah prairie dog from Project-related activities are not anticipated. Neither the Proposed Action ROW nor the ANWS Alternative ROW pass through any occupied Utah prairie dog habitat, and no occupied habitat occurs within the 1,000-foot action area. However, UDWR-mapped colony 120i is occupied and located outside the 1,000-foot buffer near the northern portion of the action area, and individuals have the potential to disperse toward the Project area. If the Project area remains unoccupied, activities of the Proposed Action or ANWS Alternative would not affect Utah prairie dog directly. To update the Utah prairie dog occupancy status of the Project area, a pre-construction Utah prairie dog survey of suitable habitat in the entire Project ROW and 1,000-foot buffer would be conducted during the active season (April 1 to August 31) within 1 year prior to the initiation of Project construction.

Suitable Utah prairie dog habitat may be indirectly disturbed by noise or vibrations from construction activities, but because construction activities are occurring more than 1,000 feet from occupied colonies and there are other areas of suitable habitat available for individuals from the nearest occupied colony to colonize and expand into, habitat disturbance would not negatively impact species success. Noise caused from construction activities may at times be discernable in the occupied suitable habitat patch outside the 1,000-foot buffer. However, due to the distance from the Project ROW and construction activities, disturbance from the construction area is not expected to rise to the level of or contribute to harassment of species within the suitable habitat.

Greater Sage-Grouse

The implementation of the Proposed Action and ANWS Alternative both have the potential to impact GRSG. Project construction would result in noise, dust, and disturbance to individuals and would impact habitat. The construction of the pipeline would result in short-term surface disturbance that would remove GRSG habitat in areas of sagebrush. These areas would eventually be reclaimed. Some of these areas would be within the Pine Valley PHMA. The construction of permanent facilities would place well houses, power lines, and the solar field within GRSG PHMA. The effects of these Project activities and features are analyzed for conformance with the objectives and management actions of the 2015 ARMPA. The primary management action that applies to the Project is MA-SSS-3, which provides measures for minimizing or mitigating effects from discretionary disturbances.

As the Project under either action alternative would result in GRSG habitat loss or degradation due to construction impacts and long-term facility installation, the BLM must ensure that mitigation measures would provide a net conservation gain to the species. The approach developed by the BLM and UDWR includes the development of the mesic meadow resources detailed in the subsection to Section 2.2.2. The net effect of this approach is discussed more thoroughly in the *Greater Sage-Grouse Net Conservation Gain Analysis* (available on ePlanning). The BLM's conclusion is that with the implementation of these features and the application of other Project design features to minimize impacts, the Project would provide a net conservation gain for GRSG.

Within a PHMA, anthropogenic disturbance (whether temporary or permanent) is managed so that they cover less than 3 percent of the total PHMA. Construction of the Proposed Action or ANWS Alternative would result in approximately 318 acres of temporary disturbance and 218 acres of permanent disturbance to GRSG habitat within the Hamlin Valley population area. All this disturbance is within the Hamlin Valley PHMA. Combined, this represents approximately 1.5 percent of the Hamlin Valley PHMA. Under the 2015 ARMPA, the maximum anthropogenic disturbance cap within the GRSG PHMA is 3 percent. Existing infrastructure within Pine Valley disturbs a total of 0.86 percent of the Hamlin Valley PHMA. Combined with the infrastructure under either the Proposed Action or ANWS Alternative, the total disturbance is less than 2.4

percent, which is less than the maximum disturbance cap used for planning actions. Additionally, disturbance must be under the disturbance cap of the greater Biologically Significant Unit, which is the Hamlin Valley population area. This population area contains a total of 143,700 acres (BLM 2015). The 536 acres of disturbance from the PVWS Project combined with the 851 acres of current disturbance constitute less than 1 percent of the population area; this is acceptably under the 3 percent disturbance cap. Disturbance cap calculations were completed by the BLM Utah State Office and are contained in the *Greater Sage-Grouse Net Conservation Gain Analysis* (available on ePlanning). The disturbance cap calculations originally used an estimated disturbance of 620 acres, which has been reduced to 536 acres after further Project refinement.

The BLM applies a limit of one energy or mining facility within a PHMA per 640 acres. There are currently no energy or mining facilities within the PHMA. The construction of the solar field would be partially within the PHMA on private land owned by the CICWCD and would be the only energy facility within the PHMA.

Management action MA-SSS-3 also requires that best management practices be applied that eliminate or minimize predation of GRSG. Protection measures for GRSG are incorporated into the Project design features (see **Appendix C**) to minimize the impact of proposed infrastructure within the PHMA. Placement of tall structures, such as power poles, is generally limited within PHMA. Proposed poles are 34 feet tall, and the transmission voltage would not be high voltage as defined by the BLM. Research suggests that GRSG habitat with vertical structures (which is typically devoid of any vertical structures) is generally avoided by GRSG during the breeding season because of the increased risk of predation posed by artificial raptor perches and the novel nature of such structures (Messmer 2011). After consulting with the UDWR, it was determined that an aboveground monopole design is acceptable if the power line does not create perching opportunity. Therefore, all monopole structures installed for the Project would be equipped with perch deterrents to prevent raptors from utilizing the structures as artificial hunting perches. These monopoles would also not include a crossarm in the design. With these features included, impacts to GRSG from the transmission line would be minimized.

Noise from discrete anthropogenic disturbances is limited to 10 decibels above ambient sound levels at occupied leks from two hours before to two hours after sunrise and sunset. Construction impacts to GRSG include noise from construction activities that could disturb individuals within habitat in the Project area. Noise-generating construction activities would occur more than 0.25 mile from nearby leks, and noise would attenuate sufficiently over that distance. Nevertheless, the BLM proposes seasonal restrictions during breeding, nesting, brood rearing, and winter habitat to minimize disruption to GRSG (see Appendix A of the *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]). These seasonal construction restrictions would avoid impacts to GRSG during the most critical times. During Project operation, weekly survey visits by a single pickup truck to the Project area during daylight hours are not anticipated to impact GRSG. The operation of well houses would not result in noise that would affect the leks (see *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]).

Drone use during Project operation has the potential to disturb and harass GRSG. Drone usage would be subject to the same seasonal restrictions as construction activities.

The CICWCD would install fence markers on the approximately 4.02 miles of barbed-wire fence immediately surrounding the well houses and the tank site within the PHMA. The 9.04 miles of exclosure fencing within the PHMA around mesic meadow resources would be post-and-rail construction to minimize the impact to GRSG.

The 2015 ARMPA specifies buffer distances for various types of infrastructure to evaluate impacts to GRSG leks, based on a previous USGS report on conservation buffer distances (USGS 2014). Application of these distances is specifically contained in Appendix B of the 2015 ARMPA (BLM 2015). The two leks within Pine Valley are located approximately 0.3 mile and 1.2 miles from proposed infrastructure for either the Proposed Action or ANWS Alternative. This places linear features and surface disturbance within the 3.1-mile buffer distance and tall structures (i.e., electric transmission poles) within the 2-mile buffer distance identified in the 2015 ARMPA. Five of the well houses for the Proposed Action would be located within the 1.2-mile low-structure buffer. Well houses are outside the 0.25-mile buffer for noise and other disruptive activities.

As it is not possible to place all Project facilities outside the PHMA, the BLM must show that a different lek buffer offers the same protection as a larger buffer, that the Project would result in minor new disturbance, and that any residual impacts are mitigated and compensatory to ensure net conservation gain. For the action alternatives, the proposed pipeline is co-located with existing roads except for two of the well lateral pipelines totaling 0.9 mile. A third lateral pipeline is located along an existing two-track road and fence. The power poles would be located within the permanent pipeline ROW and predominantly along existing dirt or gravel roads except for the same spurs described. With the required design features, the impacts of these tall structures within the PHMA would be minimized. The well houses are low lying (no more than 12 feet tall) and would be painted BLM shadow gray in sagebrush areas to blend into the landscape. Well houses are also downslope of both leks and, combined with their height, would not stand out against the landscape when viewed from the leks. In consultation with the UDWR and CICWCD, the BLM has developed the mesic meadow wildlife watering area approach to offset remaining impacts to GRSG and PHMA.

Although Project infrastructure is located within the prescribed buffers contained in the 2015 ARMPA, the BLM and UDWR have consulted on the overall net effect of the Project and proposed mesic meadow development design feature for determining the net benefit to the species. One intent of the proposed mesic areas is to improve the brood-rearing habitat near the leks. The two leks recorded five birds in 2014, two birds in 2015, and no birds observed in each subsequent year. With multiple years passing where no GRSG have been observed at both leks, this provides evidence toward a declining population trend or lek abandonment within Pine Valley. Due to the importance of mesic resources to be located near leks as brood-rearing habitat, the BLM and UDWR's goal is to revitalize the usage of these leks by GRSG. The 2019 Utah Conservation Plan for GRSG includes among its strategies to meet plan objectives: "improve and increase sage-grouse seasonal habitats by 75,000 acres each year, including riparian and mesic habitats." This is typically employed using Utah's Watershed Restoration Initiative, as discussed in strategy 4f (State of Utah 2019); however, the development and maintenance of mesic meadow areas would be directly implemented by the BLM CCFO. Approximately 273 acres have been identified for mesic meadow development. The CICWCD would commit to providing 300 afy of water to develop and maintain these mesic resources. This water allocation is anticipated to support up to 150 acres of mesic meadow habitat within the 273 acres identified for improvement. Mesic meadow resources would likely take 1 to 2 years to establish. Pine Valley currently has few mesic meadow resources, none of which are near the leks (see *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]). The development of the proposed mesic meadows would result in a more spatially balanced distribution of mesic areas within the PHMA and represents a 20-times increase in mesic areas within the PHMA. Four of the proposed mesic meadow resources would be located within 2 miles of the existing mapped leks (see Appendix A of the *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]).

The development of the mesic meadow areas may introduce breeding habitat for mosquitoes, which could result in the spread of West Nile Virus. The BLM would implement the best management practices contained in Appendix C of the 2015 ARMPA to mitigate potential impacts from West Nile Virus.

Some of the proposed mesic meadows would be located within ¼-mile of the proposed power poles. The proximity of the power poles to these resources could discourage GRSG from using them. Depending on the observed effect of the proposed mesic meadows to GRSG over the initial years after their development, the BLM will have the ability to adjust their location if it is determined that their proximity to the proposed power poles is limiting GRSG use.

Given the value of the mesic resources to the species, the BLM and UDWR concur that the proposal would satisfy the net conservation gain requirement, notwithstanding the placement of infrastructure within the PHMA (see *Greater Sage-Grouse Net Conservation Gain Analysis* [available on ePlanning]). The impacts of the proposed infrastructure have been minimized to the extent feasible and the mesic meadow development has the potential to greatly improve GRSG habitat quality within PHMA.

Impacts to GRSG are not anticipated due to groundwater drawdown from Project pumping. Based on the geologic setting of mountain and valley springs and the geochemical data gathered by USGS (Gardner et al. 2020), springs (with the exception of Wah Wah Springs) are assumed to be connected to local perched aquifers and would not be affected by pumping of the regional aquifer. No impacts are anticipated to the springs within PHMA that would serve as water and habitat sources for GRSG.

BLM Sensitive Mammals

The Proposed Action and ANWS Alternative would result in habitat loss and fragmentation due to planned permanent infrastructure (e.g., solar power generation sites, power poles, well houses, etc.). Habitat degradation and disruption to BLM sensitive mammals would occur in areas disturbed by Project construction activities. The Proposed Action would impact areas that are predominantly “good” pygmy rabbit habitat; the section of additional alignment under the ANWS Alternative is overwhelmingly “good” pygmy rabbit habitat (see *Habitat Suitability Modeling for Pygmy Rabbit* [available on ePlanning]). The Proposed Action would impact areas that vary from “fair” to “very good” kit fox habitat; the section of additional alignment under the ANWS Alternative is overwhelmingly “good” or “very good” kit fox habitat (see *Habitat Suitability Modeling for Kit Fox* [available on ePlanning]). The area where the 200-acre solar field would be placed is designated “fair” kit fox habitat (see *Habitat Suitability Modeling for Kit Fox* [available on ePlanning]). Project design features include pre-construction surveys and avoidance buffers around any dens and burrows of BLM-sensitive mammals (**Appendix C**). Long-term impacts due to Project facilities and short-term impacts due to construction are not anticipated to result in negative impacts to any BLM-sensitive mammals.

Springsnails

During springsnail surveys, snails were detected in only two of the surveyed springs. At an unnamed spring between Pine Valley and Hamlin Valley, 41 snails were observed. These surveys do not rule out the presence of snails at additional springs and were conducted as a representative geographic sample of the springs within and around Pine Valley. See the *Springsnail Survey Report* (available on ePlanning) for additional information.

Based on the geologic setting of mountain and valley springs and the geochemical data gathered by USGS (Gardner et al. 2020), springs (with the exception of Wah Wah Springs) are assumed to be connected to local perched aquifers and would not be affected by pumping of the regional aquifer. Impacts are not anticipated to mountain or valley springs within the area of effect of the Project aside from Wah Wah Springs due to the Proposed Action or ANWS Alternative; however, as part of the Project design features and groundwater monitoring and mitigation plan, both triennial springsnail surveys and annual spring monitoring would be conducted as part of the adaptive management program (see **Appendix C** and **Appendix F**).

Other Special Status Wildlife Species

Impacts including habitat loss and fragmentation would occur in areas of both the Proposed Action and the ANWS Alternative with planned permanent infrastructure (e.g., solar power generation sites, power poles, well houses, etc.), and habitat degradation would occur in areas temporarily disturbed by Project construction activities. Noise from Project construction activities would disturb some animals in the vicinity. Special status wildlife species in the immediate Project vicinity may be injured or killed during construction activities from being driven over by work vehicles or buried during trenching activities. Avian species would be at risk from collisions with Project-associated power lines and solar panels (i.e., "lake effect").

Cumulative Impacts of the Action Alternatives

Vehicular travel along regional roads, including Pine Valley Road and Mountain Springs Road, may be cumulatively detrimental to special status wildlife species. Construction, maintenance, and operational impacts would be temporary along these roads and are anticipated to cause minor disruptions to special status species due to noise and human activity. Long-term cumulative impacts are considered minor, as the Project would result in a minor increase in road travel during Project operation and maintenance.

Impacts of the No Action Alternative

Under the No Action Alternative, the ROW grant would not be issued, and the proposed pipeline, wells, and ancillary facilities would not be constructed, operated, or maintained. The sensitive species and associated habitat would exist under current and future authorizations and land uses. Therefore, effects to sensitive species associated with construction or operation of the action alternatives would not occur. There would be no detrimental impacts to special status wildlife species. Additionally, there would be no benefit to GRSG habitat from mesic meadow habitat development planned for the Proposed Action and ANWS Alternatives.

3.10 Vegetation Communities

3.10.1 Issues to be Addressed in the Analysis

The following issues relating to vegetation communities were identified in public and agency scoping:

- How would the Proposed Action affect the vegetation communities and riparian habitat in Pine Valley and the surrounding area?

3.10.2 Environmental Consequences

For the Project area where direct ground disturbance is expected, the potential impact to the overall vegetation communities was assessed at the sub-watershed level.

Impacts from Proposed Action and the ANWS Alternative

Both the Proposed Action and the ANWS Alternative would result in direct and adverse impacts to vegetation communities, particularly on native desert shrubland communities, which represent the most common vegetation community type due to the location of Project construction (**Table 21**). Vegetation would be permanently removed because of Project activities and the long-term installation of Project infrastructure, including well houses, power transmission poles, solar field panels, and water tanks. Other areas temporarily impacted, such as the pipeline ROW, would be reclaimed and revegetated. The total acreage potentially impacted by the Proposed Action and the ANWS Alternative is provided in **Table 21**. This represents less than 1 percent of the total area of the HUC-8 sub-watersheds, which includes Pine Valley and the Escalante Desert.

Table 21. Potential Impacts to Vegetation Communities by Proposed Action and ANWS Alternative

Vegetation Community Type	Proposed Action (acres)	ANWS Alternative (acres)
Herbaceous/Other Communities		
Inter-Mountain Basins Semi-Desert Grassland	15.9	15.9
Invasive Annual/Perennial Grasslands and Forblands	9.1	9.1
Other (Inter-Mountain Basins Active and Stabilized Dune, Inter-Mountain Basins Cliff and Canyon, Southern Rocky Mountain Montane-Subalpine Grassland)	10.7	10.7
Shrubland Communities		
Great Basin Xeric Mixed Sagebrush Shrubland	43.6	43.6
Inter-Mountain Basins Big Sagebrush Shrubland	1,214.1	1,232.2
Inter-Mountain Basins Greasewood Flat	16.5	16.8
Inter-Mountain Basins Mixed Salt Desert Scrub	132.4	226.2
Inter-Mountain Basins Semi-Desert Shrub Steppe	67.5	67.9
Woodland Communities		
Great Basin Pinyon-Juniper Woodland	111.7	111.7

Vegetation Community Type	Proposed Action (acres)	ANWS Alternative (acres)
Developed/Disturbed		
Agriculture	1.1	1.1
Developed, Low–High Intensity	11.1	11.1
Recently Mined or Quarried	16.6	16.6
TOTAL	**1,650.3**	**1,763.2**

Based on previous research by the USGS, mountain and valley springs within Pine Valley and the surrounding valleys are presumed to be disconnected from the regional aquifer (see *Groundwater Resources Impact Assessment* [available on ePlanning]). Because of this disconnection, impacts to riparian habitats associated with mountain and valley springs are not anticipated. Nevertheless, because potential connection cannot be ruled out, a spring flow depletion monitoring and mitigation program would be implemented that includes monitoring several local springs (**Appendix F**). This program would monitor surface water sources and take corrective action that would mitigate any spring flow loss that may affect riparian habitat (**Appendix F**).

The new livestock water locations have the potential to change livestock distribution across allotments. Livestock would potentially congregate in these areas, altering existing grazing patterns, which would result in indirect impacts to vegetation in these areas. The mesic meadow wildlife watering areas include enclosure fencing that would prevent livestock and wild horses from disturbing vegetation in these areas. The vegetation within these approximately 273 acres are in sagebrush shrubland communities and would be modified to include these wet meadow features.

Cumulative Impacts

Cumulative impacts to vegetation communities due to either action alternative would result from land use by livestock and wild horses within the analysis area. Much of this area is within BLM grazing allotments that are managed for livestock grazing. Impacts due to construction and the permanent installation of Project facilities under either alternative would not result in cumulatively considerable impacts to vegetation. Increased traffic along Mountain Springs Road and Pine Valley Road would result in very minor incremental increase in dust deposition within vegetation communities within 0.5 mile of roads. These cumulative impacts are considered negligible, as these are established uses for the Project area.

Impacts from the No Action Alternative

Under the No Action Alternative, no ROW grant would be issued for Project construction, maintenance, or operation. The proposed Project facilities would not be constructed. No direct, indirect, or cumulative impacts to vegetation communities would occur.

3.11 Water Resources and Hydrology

Groundwater withdrawal from Pine Valley is a primary feature of the Proposed Action and ANWS Alternative. This withdrawal has the potential to result in a variety of impacts over time. For this reason, a *Groundwater Resources Impact Assessment* (available on ePlanning) report was developed for the Project using previous data and a model developed from previous USGS work for the Great Basin and local groundwater basins. The analysis addresses the issues raised in scoping, discloses the anticipated impacts, and details proposed monitoring and mitigation measures to be implemented to avoid, minimize, or mitigate any adverse impacts.

3.11.1 Issues to be Addressed in the Analysis

The following water resources and hydrology issues were identified in public and agency scoping:

- How would the Proposed Action affect springs, seeps, streams, wetlands, and other surface waters?
- How would the Proposed Action affect groundwater wells within the analysis area?
- How would the Proposed Action affect senior water rights holders?
- How would the Proposed Action affect groundwater aquifer balance?
- How would the Proposed Action affect phreatophytes and other groundwater-dependent vegetation?
- How would the CICWCD incorporate water conservation to reduce water demand and reduce the need for the Proposed Action?
- How would the Proposed Action affect intra-basin transfer of water across the Utah–Nevada state line?
- Would the Lincoln County Conservation, Recreation, and Development Act of 2004 apply to the Project?
- How would the Proposed Action affect the long-term water supply in Beaver County, Utah?
- How would the Proposed Action impact groundwater resources in Lincoln County, Nevada; White Pine County, Nevada; and Millard County, Utah?
- How could water conservation, reclamation, and efficiency methods be incorporated into the Proposed Action?
- How would the Proposed Action affect groundwater resources in Tule Valley, Fish Springs National Wildlife Refuge, and Sevier Lake?
- How would the Proposed Action affect downgradient groundwater basins and the Greater Salt Lake Desert regional groundwater flow system?
- How would the Proposed Action draw down or otherwise affect groundwater resources in and around Pine Valley over a long period, such as the next 200 years?
- How would the Proposed Action affect federally reserved water rights?
- How could the Proposed Action include the data and analysis of previous USGS studies, reports, and models, including the Great Basin Carbonate-Alluvial Aquifer System regional model?
- How would the Proposed Action affect water quality in neighboring basin within the analysis areas: Snake Valley basin, Tule Valley basin, Sevier Desert basin, Wah Wah Valley basin, Milford Area basin, and Beryl-Enterprise area basin?
- How would the Proposed Action impact the Cedar City Valley GMP?
- How would the Proposed Action interact with other water management plans for Pine Valley and the surrounding basins, including the Beryl-Enterprise GMP?

- How would the potential for land subsidence due to extraction of groundwater by the Proposed Action be addressed?
- How would impacts to surface water and groundwater be monitored and mitigated and the Proposed Action adaptively managed to prevent or reduce impacts to water-dependent resources?
- How would impacts to springs due to the Proposed Action be addressed?
- How would impacts to other water rights holders due to the Proposed Action be addressed?
- How would the Proposed Action affect groundwater quality?
- How would the Proposed Action affect surface water quality?
- How would the potential for sedimentation from runoff in disturbed areas be addressed?
- How would streambank integrity be maintained and restored at drainage crossings?

3.11.2 Affected Environment

Background and Previous Work

The proposed PVWS Project is located in the southeast portion of the Basin and Range physiographic province (Fenneman and Johnson 1946), which consists of a system of fault-bounded, north-northeast-trending alluvial basins that are hydrologically separated by uplifted bedrock mountain ranges. The GBCAAS covers an area of approximately 110,000 square miles within the Basin and Range province where the alluvial basins are underlain and separated by carbonate bedrock systems that act as regional aquifers (see Figure 1-2 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). These regional carbonate aquifers allow groundwater to flow between the individual basins in the GBCAAS and allow groundwater effects to be regionally transmitted over wide areas.

The first comprehensive study of groundwater resources in the Pine Valley HA was conducted by Stephens (1976). The estimated recharge component of the groundwater budget for Pine Valley HA was 21,000 afy, 3,000 afy of which was accounted as recharge to the Wah Wah Valley HA due to local hydrostratigraphic conditions. This number was used to inform the regulation of water rights in the basin and remains the technical basis for the understanding of the water volume available for appropriation determined by the Utah DWRi. To help address the potential implications of groundwater supply development in the GBCAAS, the USGS developed a regional steady state numerical groundwater flow model referred to as GBCAAS v. 1.0 (Brooks et al. 2014). In this model, the recharge component of the groundwater budget for the Pine Valley HA was increased to 24,000 afy.

To provide additional scientific context for the potential development of groundwater supplies in the southeastern portion of the GBCAAS in Utah, USGS performed additional hydrogeologic studies and updated GBCAAS v. 1.0 to provide perspective on the potential effects of groundwater supply development in the Pine Valley, Wah Wah Valley, and Parowan Valley HAs. The subregionally updated version of the steady state GBCAAS model was referred to as GBCAAS v. 3.0. To support this update, Gardner et al. (2020) conducted a hydrogeologic and geochemical investigation of the Pine and Wah Wah Valley HAs to further characterize aquifer conditions, groundwater occurrence and flow, groundwater recharge and discharge volume estimates, and the source and age of aquifer water and spring discharge. The investigation included pump testing of several wells to better characterize aquifer conditions; sampling and geochemical analysis of groundwater samples from wells to assess the nature, age, and source of the water; sampling and geochemical analysis of water from springs to determine whether they are connected to the regional aquifer system or discharge water from perched aquifers; and an evaluation of ET in GDAs in the Tule Valley and Sevier Desert HAs to further constrain groundwater budget estimates. GBCAAS v. 3.0 incorporated changes to the groundwater budget and recalibrated basin fill hydraulic conductivities based on the assumed water budget changes. Notably, the groundwater recharge component of the groundwater budget for the Pine Valley HA was decreased to 11,000 afy; however, hydraulic conductivities of the alluvial aquifer had to be decreased below measured levels in order to meet calibration targets. The updated model was used to evaluate the aquifer response to long-term pumping stresses in the Pine Valley and Wah Wah Valley HAs. The study included a theoretical analysis of drawdown impacts that would result if groundwater pumping were continued for 62 years, 1,000 years, and 5,000 years. While simulations of 1,000 and 5,000 years can provide valuable scientific context to understand the nature of the aquifer system, they are too speculative and hypothetical to be considered for use in assessing the actual effects of a project.

Development of the GBCAAS-PV Model

For this EIS, the USGS GBCAAS v. 3.0 model was updated as discussed in the *Groundwater Resources Impact Assessment* (available on ePlanning) to evaluate the potential environmental impacts that could result from extraction of groundwater in Pine Valley for the PVWS Project (the GBCAAS-PV model). The groundwater modeling evaluation assessed the potential hydrogeologic effects of the Project across a broad area encompassing several adjacent HAs, including Hamlin Valley, Snake Valley, Tule Valley, Sevier Desert, Wah Wah Valley, Milford Area, and Beryl-Enterprise area HAs (the Hydrogeologic Study Area). The Hydrogeologic Study Area was established based on the extent of reasonably anticipated PVWS Project hydrogeologic and groundwater budget effects. The area predicted to experience drawdown induced by pumping for the PVWS Project falls within this area and is considered the Area of Project Effects (APE). Hydrogeologic conditions in this area were evaluated in greater detail, and refinements during development of the GBCAAS-PV model were focused primarily on this area. The Hydrogeologic Study Area, APE, and focused model area are shown on Figure 3-1 of the *Groundwater Resources Impact Assessment* (available on ePlanning). For perspective, this figure also shows the locations of important nearby protected lands, including Fish Springs National Wildlife Refuge and Great Basin National Park and the Clear Lake, Topaz Slough, and Topaz Marsh Waterfowl Management Areas, which are located outside the area expected to be affected by the Project. Also shown are wilderness areas in the mountains surrounding the area. Some of these lie within the APE; however, as explained in subsequent sections, drawdown in the regional aquifer system is not expected to affect springs, seeps, or vegetation in these mountain block areas. The most pronounced effects induced by the PVWS Project would occur in the center of the focused model area in Pine Valley HA and would cascade into the surrounding portions of the Hydrogeologic Study Area and attenuate with distance. Outside the Hydrogeologic Study Area, Project effects are not expected to be measurable or observable. As described in detail in the *Groundwater Resources Impact Assessment* (available on ePlanning), the GBCAAS-PV model was developed using setting information and data discussed in the following sections, which also describe the affected environment.

Surface Water Resources, Springs, and Seeps

There is no surface water outflow from the Pine Valley HA. A well-developed network of intermittent to ephemeral stream channels leads onto the playa from the surrounding mountains (Figure 3-5 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). Stephens (1976) observed that runoff seldom reaches the playa except during intense local storms because most runoff from the southern portion of the HA is dissipated by infiltration and evaporation before it reaches the playa. The only perennial streams in the Pine Valley HA consist of a few short headwater reaches that appear to be perched above the regional groundwater table (Gardner et al. 2020). As such, they are not expected to be affected by groundwater level drawdown due to pumping associated with the PVWS Project. Pine Valley Wash is the predominant wash that drains to the playa. Stephens (1976) estimated that runoff reaching the Pine Valley playa averages less than 500 afy, or about 0.1 percent of the total precipitation on the HA.

The only surface water body within the APE that is thought to have a potential to be connected to the regional aquifer system is Sevier Lake, located in the southern portion of the Sevier Desert HA approximately 50 miles north-northeast of the proposed PVWS Project well field. No other interconnected surface water bodies have been identified in the Hydrogeologic Study Area (Brooks 2017). Although Sevier Lake receives significant runoff in some years that results in the formation of a large, shallow, playa lake, recent investigations for the CPM Project determined that the shallow brine system at Sevier Lake occurs in relatively low permeability playa sediments that impede communication with the underlying regional aquifer system (Whetstone Associates and ENValue 2019). Based on this information, Brooks (2017) assumed that Sevier Lake is disconnected from the regional aquifer.

A total of 268 springs and seeps are reported in the USGS National Hydrography Dataset as being located within the APE for the Proposed Action in the mountains surrounding Pine Valley (Figure 3-6 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). In the APE for the ANWS Alternative, 230 springs and seeps are reported (Figure 3-7 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). Discharge data are not available for most of these springs. The identified springs include one suspected regional spring (Wah Wah Springs) that is assumed to discharge water from, and be hydraulically connected with, the regional GBCAAS. Three other regional springs (Big Springs, Dearden Springs, and Clay Spring) are located in Snake Valley within the Hydrogeologic Study Area but outside the APE. In addition, Fish Springs, an important regional groundwater discharge point and ecological resource, is located outside the Hydrogeologic Study Area about 100 miles north of the well field.

Based on their geologic setting and geochemical data collected by the USGS (Gardner et al. 2020), the remaining springs are suspected to discharge water from local perched aquifers that are not connected to the regional aquifer system. Most of the local springs in the mountains surrounding Pine Valley and Wah Wah Valley are at elevations above 5,400 feet above mean seal level, which is above the mountain bedrock-basin fill transition zone and suggests that the springs are perched (Stephens 1974, 1976). In addition, the greatest number of springs occur in the volcanic rocks of the Needle Range, which have relatively discontinuous permeable zones and many zones that do not yield significant quantities of water to wells. Historical discharge rates for the springs in the Pine Valley HA are less than 60 gallons per minute (Stephens 1976). Gardner et al. (2020) collected water samples from springs in the mountains surrounding Pine and Wah Wah valleys, and the results were compared to similar analyses of groundwater samples collected from wells completed in Pine and Wah Wah valleys. The results support the conclusion that the springs are associated with perched or semi-perched mountain aquifers that are hydraulically separate from groundwater in the valleys, which tends to be significantly older and different geochemically. Both the hydrogeologic and geochemical data support the interpretation that, except for Wah Wah Springs, springs in the mountains surrounding Pine and Wah Wah valleys are not connected to the regional aquifer system.

Groundwater Occurrence and Flow

In the Hydrogeologic Study Area, groundwater occurs under confined and unconfined conditions in alluvial basin-fill aquifers and in bedrock aquifers in the adjacent mountain blocks and underlying the valleys (Gardner et al. 2020). Groundwater levels in adjacent wells completed in the alluvial valley fill and underlying carbonate aquifers were found to be similar, supporting the conclusion that the aquifers are hydraulically connected (Gardner et al. 2011). In the alluvial basin-fill aquifers, unconfined conditions occur in the upper portions of alluvial fans, and confined conditions exist in areas where fine-grained distal fan and lacustrine sediment is interlayered with coarser gravels and sands near the centers of the valleys. Most of the recharge occurs in bedrock mountain blocks and adjacent mountain front areas. Recharge to perched mountain aquifers discharges to gaining streams or to mountain springs or seeps and otherwise percolates into the underlying regional aquifer system.

In Pine Valley, groundwater-level depths range from about 300 to 620 feet bgs (Gardner et al. 2020). Long-term groundwater level trends were assessed for six alluvial aquifer wells and one volcanic bedrock well in Pine and Wah Wah valleys (Figure 3-15 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). Groundwater levels in these wells were relatively stable and fluctuated by up to a maximum of about 2 to 3 feet during the period of record. This is consistent with minor climatic and recharge fluctuations.

When compared to other areas in this part of the Great Basin, Pine Valley HA is unique because the depth to groundwater in the regional aquifer system precludes the possibility of natural groundwater discharge in the basin, except from perched mountain aquifers. By comparison, other valleys in the eastern Great Basin have extensive areas of lowland discharge where groundwater levels are near the land surface, and the bulk of the groundwater discharge occurs through springs and by ET from phreatophytes. A consequence of the deep groundwater levels is that all discharge from the basin-fill aquifers in both valleys must occur through the subsurface where it is not observable and cannot be measured. Groundwater levels from Gardner et al. (2011) indicate that groundwater moves northward from Pine Valley into Wah Wah Valley, and groundwater in Wah Wah Valley flows north into Tule Valley and the area around Sevier Lake, and from there into Fish Springs Flat (Figure 3-13 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). In Tule Valley and the area surrounding Sevier Lake, the depth to groundwater is shallow enough for discharge to occur via ET from phreatophytes (Gardner et al. 2020). USGS has mapped GDAs in these basins consisting of phreatophyte shrubs and a few alkali meadow areas in Tule Valley. Some inter-basin flow (IBF) also occurs from Pine Valley to Snake Valley (estimated to be about 1,070 afy) and from Pine Valley to the Beryl-Enterprise area (estimated to be about 820 afy) (Figure 4-3 of the *Groundwater Resources Impact Assessment* [available on ePlanning]).

The mapped groundwater gradients are generally consistent with the regional groundwater flow directions; however, relatively steep eastward gradients were interpreted near the western edge of Pine Valley in recent work completed by Gardner et al. (2020) (Figure 3-14 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). These gradients are consistent with an impediment to local groundwater flow. The southern and western sides of Pine Valley likely contain fine-grained sediment that is a weathering product of the volcanic rocks that dominate the Needle Mountains and southern portions of the Wah Wah Mountains, whereas the eastern side of Pine Valley likely contains more coarse-grained sediment derived from quartzites that outcrop on the western slopes of the Wah Wah Mountains (Gardner et al. 2020). A second zone with a steep north-northeast groundwater gradient trends across the southern portion of the Pine Valley HA in a west-northwest direction. Similar to the steepened gradients along the west side of the valley, this area of steepened gradients may also be caused or contributed to by differences in the permeability of the alluvial sediments derived from the surrounding mountains. Faults in the region generally do not trend along this alignment; however, it is located near the inferred edge of the Indian Peak-Caliente caldera complex based on gravity data (Best et al. 2013). This suggests that subsurface structural or stratigraphic changes could be contributing to a groundwater flow impediment in this area. As discussed in the *Groundwater Resources Impact Assessment* (available on ePlanning), direct geologic data regarding the existence of flow impediments at these locations have not been confirmed, and none were therefore modeled by the USGS or included in the GBCAAS-PV model. To address this uncertainty, the Well Field Operation Adaptive Management Program would be implemented as described in **Appendix F**. This program would allow up to 60 percent of the Project wells to be shifted to more northerly locations to decrease interaction with these potential flow impediments if they are determined to exist based on early well field operation data.

Water Quality

USGS collected water samples in 2008 and from 2011 through 2013 from 24 locations as reported in Gardner et al. (2020) and summarized in additional detail in the *Groundwater Resources Impact Assessment* (available on ePlanning). Mountain groundwaters were sampled from springs and from wells screened in bedrock or shallow alluvium in the foothills and mountains adjacent to the valleys and well above the valley floors. Valley groundwaters were sampled from relatively deep alluvial wells with long screens that were generally located near the axis of each valley. This work was done to investigate the nature and source of groundwater in the area and the potential interconnection of shallow groundwater systems to the underlying regional carbonate and adjacent valley aquifers.

Dissolved major-ion, nutrient, and trace-metal concentrations in groundwater samples were analyzed to assess general water-quality conditions in Pine and Wah Wah valleys (Gardner et al. 2020). Concentrations of total dissolved solids (TDS) ranged from 120 to 1,290 milligrams per liter (mg/L) and exceeded the recommended secondary Maximum Contaminant Level (MCL) of 500 mg/L for drinking water at approximately one quarter of the wells and springs. Groundwater samples from wells in Pine Valley had generally lower TDS concentrations than samples from wells and springs in the surrounding mountains. Manganese concentrations exceeded the secondary MCL of 0.05 mg/L at two springs, and sulfate concentrations exceeded the secondary MCL of 250 mg/L at one spring. Arsenic exceeded the primary MCL of 0.01 mg/L in a water supply well at the Desert Experimental Range, an observation well in Pine Valley, and a stock well in the volcanic bedrock hills of southwestern Wah Wah Valley. Arsenic is likely derived from alluvial sediments eroded from volcanic rocks in the surrounding mountains.

As discussed in the *Groundwater Resources Impact Assessment* (available on ePlanning), general water quality chemistry differed between mountain wells, springs, and valley wells. Drinking water quality was also variable.

Environmental tracers and major-ion chemistry were used to investigate sources of recharge, groundwater flow paths, and groundwater ages to refine the conceptual understanding of the groundwater systems. The combined analysis of tritium and helium identified a component of "modern" water (less than about 60 years old) at the wells and springs sampled in the mountains. Some mountain samples appeared to be pre-modern (more than 60 years old) or mixtures of modern and pre-modern water, indicating areas of residence times of 60 years or but still produced relatively young water with residence times consistent with locally circulating perched mountain aquifers. None of the valley samples contained even a fraction of modern water. The valley aquifer samples by contrast consisted of significantly older water, indicating that these waters are part of a more broadly circulating regional aquifer. However, that does not mean the valley aquifers do not receive significant modern recharge. The valley groundwater samples were collected from deeper wells that would be expected to produce older water, and younger shallow groundwater recharged at the mountain fronts may be present in the upper groundwater zone beneath the water table and was not represented in these samples.

All modern and mixed groundwater was found in the mountains surrounding the valleys at springs that discharge from volcanic bedrock and from one well in alluvium eroded from volcanic rocks in the hills and mountains bordering the valleys. No modern groundwater or mixtures containing modern water were reported in samples from either Pine Valley or Wah Wah Valley. Pine Valley-valley groundwater was classified as Holocene or Pleistocene, and Wah Wah Valley-valley groundwater was classified as Late Holocene or Pleistocene. In both HAs, the youngest samples are from high-elevation mountain locations and valley groundwater increases in age downgradient from south to north. However, as noted above, these conclusions may be biased by the collection of valley samples from deep wells with long screen intervals, and younger, more recently recharged groundwater is likely to present near the water table.

Stable-isotopes (oxygen-18 and deuterium) were measured in groundwater sampled from Pine and Wah Wah Valley HAs. There were no significant differences between samples collected from Pine or Wah Wah valleys or between samples collected from mountain or valley locations. Most of the samples from Pine and Wah Wah valleys were isotopically indicative of precipitation falling at lower elevations or during the summer months as the dominant source of recharge in Pine and Wah Wah valleys. Noble gas analyses were also conducted to determine recharge temperatures and the contribution of snow melt versus precipitation. In many parts of the eastern Great Basin, mountain water-table temperatures are notably cooler than valley water-table temperatures, providing a clear contrast between the two (Gardner and Heilweil 2014). However, this contrast was not observed in the Pine and Wah Wah Valley area, indicating a greater prevalence of warm weather recharge from non-snow sources.

Geochemical data presented in Gardner et al. (2020) support an overall interpretation that recharge rates in the Pine Valley HA are relatively low and that, in contrast to other nearby basins, much of the local recharge occurs as precipitation rather than as snowmelt. However, exact quantification of the amount, age, and temperature of recharge in the regional aquifers remains uncertain because most aquifer samples came from deep wells with long screen intervals. Although the general conclusions presented in the report are reasonable, the inability to distinguish potentially younger groundwater near the water table limits the ability to understand the contribution of recent mountain recharge to the regional aquifer indicates that significant contribution of recent recharge to the local groundwater budget is possible.

Aquifer Properties

As part of the Gardner et al. (2020) study, aquifer properties for the basin-fill aquifers in the Pine and Wah Wah Valley HAs were estimated from 10 single-well pump tests (Figure 3-12 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). For development of the GBCAAS-PV model, Formation Environmental verified the estimated transmissivity ranges from Gardner et al. (2020) using the specific-capacity method, compared the results to historical pump test analysis data for the wells, and performed a more refined aquifer test analysis for four wells for which time-series drawdown or recovery data of suitable quality were available. The aquifer test analyses used a more detailed curve matching evaluation, based on confined Theis recovery and confined Cooper-Jacob Agarwal methods. The transmissivities calculated from this evaluation were approximately 30 to 150 percent higher than values calculated by Gardner et al. (2020) and are considered a more reliable estimate. Hydraulic conductivity values estimated based on the calculated transmissivity ranges and the minimum saturated well screen lengths for the wells, where known, ranged from 27 percent to more than 10 times higher than those estimated by Gardner et al (2020). During development of GBCAAS v. 3.0, hydraulic conductivities assigned to the alluvial basin fill aquifers were decreased below the values estimated by Gardner et al. (Brooks 2017). Based on this information, the hydraulic conductivity values in GBCAAS v. 3.0 appear to be biased low and increasing the hydraulic conductivities of these materials in GBCAAS-PV is justified provided the increased values are consistent with refined water budget estimates and result in a reasonable calibration.

Groundwater Budget

Pine and Wah Wah Valley HAs

The *Groundwater Resources Impact Assessment* (available on ePlanning) presents a refined analysis of the groundwater budgets for the Pine and Wah Wah Valley HAs. Groundwater resources in the Pine and Wah Wah Valley HAs and surrounding basins have been very sparsely developed, and therefore, significant data gaps exist in the hydrogeologic understanding of the area. The stability of groundwater levels indicates the amount of groundwater in storage is not currently changing, and therefore, recharge is equal to discharge. Furthermore, since Pine and Wah Wah valleys are topographically closed basins with relatively deep groundwater levels, the amount of groundwater underflow leaving the valleys is equal to the amount of recharge. Recharge to the groundwater system is equal to the difference between HA-wide precipitation and ET.

A refined recharge estimate was developed using a water balance approach for a representative 10-year hydrologic period from 2005 to 2014. The following approach was utilized:

- First, the average precipitation depth was calculated for the Pine and Wah Wah Valley HAs using data from 17 stations. The data were evaluated by comparing them to the gridded data from the Parameter-elevation Relationships on Independent Slopes Model (PRISM) and assessing trends and differences related to station elevation and cool versus warm season precipitation. Based on this analysis, the average precipitation depth was calculated using an approach that was spatially representative. The calculated average precipitation depth in the Pine and Wah Wah Valley HAs is 9.86 and 7.62 inches, respectively. The precipitation volume calculated for the Pine and Wah Wah Valley HAs based on these precipitation depths is 387,991 and 245,727 afy, respectively. This represents a conservative estimate of true precipitation and considerably less than precipitation volumes assumed by Stephens (410,000 and 290,000 afy, respectively) or PRISM precipitation estimates cited in Gardner et al. (2020) (510,000 and 320,000 afy, respectively)

- Second, the average annual ET depth was calculated from Landsat remote sensing data. The Surface Energy Balance System, a peer-reviewed, extensively applied algorithm (Paul et al. 2011, 2018; Su 2002), was used for regional-scale mapping of ET on a 30-meter grid. The algorithm uses local weather information and visible, near-infrared, shortwave infrared, and thermal infrared reflectance data to generate ET estimations. The modeling framework includes a set of automated routines (scripts) to download satellite imagery, filter-out clouds, convert imagery to reflectance (using an atmospheric correction model), derive physical and biophysical variables, and ultimately produce daily evaporation estimates. The data were derived from 251 satellite flyovers of one Landsat scene (path row 39-33) that measures approximately 180 by 185 kilometers and encompasses Pine and Wah Wah Valley HAs, Sevier Lake, most of Tule Valley HA, and much of the surrounding area. The calculated spatially weighted annual ET depth for Pine and Wah Wah Valley HAs is 9.41 and 7.46 inches, respectively. This equates to an average annual estimated actual ET volume of 370,284 and 244,567 afy, respectively. These values are based on the most spatially and temporally robust analysis of ET in the area currently available
- Recharge was calculated by subtracting ET from precipitation. The calculated net recharge depths across the Pine and Wah Wah Valley HAs are 0.45 and 0.16 inch per year, respectively. Multiplying this depth by the areas of the HAs—472,200 and 386,971 acres, respectively—yields net recharge estimates of 17,700 afy in the Pine Valley HA and 5,160 afy in Wah Wah

Because groundwater in the Pine and Wah Wah Valley HAs is sparsely developed and groundwater levels are relatively stable, groundwater outflows are considered to be in equilibrium with inflows. Net underflow out of Pine and Wah Wah valleys are presented below in **Table 22** and compared to historical estimates by Stephens (1974, 1976), Brooks et al. (2014), and Brooks (2017). For the purposes of the table below, only outflows resulting from local recharge in the Pine and Wah Wah Valley HA are considered and other IBFs attributable to the regional aquifer system are neglected to focus the analysis on the actual effects of the Project on the water budget. These regional underflows were evaluated using the GBCAAS-PV model as discussed in the *Groundwater Resources Impact Assessment* (available on ePlanning) and are briefly summarized in the next section.

Table 22. Net Groundwater Ouflows from Pine and Wah Wah Valleys (AFY)

HA	Stephens (1974 and 1976)	Brooks et al. (2014) GBCAAS v. 1.0*	Brooks (2017) GBCAAS v. 3.0*	Formation (2020)
Pine Valley	3,000 to Wah Wah Valley; 11,000 mostly northward	24,000 mostly northward	11,000 mostly northward**	3,000 to Wah Wah Valley; 14,700 mostly northward
Wah Wah Valley	8,450 mostly northward	4,230 mostly northward	2,450 mostly northward	8,160 mostly northward

Notes:

* A complete accounting of modeled IBFs simulated in GBCAAS v. 1.0 and 3.0 is not provided by Brooks (2017); therefore, reported inflows are assumed to equal outflows, less reported consumptive groundwater use of Wah Wah Springs discharge.

** Zone budget analysis of GBCAAS v. 3.0 indicates that recharge to the Pine Valley Hydrologic Unit was decreased to account for 3,000 afy of assumed underflow from Pine Valley to Wah Wah Valley, and this underflow was not actually simulated by the model.

Inter-basin Flows

Groundwater flow is generally northward and obliquely away from the mountain fronts in Pine, Wah Wah, and Snake valleys. Groundwater flows northward from Pine Valley into Wah Wah and Snake valleys and from there into the Sevier Desert and Tule Valley HAs. Although groundwater elevations in Snake Valley are lower than in Pine Valley, very little groundwater discharges westward from Pine Valley into Snake Valley because much of the volcanic rock in the Needle Range does not have laterally continuous permeability and range-front fault are impediments to groundwater flow (Gardner et al. 2011) (see Figure 4-3 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). Similarly, a portion of the precipitation that falls on the Wah Wah Range in the eastern portion of the Pine Valley HA is separated from the rest of Pine Valley by a range-front fault and is believed to flow in the subsurface into Wah Wah Valley (Gardner et al. 2020; Stephens 1976). Other than this recharge, which accrues to the water budget of Wah Wah Valley, very little groundwater interchange is believed to occur between the southern portions of Pine and Wah Wah valleys. Thus, the predominant direction of groundwater flow is northward out of Pine Valley and into the northern portions of Snake and Wah Wah valleys, where IBF is not impeded by faults. Within Snake Valley, groundwater flows northward and northeastward into the Tule Valley HA and the Fish Springs Valley HA. From Wah Wah Valley, groundwater flows northwards into the Sevier Desert HA and west-northwestward into Tule Valley. IBF also occurs south from Pine Valley into the Beryl-Enterprise area HA, which lies at a lower elevation than Pine Valley and is separated from it by an inferred hydraulic divide. The exact location and elevation of this divide cannot be constrained by the available groundwater elevation data and is inferred from modeling. The amount and direction of IBF across this HA boundary depends on the location of the divide and local hydraulic gradients, which may vary over time. Based on the available data, it is reasonable to conclude that IBF across this boundary is one or more orders of magnitude less than local pumping or recharge. As such, the exact quantity of IBF between Pine

Valley and the Beryl-Enterprise area HA is uncertain but believed to be southward and relatively small based on modeling.

Groundwater ET Discharge

The Pine and Wah Wah Valley HAs are part of a regional groundwater flow system with groundwater discharge via ET from vegetation in low-lying areas in Tule Valley and the area surrounding Sevier Lake. Gardner et al. (2020) mapped GDAs based on interpolated depths to groundwater supplemented by aerial imagery interpretation and field reconnaissance. Five GDA land cover classes were mapped, including open water, very sparse desert shrub, sparse-to-dense desert shrub, grassland, and marshland. Each land use class was assigned a range of ET rates based on published literature, and ET was interpolated spatially across the GDAs using remote sensing-derived reflectance indices. Finally, measured precipitation for a period of 4 years at Tule Valley Remote Automatic Weather Station (RAWS) station was subtracted from the calculated ET rates to develop groundwater ET rates. These revised groundwater ET rates were then applied to designated groundwater ET discharge cells in GBCAAS v. 3.0, and an extinction depth was established for the water table, below which groundwater ET by phreatophytes was assumed not to occur.

For this EIS, an updated analysis of groundwater ET rates was conducted by calculating the average ET rates in the GDAs for a 10-year representative hydrologic period using the surface energy balance method. The reasonable range of ET discharge was then estimated by analyzing precipitation data from four precipitation stations in the area and comparing the results. The alternative approaches to calculating the precipitation depth included 1) using the 4-year period at Tule Valley RAWS analyzed by Gardner et al. (2020), 2) using the full long-term record (30 years) for Tule Valley RAWS, 3) using the full long-term record for all four stations in the vicinity of Tule Valley and Sevier Lake, and 4) using the long-term record for the two lowest elevation stations in Tule Valley and Sevier Lake. The estimated groundwater ET using these methods ranged from approximately 18,000 afy to 67,000 afy, reflecting considerable uncertainty regarding the precipitation component of ET in this area. For comparison, the estimate of groundwater ET for these areas in Gardner et al. (2020) is 45,500 afy, and Brooks (2017) indicates the calibrated groundwater ET simulated in GBCAAS v. 3.0 is 38,200 afy. The findings of the above calculations span these USGS estimates. The ET discharge in these areas was further evaluated during calibration of the GBCAAS-PV model (see *Groundwater Resources Impact Assessment* [available on ePlanning]) and estimated as 38,146 afy from the GDA in Tule Valley HA and 4,231 afy from the GDA around Sevier Lake, for a total groundwater ET of 42,377 afy.

Climate Change

The Project is not expected to affect climate change (see **Appendix B**). However, climate change may affect groundwater recharge, if predicted changes such as increased temperatures and decreased precipitation come to pass. Slower recharge to the aquifer could result in a more rapid decrease in groundwater levels. The possibility of climate change to groundwater was incorporated into the model used to estimate groundwater drawdown over time. If drawdown was found to be greater than anticipated, the mitigation measures described in **Appendix F** would be implemented.

The Project area lies in the transition between the Basin and Range and Colorado Plateau physiographic provinces and is designated as steppeland, which occurs between desert and mountain regions and represents the most extensive climatic zone in Utah. The steppeland climate zone is characterized as semi-arid, with an average of 8 to 14 inches of precipitation per year. On average, July is the warmest month in the area (with an average maximum temperature of 90.3 degrees Fahrenheit) and January is the coldest (with an average minimum temperature of 17.3 degrees Fahrenheit). The overall annual precipitation is greatest in March (1.21 inches), and the greatest amount of snowfall typically occurs in January (8.5 inches) (Western Regional Climate Center 2020).

The Intergovernmental Panel on Climate Change and Global Change Research Program include the Project area in the "southwest" region. Recent warming in the southwest region has been among the most rapid in the nation, with the average temperature increasing approximately 1.5 degrees Fahrenheit compared to a 1960 through 1979 baseline period. Since 2000, drought that was intensified by long-term trends of higher temperatures due to climate change has reduced the flow in the Colorado River, combining with other factors to affect water supply (USGCRP 2018). Projections suggest continued warming in the southwest region.

Average temperatures in St. George in southwestern Utah have been steadily warming since 1895 and have increased by approximately 3 degrees Fahrenheit during the period of record (DPS 2019). The temperature record for Cedar City indicates more variable average temperatures, but also with an overall increasing trend of about 0.5 degrees Fahrenheit since 1950. Temperatures in St. George, Utah, are projected to warm by 2.5 to 5.5 degrees Fahrenheit over the next 50 years (DPS 2019) under a moderate emission scenario (Representative Concentration Pathway [RCP] 4.5) and a high-emissions scenario (RCP 8.5), respectively, developed by the Intergovernmental Panel on Climate Change.

Historical data also indicate an increase in annual precipitation amounts in the Great Basin over the past century, together with increased year-to-year variability in precipitation amounts and a decrease in winter snowpack. These changes have resulted in earlier snowmelt, higher winter stream flow volumes, reduced spring peak volumes, and lower summer and fall stream flow volumes. Chambers (2008) noted that while historical data indicate an increase in annual precipitation in the Great Basin, regional climate models tend to show little long-term change in precipitation amounts for the Great Basin as a whole, with some areas predicted to have increased precipitation amounts and other areas predicted to have reduced precipitation amounts.

No long-term trends in precipitation were observed at either location during the periods of record. The long-term average annual precipitation is 10.8 inches for Cedar City and 8 inches for St. George. Significant periods of drought occurred in the 1930s in St. George and in the 1950s and early 2000s in both locations. Long-range climate models do not provide clear projections of how precipitation would change in southwestern Utah and do not predict an increase in precipitation. However, increased temperatures would be expected to raise potential ET and may decrease the amount of precipitation that falls as snow, with both effects depending upon the timing of storm events. Gardner et al. (2020) indicates snowfall is a less important source of groundwater recharge than higher temperature storms in the Hydrogeologic Study Area, so the effect of climate change on groundwater recharge in these basins is not clear. It is likely that increased potential ET would result in some decrease in the amount of groundwater available for mountain recharge and an increase in the amount of ET discharge to the north, but the magnitude and timing of this effect is uncertain.

Current conditions and potential climate change trends have been included as inputs in the groundwater modeling and analysis. The Project is not expected to contribute measurably to climate change due to the limited emissions associated with construction and the development of the solar field to power the Project facilities.

Groundwater Pumping

Information regarding historical, current, and projected future groundwater demand and existing well locations in the Pine Valley HA and surrounding basins is discussed in detail in the *Groundwater Resources Impact Assessment* (available on ePlanning) and summarized briefly below and in **Table 23**.

- Pine Valley HA includes no permanent residences or other development. Groundwater pumping is therefore limited to a few domestic and stock wells. Stephens (1976) reported that groundwater demand was estimated at less than 5 afy and was considered an insignificant part of the total discharge. Future groundwater demand increases in Pine Valley related to the PVWS Project would withdraw up to 15,000 afy from the basin-fill aquifer
- Similar to Pine Valley, Wah Wah Valley is sparsely inhabited, and groundwater pumping is limited to a few domestic and stock wells. Pumping from basin-fill aquifer wells was estimated at 1 to 2 afy (Stephens 1974). There are no currently planned developments that would increase future groundwater demand in Wah Wah Valley
- Water demand for agricultural irrigation in Snake Valley is supplied by groundwater pumping and surface water diversion. The groundwater demand in this valley was evaluated by analyzing land use, ET, and information regarding existing water right points of diversion and Places of Use. Using this approach, current demand may be somewhat over-estimated as described in the *Groundwater Resources Impact Assessment* (available on ePlanning). In addition, given current groundwater level trends and predicted trends if pumping continues at current rates, some curtailment of groundwater extraction may be reasonably foreseeable in the next several decades under applicable State regulations to avoid potential adverse impacts to spring discharge and groundwater-dependent ecosystems. Therefore, groundwater demand is assumed to remain constant at this estimated value for the foreseeable future and is assumed to remain constant for the foreseeable future
- Groundwater demand in the Beryl-Enterprise area HA is managed under a GMP and therefore, is well documented. Under the GMP, pumping will be sequentially reduced through 2130 to bring pumping to levels that are consistent with the estimated safe yield
- No groundwater demand is reported in Tule Valley HA or the area around Sevier Lake. In the future, industrial supply water demand for the proposed CPM Project would be met through the installation of wells south of the playa

Table 23. Historical, Current, and Future Groundwater Pumping in HAs in the Hydrogeologic Study Area

HA	Historical Groundwater Pumping (afy)	Current Groundwater Pumping (afy)	Projected Future Groundwater Pumping (afy)
Pine Valley	5 (1976)	5	15,005
Wah Wah Valley	2 (1974)	2	2
Sevier Desert (southern portion within APE)	None reported	None reported	1,500
Snake Valley / Hamlin Valley*	5,469 (1945) to 21,649 (2004)	28,655	28,655
Beryl-Enterprise area**	3,000 (1937) to 92,000 (1974)	95,000 (2016)	34,000 (2130)

Notes:

*Snake Valley estimates represent net pumping based on an analysis of ET discharge. Refer to Section 3.9.5.2 of the *Groundwater Resources Impact Assessment* (available on ePlanning) for details.

**Beryl-Enterprise area current estimates represent gross pumping and do not account for deep percolation of applied water; however, the projected future pumping considers deep percolation from irrigation. Refer to Section 3.9.5.2 of the *Groundwater Resources Impact Assessment* (available on ePlanning) for details.

3.11.3 <u>Environmental Consequences</u>

Potential Impacts and Evaluation Approach

Potential effects that could occur in the APE as a result of groundwater extraction include the following:

- Groundwater level drawdown would occur as a result of groundwater extraction for the proposed PVWS Project and is the primary effect that would result from the Project
- Groundwater level drawdown may affect the operation of existing wells in the area around the proposed well field. This is referred to as interference drawdown and could impair the exercise of prior water rights by drying up a well, decreasing its capacity, shortening its usable life, and/or increasing maintenance and operational costs
- Regional groundwater level drawdown and flow changes would decrease the amount of groundwater in storage and change the groundwater balance in the area. This may affect the amount of groundwater available for future beneficial uses or interfere with the implementation of GMPs
- Groundwater level drawdown and water balance changes may deplete the flow of springs connected to the regional aquifer system within the APE. Spring flow depletion and potential adverse impacts to groundwater dependent ecosystems, wildlife, and prior water rights

- Groundwater extraction would change the regional water balance and intercept water that currently discharges to areas of phreatophytes and other groundwater-dependent vegetation in Tule Valley and around Sevier Lake. ET discharge depletion could result in stress and decline of groundwater-dependent vegetation, habitat degradation or succession, loss of forage or habitat, increased soil erosion, and/or air quality degradation
- Water quality degradation can occur from changes in groundwater gradients or the migration of water of differing quality through wells when they are not being pumped. The formation of large cones of depression can trap salt loading from recharge containing high concentrations of dissolved solids. Gradients induced by wells can cause the migration or capture of contaminated or lower quality groundwater. These effects can impair the exercise of water rights and harm the chemical integrity of the basin by rendering the water unusable for certain beneficial uses, increasing treatment costs, or damaging environmental resources
- Drawdown in Pine Valley could result in the depressurization and consolidation of clay sediments, leading to land subsidence. Land subsidence and fissure formation can damage surface infrastructure; change drainage patterns and increase flooding; and/or pose a risk to public health and safety, wildlife, and livestock

The GBCAAS-PV numerical flow model was developed to evaluate the reasonable range of impacts that could occur from groundwater extraction related to the PVWS Project. The model was used to simulate a 50-year Project pumping period to evaluate the effects from implementation of the requested 30-year ROW grant plus one 20-year extension. A 50-year pumping period was also used to simulate the cumulative effects of PVWS Project pumping together and existing and projected future pumping in the area. GDAs are located many miles from the proposed Project well field, so many of the effects of groundwater pumping take decades to hundreds of years to fully manifest themselves and recover. For this reason, recovery periods ranging from 200 to 450 years were simulated after the pumping period, depending on the effect being evaluated. As discussed in the *Groundwater Resources Impact Assessment* (available on ePlanning), cumulative impacts simulations included agricultural pumping in Snake Valley, agricultural pumping in the portion of the northern Beryl-Enterprise area HA within the APE, and pumping within the portion of the Sevier Desert HA that falls within the APE, namely, for the proposed CPM Project. Therefore, the GBCAAS-PV consists of 1) a calibrated historical model that simulates groundwater and surface water conditions, 2) a baseline forecast model without Project pumping, 3) 250-year forecast scenarios (including 50 years of Project pumping and 200 to 450 years of recovery) to establish the aquifer response under the Proposed Action and the ANWS Alternative, and 4) 250-year to 500-year forecast scenarios (including 50 years of Project pumping and 200 to 450 years of recovery) to establish the cumulative aquifer response under both Project and existing and reasonably foreseeable pumping in the area that may be affected by the Project.

Consistent with the modeling objectives, a superposition modeling approach was used for assessment of Project effects. “Superposition” or “impact modeling” is a robust modeling approach that focuses on evaluating drawdown and flow changes induced by a project rather than actual predicted groundwater levels and flows (Reilly et al. 1987). All models of natural systems are limited by inherent inaccuracies, and by subtracting a no-project baseline model from model cases that simulate project pumping, the potential effects of model inaccuracies on the evaluation of project effects can, to some extent, be subtracted out. The use of superposition modeling to focus on changes induced by a project is well established in hydrogeologic literature, and this approach has been widely used to evaluate the impacts of water supply pumping under NEPA.

The 2014 DWRi Order approving Application to Appropriate Water Number 14-118 (A76676) (DWRi 2014b) requires CICWCD to develop a monitoring program that ensures no prior water rights are impaired and that the aquifer system in the Pine Valley HA is not exceeding safe yield. The Utah Code defines safe yield as "the amount of groundwater that can be withdrawn from a groundwater basin over a period of time without exceeding the long-term recharge of the basin or unreasonably affecting the basin's physical and chemical integrity" (Utah Code §73-5-15(1)(b)). If the Utah DWRi determines that the basin's safe yield is being exceeded, or more than 1/3 of the water rights holders in the Pine Valley HA request it, a GMP would be adopted that limits groundwater extractions to the safe yield (Utah Code §73-5-15(2)). The GMP would specify allowable pumping rates for each water right holder that are protective of the physical and chemical integrity of the basin. Appendix C of the *Groundwater Resources Impact Assessment* (available on ePlanning) lists all potentially impacted water rights for both surface and underground diversions.

As discussed previously, groundwater resources in Pine Valley have been relatively sparsely developed. As a result, the forecasts made using the GBCAAS-PV model include inherent uncertainties. To address the requirements of the Utah DWRi's 2014 Order to verify the basin's safe yield is not being exceeded, CICWCD would implement several "Applicant-Provided Measures" as part of the PVWS Project. These measures are intended to respond to information gathered during implementation of the Project and update the model, address new findings, and adapt well field operations as needed such that impacts do not exceed the impacts identified by the model and discussed herein. These measures are described in detail in Sections 2.3 and 6.1 of the *Groundwater Resources Impact Assessment* (available on ePlanning) and include the following:

- A Well Field Construction Monitoring and Adaptive Management Program would be implemented to collect data during construction and initial operation of the first six wells (see **Appendix F**). The aquifer and drawdown data collected during this time would be used to adjust the well field configuration as needed so drawdown and water budget impacts to the Beryl-Enterprise area HA do not exceed those forecast by the GBCAAS-PV model
- A Well Field Operation Monitoring and Adaptive Management Program would be implemented to collect data during long-term operation of the well field. The drawdown and water quality data would be used to help ensure that exceedances of the safe yield and exceedances of the impacts identified in this EIS are pre-emptively identified and avoided

Section 3.2.3 states that a detailed analysis of a 200-year pumping scenario is not included in this document because modeling a 200-year pumping scenario relies upon assumptions and information that are unavailable or highly uncertain, and not essential to a reasoned choice among alternatives. Information associated with the following variables that would affect Project pumping rates are highly uncertain beyond a 50-year timeframe.

- The ability of project wells to sustain the simulated pumping rates as groundwater levels in Pine Valley continue to drop.

- Future changes in pumping by CICWCD in response to changes in water demand, adaptive management, and State requirements.

- Future changes and distribution of urban, agricultural and range land use patterns and associated water demands.

- The location, amount, and timing of groundwater demand, including changes created by groundwater and surface water projects in other basins and changes created by water use technology.

- The volume, timing, and distribution of groundwater recharge, as influenced by land use, drought, and climate change.

- Groundwater management responses implemented by water users and governments in response to changed groundwater supply and environmental conditions, including changes to Utah water law and regulations.

Despite these unknowns, a scoping-level model run was completed assuming the worst-case scenario for impacts, (assumes pumping at the full diversion volume each year for 200 years, followed by 200 years of recovery) without adaptive management provisions or State of Utah intervention. The *Supplemental 200-Year Analysis* technical memorandum contains this scoping-level analysis is available on BLM's ePlanning website. The results are summarized at the end of Section 3.11.3.

Groundwater Drawdown, Water Budget Changes, and Storage Depletion

Regional drawdown and changes in groundwater flow would be induced by the PVWS Project and would result in a decrease in groundwater storage and changes to the groundwater budget, especially in the Pine Valley HA and, to a lesser extent, the surrounding basins. Declines in groundwater storage, declines in groundwater flow between basins, and exports of groundwater out of a basin can result in less groundwater being available for beneficial use. Groundwater level declines can also make future groundwater development more difficult or expensive by increasing the depth to which wells must be drilled and/or from which groundwater must be pumped. Potential impacts related to regional drawdown, storage depletion, and groundwater budget changes include the following:

- Increased well drilling expenses and pumping costs due to declining groundwater levels
- Potential reduction in the water supply available to senior water right holders
- Reduced long-term groundwater storage that could be available to supply future regional needs, such as during extended drought conditions
- Interference with the implementation of a GMP, such as the GMP in effect for the Beryl-Enterprise area

The drawdown and groundwater storage impacts of the proposed PVWS Project are discussed in detail in the *Groundwater Resources Impact Assessment* (available on ePlanning) and summarized below in **Table 24**. The extent of projected drawdown impacts for the Proposed Action and the ANWS Alternative over time are illustrated in Figures 4-1 and 4-2 of the *Groundwater Resources Impact Assessment* (available on ePlanning), respectively. The extent of cumulative drawdown impacts for the PVWS Project and other nearby pumping are illustrated in Figures 4-14 and 4-15 for the Proposed Action and the ANWS Alternative, respectively. Changes to IBFs under both Project alternatives are illustrated on Figure 4-3 and graphed in Figures 4-5 and 4-7 of the *Groundwater Resources Impact Assessment* (available on ePlanning). Impact information is summarized for each of the HAs in the Hydrologic Study Area for the Proposed Action and the ANWS Alternative. This summary also considers the cumulative effects of Project pumping together with pumping in Snake Valley, the northern Beryl-Enterprise area HA, and the southern Sevier Desert HA.

Table 24. Summary of Groundwater Level Drawdown and Storage Depletion Impacts

Effect	Proposed Action		ANWS Alternative	
	Project Impacts	**Cumulative Impacts**	**Project Impacts**	**Cumulative Impacts**
Pine Valley HA				
Maximum Drawdown	Proposed Action: 350 to 400 within approximately 500 feet of four wells after 50 years of pumping; decreasing to between 50 and 100 feet after 150 years' recovery ANWS Alternative: Up to 200 feet within approximately 500 to 2,500 feet of pumping wells after 50 years of pumping; decreasing to 100 feet within 20 years and 50 feet within 150 years' recovery	Same as Proposed Action	200 feet after 50 years of pumping; decreasing to 100 feet within 20 years and 50 feet within 150 years' recovery	Same as Proposed Action
Drawdown >100 feet	7- by 12-mile area in southern Pine Valley after 50 years of pumping		4- by 7- and 4- by 5-mile areas in southern and central Pine Valley after 50 years of pumping	
Drawdown >50 feet	10- by 16-mile area in southern Pine Valley after 50 years of pumping; decreasing to 7 by 10 miles after 200 years' recovery		7 by 20 miles in southern and central Pine Valley after 50 years of pumping	

Effect	Proposed Action		ANWS Alternative	
	Project Impacts	Cumulative Impacts	Project Impacts	Cumulative Impacts
Drawdown > 10 feet	15- by 22-mile area around well field in southern Pine Valley after 50 years of pumping; increasing to 16 by 40 miles after 200 years of recovery		12 by 40 miles covering most of valley floor after 50 years' pumping and most of the HA after 200 years' recovery	
Drawdown > 1 feet	All of Pine Valley HA		All of Pine Valley HA	
Storage Depletion (acre-feet)	-717,100 after 50 years' pumping -412,200 after 200 years' recovery	-719,200 after 50 years' pumping -417,400 after 200 years' recovery	-715,700 after 50 years' pumping -397,900 after 200 years' recovery	-717,700 after 50 years' pumping -403,000 after 200 years' recovery
Snake Valley HA (including Hamlin Valley)				
Drawdown >100 feet	-	2- by 5-mile area northwest of Gandy after 50 years' pumping; recovering shortly after pumping ceases; outside APE (i.e., no measurable contribution from PVWS pumping)	-	2- by 5-mile area northwest of Gandy after 50 years' pumping; recovering shortly after pumping ceases; outside APE (i.e., no measurable contribution from PVWS pumping)

Effect	Proposed Action		ANWS Alternative	
	Project Impacts	**Cumulative Impacts**	**Project Impacts**	**Cumulative Impacts**
Drawdown >50 feet	-	3- by 8-mile area northwest of Gandy after 50 years' pumping; recovering to <50 feet after 50 years; outside APE (i.e., no measurable contribution from PVWS pumping)	-	3- by 8-mile area northwest of Gandy and 3- by 5-mile area in Hamlin Valley after 50 years' pumping; recovering to <50 feet after 50 years; outside APE (i.e., no measurable contribution from PVWS pumping)
Drawdown > 10 feet	Up to 2 miles into eastern Snake Valley HA after 50 years' pumping; increasing to 4.5 miles after 200 years' recovery	9- by 16-mile area northwest of Gandy, 10- by 35-mile area near Baker and 3- by 5-mile area in southern Hamline Valley after 50 years' pumping; recovering to <10 feet in 75 to 150 years; outside APE (i.e., no measurable contribution from PVWS pumping)	None after 50 years' pumping; up to 3 miles into eastern HA after 200 years' recovery (i.e., no measurable contribution from PVWS pumping)	9- by 16-mile area northwest of Gandy, 10- by 35-mile area near Baker, and 3- by 5-mile area in southern Hamlin Valley after 50 years' pumping; recovering to <10 feet in 75 to 150 years; outside APE (i.e., no measurable contribution from PVWS pumping)

Effect	Proposed Action		ANWS Alternative	
	Project Impacts	**Cumulative Impacts**	**Project Impacts**	**Cumulative Impacts**
Drawdown > 1 feet	Up to 6 miles into eastern Hamlin Valley after 50 years' pumping; increasing to occupy all of Hamlin Valley after 200 years' recovery	Almost all of Snake Valley from Juab County, Utah, south after 50 years of pumping; recovering after 200 years except in Hamlin Valley, near Baker and northwest of Gandy (minor contribution from PVWS pumping in mountain block and upper alluvial fan areas)	Up to 5 miles into eastern Hamlin Valley and 2 miles into central Snake Valley after 50 years' pumping; increasing to 10 to 12 miles into Hamlin Valley and 5 miles into central Snake Valley after 200 years' recovery	Almost all of Snake Valley from Juab County, Utah, south after 50 years of pumping; recovering after 200 years except in Hamlin Valley, near Baker and northwest of Gandy (minor contribution from PVWS pumping in mountain block and upper alluvial fan areas)
Storage Depletion (acre-feet)	-2,500 after 50 years' pumping -43,300 after 200 years' recovery	-450,300 after 50 years' pumping -90,700 after 200 years' recovery	-1,900 after 50 years' pumping -33,800 after 200 years' recovery	-449,600 after 50 years' pumping -81,300 after 200 years' recovery
Beryl-Enterprise Area HA				
Drawdown > 10 feet	Up to 3 miles into northern HA after 50 years' pumping, increasing to 10 miles after 200 years' recovery	1- by 3-mile cone of depression and several smaller cones after 50 years' pumping; decreasing to <10 feet after 10 years' recovery	No drawdown >10 feet after 50 years' pumping; up to 9 miles into northern HA after 200 years' recovery	1- by 3-mile cone of depression and several smaller cones after 50 years' pumping; decreasing to <10 feet after 10 years' recovery
Drawdown > 1 feet	Up to 10 miles into northern HA after 50 years' pumping; increasing to 16 miles after 200 years' recovery	Up to 25 miles into northern HA after 50 years' pumping; decreasing to 18 miles after 200 years' recovery	Up to 8 miles into northern HA after 50 years' pumping; increasing to 15 miles after 200 years' recovery	Up to 25 miles into northern HA after 50 years' pumping; decreasing to 16 miles after 200 years' recovery

Effect	Proposed Action		ANWS Alternative	
	Project Impacts	**Cumulative Impacts**	**Project Impacts**	**Cumulative Impacts**
Storage Depletion (acre-feet)	-21,700 after 50 years' pumping -79,200 after 200 years' recovery	-57,200 after 50 years' pumping -86,100 after 200 years' recovery	-9,700 after 50 years' pumping -50,700 after 200 years' recovery	-44,900 after 50 years' pumping -48,100 after 200 years' recovery
Wah Wah Valley HA				
Drawdown > 10 feet	Up to 1 mile into southwest corner of HA after 50 years of pumping; increasing to 2.5 miles after 200 years' recovery	Up to 1 mile into southwest corner of HA after 50 years of pumping; increasing to 2.5 miles after 200 years' recovery	No drawdown >10 feet	No drawdown >10 feet
Drawdown > 1 feet	Up to 8 miles into southwest HA after 50 years' pumping; beneath most of HA after 200 years' recovery	Up to 8 miles into southwest HA and 4 miles into eastern HA after 50 years' pumping; beneath most of HA after 200 years' recovery	Beneath most of the valley and Wah Wah Range after 50 years' pumping, and most of HA after 200 years' recovery	Beneath most of HA after 50 years of pumping and 200 years of recovery
Storage Depletion (acre-feet)	-3,800 after 50 years' pumping -21,800 after 200 years' recovery	-9,300 after 50 years' pumping -23,700 after 200 years' recovery	-9,800 after 50 years' pumping -30,400 after 200 years' recovery	-15,400 after 50 years' pumping -32,300 after 200 years' recovery
Southern Sevier Desert HA				
Drawdown >100 feet	-	1- by 2-mile cone of depression near southern tip of HA after 30 years of CPM pumping; recovering 20 years after CPM pumping stops	-	1- by 2-mile cone of depression near southern tip of HA after 30 years of CPM pumping; recovering 20 years after CPM pumping stops

Effect	Proposed Action		ANWS Alternative	
	Project Impacts	**Cumulative Impacts**	**Project Impacts**	**Cumulative Impacts**
Drawdown >50 feet	-	1.5- by 3-mile and additional smaller cone of depression near southern tip of HA after 30 years of CPM pumping; recovering 20 years after CPM pumping stops	-	1.5- by 3-mile and additional smaller cone of depression near southern tip of HA after 30 years of CPM pumping; recovering 20 years after CPM pumping stops
Drawdown > 10 feet	-	5- by 7-mile cone of depression near southern tip of HA	-	5- by 7-mile cone of depression near southern tip of HA
Drawdown > 1 feet	No predicted drawdown after 50 years' pumping; 8- by 22-mile area in southwest portion of HA after 200 years' recovery	Area extending up to 15 miles into southern tip of HA after 50 years' pumping; 8- by 25-mile area in southwest portion of HA after 200 years' recovery	Up to 6 miles in SW HA after 50 years' pumping; 10- by 40-mile area in southwest portion of HA after 200 years' recovery	8- to 16- by 25-mile area in southwest HA after 50 years' pumping; 12- by 43-mile area in southwest portion of HA after 200 years' recovery
Storage Depletion (acre-feet)	-500 after 50 years' pumping -15,000 after 200 years' recovery	-32,200 after 50 years' pumping -14,400 after 200 years' recovery	-5,200 after 50 years' pumping -27,200 after 200 years' recovery	-36,300 after 50 years' pumping -23,700 after 200 years' recovery
Tule Valley HA				
Drawdown > 1 feet	No predicted drawdown after 50 years' pumping; area extending 2 to 8 miles into southern tip of HA after 200 years' recovery	Area extending from Snake Valley 1 to 7 miles into western portion of HA; area extending up to 11 miles into southern tip of HA after 200 years' recovery	Area extending up to 2 miles into southern tip of HA after 50 years' pumping; 8- by 22-mile area in southeast portion of HA after 200 years' recovery	Area extending from Snake Valley 3 to 10 miles into western portion of HA; area extending up to 11 miles into southern tip of HA after 200 years' recovery

Effect	Proposed Action		ANWS Alternative	
	Project Impacts	**Cumulative Impacts**	**Project Impacts**	**Cumulative Impacts**
Storage Depletion (acre-feet)	-200 after 50 years' pumping -4,600 after 200 years' recovery	-3,900 after 50 years' pumping -5,900 after 200 years' recovery	-2,200 after 50 years' pumping -7,800 after 200 years' recovery	-5,900 after 50 years' pumping -9,100 after 200 years' recovery
Millford Area Valley HA				
Drawdown > 1 feet	Area extending up to 2 miles into southwest tip of HA after 50 years' pumping; increasing up to 5 miles after 200 years' recovery	Area extending up to 2 miles into southwest tip of HA after 50 years' pumping; increasing up to 5 miles after 200 years' recovery	Area extending up to <1 mile into southwest tip of HA after 50 years' pumping; increasing up to 4 miles after 200 years' recovery	Area extending up to <1 mile into southwest tip of HA after 50 years' pumping; increasing up to 4 miles after 200 years' recovery
Storage Depletion (acre-feet)	-100 after 50 years' pumping -4,600 after 200 years' recovery	-6,300 after 50 years' pumping -4,700 after 200 years' recovery	-300 after 50 years' pumping -3,800 after 200 years' recovery	-6,400 after 50 years' pumping -4,300 after 200 years' recovery

Groundwater Level Drawdown

Under both the Proposed Action and the ANWS Alternative, groundwater level drawdown impacts would be most pronounced in the Pine Valley HA, reach a maximum at the end of the PVWS Project 50-year operational period, and recover slowly after that time. In the surrounding HAs, groundwater level drawdown would be much less and would reach a maximum after pumping ceases and then recover very slowly. Drawdown induced by the PVWS Project would have a greater effect on the HAs adjacent to the southern portion of Pine Valley, and drawdown impacts under the ANWS Alternative would be shifted more northerly. Under both alternatives, the maximum drawdown impacts to the adjacent and nearby HAs would occur at the end of the 200-year post-pumping recovery period. Drawdown in the regional aquifer system would be limited to mountain block areas and in some cases upper alluvial fan areas within a few miles of the Pine Valley HA. Drawdowns exceeding 1 foot would cover broader areas, especially north of Pine Valley in the Wah Wah Valley HA and encroaching on the Sevier Desert HA and Tule Valley HA.

Cumulative pumping in the areas surrounding Pine Valley would not substantially increase drawdown or storage depletion within the Pine Valley HA, and there is no observable change in the predicted drawdown in this area under the cumulative pumping scenarios. This is because the Snake Valley HA is separated from the Pine Valley HA by range-front faults that impede groundwater exchange between these basins and pumping by wells in the northern portion of the Beryl-Enterprise area HA is only about 3,000 afy and affects a limited area. Similarly, possible future pumping for the CPM Project affects a limited area in the southern Sevier Desert HA and the northern Wah Wah Valley HA.

Possible future pumping in Snake Valley would result in a relatively large cone of depression in the Snake Valley HA around pumping centers located in agricultural areas around the communities of Eskdale, Baker, and Garrison and extending southward approximately to Big Spring Wash in Lincoln County, Nevada. Predicted drawdown between 10 and 50 feet underlies an area measuring approximately 10 by 35 miles. A small area within this depression measuring about 1 by 3 miles is predicted to experience drawdown over 100 feet. Additional drawdown cones in Snake Valley are predicted to form in Hamlin Valley and northwest of the community of Gandy. Recovery is predicted to be relatively rapid after pumping ceases, and the residual drawdown is predicted to be less than 10 feet in most of Pine Valley within 75 years after pumping ceases. The main drawdown cone at the end of pumping is outside the area of drawdown that would be induced by the PVWS Project, and the Project would not add measurably to the predicted drawdown in this area. Approximately 1 to 5 feet of cumulative drawdown would be added by the Project near the east side of the Snake Valley HA in the mountain block and upper alluvial fan areas.

Several local areas of groundwater depression (cones of depression) are projected to form in several isolated areas in the northern portion of the Beryl-Enterprise area HA due to local agricultural pumping. The most prominent of these is about 12 miles south of the Pine Valley HA. Drawdown is predicted to be between 10 and 50 feet beneath an area measuring about 1 by 3 miles. Published hydrographs for wells in the Beryl-Enterprise area HA from USGS National Water Information System show that groundwater levels in the central area of the basin, south of the APE of the Proposed Action, have been declining since the 1940s. Drawdown induced by the Proposed Action after 50 years of pumping may add about 1 foot to the drawdown at the northern fringe of the main area of groundwater level decline in the Beryl-Enterprise area HA, about 6 miles south of the Pine Valley HA. As drawdown associated with the Proposed Action spreads southward into the northern Beryl-Enterprise area HA after PVWS pumping stops, it may add about 1 to 5 feet to the local drawdown.

A cone of depression is projected to form in the southern portion of the Sevier Desert HA about 20 miles east of the Pine Valley HA due to pumping for the CPM Project. Drawdown is predicted to be between 10 and 50 feet beneath an area measuring about 4 by 8 miles at the end of 30 years of pumping. Several small areas where drawdown is predicted to be between 50 and 100 feet are located around the proposed well sites for the CPM Project. Groundwater drawdown in this area is predicted to recover to less than 10 feet within 70 years after CPM Project pumping ceases. Drawdown associated with the Proposed Action is predicted to expand into this area about 150 to 200 years after pumping for the CPM Project ceases and would add about 1 to 2 feet of residual drawdown in this area.

Groundwater Storage Depletion

The proposed groundwater extraction rate for the PVWS Project is 15,000 afy, which equates to extraction of 750,000 acre-feet over the 50-year Project operational period. As is evident from the information in **Table 24**, most of this groundwater would be removed from storage in the Pine Valley HA, with a smaller amount coming from storage in the surrounding HAs. These effects were known and predictable when the GMP was adopted for the Beryl-Enterprise area HA and the CICWCD Pine Valley water rights were approved. During the 200 years after pumping ceases, groundwater would flow from the surrounding HAs into the Pine Valley HA, restoring much of the extracted storage while further depleting storage in the surrounding HAs. Under the Proposed Action, about 305,000 acre-feet of storage extracted from the Pine Valley HA during the 50-year pumping period would be restored in the 200-year period after pumping ceases; however, the net storage recovery in the Hydrogeologic Study Area is predicted to be approximately 165,000 acre-feet because of storage depletion effects in the basins surrounding Pine Valley after pumping for the PVWS Project ceases. The maximum storage depletion in the basins surrounding the Pine Valley HA during the recovery period is predicted to be about one to three orders of magnitude less than the maximum storage depletion in the Pine Valley HA at the end of the pumping period.

The ANWS Alternative would shift 60 percent of the production wells further north. Groundwater storage depletion under implementation of the ANWS Alternative would be similar to, but slightly less, than the Proposed Action because storage depletion would be more quickly replenished by intercepted groundwater ET discharge north of Pine Valley. Storage depletion in Wah Wah Valley HA would be greater under this alternative than under the Proposed Action, and storage depletion in Beryl-Enterprise area HA would be less. This is because the well field would be expanded north, farther from the boundary with the Beryl-Enterprise area HA and closer to the Wah Wah Valley HA. An additional result is that after 200 years of recovery, overall regional storage recovery in the Hydrogeologic Study Area would be approximately 193,000 acre-feet, or about 30,000 acre-feet greater than under the Proposed Action. This is likely due to the earlier interception of ET discharge by shifting drawdown effects northward.

As summarized in the cumulative storage depletion presented in Tables 25 and 26 of the *Groundwater Resources Impact Assessment* (available on ePlanning), storage depletion resulting from existing and projected future pumping other than for the PVWS Project would primarily affect the basins surrounding Pine Valley. Storage depletion is predicted to be at maximum at the end of the simulated pumping period and is predicted to recover more rapidly than the storage depletion induced in those basins by the PVWS Project. The most pronounced storage depletion (approximately 450,000 acre-feet) is predicted to occur in Snake Valley because of agricultural pumping. This is approximately 10 times greater than the maximum depletion predicted to be induced in the Snake Valley by the PVWS Project. The cumulative storage depletion predicted in the other basins surrounding Pine Valley would remain much smaller.

Cumulative storage depletion is a long-term Project impact that is reversible over a long period of time. The Project planning horizon includes 50 years of pumping followed by 200 years of recovery, after which the regional aquifer would not have fully rebounded to pre-Project conditions. Groundwater storage depletion can be reasonably seen as an irreversible commitment of resources, at least in the short-term planning horizon. However, it should be noted that this commitment of resources has been fully authorized under Utah state water law and is subject to the requirements and stipulations of the CICWCD's acquired water rights.

Changes in Boundary Flows

The changes in IBF are summarized in map view on Figure 4-3 in the *Groundwater Resources Impact Assessment* (available on ePlanning) and are graphed over time in Figures 4-5 and 4-7. These changes reflect a gradual, long-term re-equilibration of regional groundwater flows as a result of pumping for the PVWS Project. Annual changes in IBF are a relatively small percentages of the basins' overall water budgets but persist for many years, resulting over time in the storage depletions discussed in the previous section. In general, the magnitude and timing of induced changes in IBF is consistent with the distance of the affected inter-basin boundary from the PVWS well field. Flows across boundaries located near the well field experience greater IBF depletions that reach maximum levels earlier and recover more quickly, whereas more distant boundaries experience less IBF depletion over longer periods of time. Changes are also influenced by the presence of faults that impede groundwater flow (e.g., the range-front faults along the eastern and western sides of Pine Valley which impede groundwater exchange between southern Pine Valley and the adjacent portions or Snake and Wah Wah valleys). The most pronounced changes in IBF are to underflow from the Pine Valley HA into the Beryl-Enterprise area HA and the Wah Wah Valley HA, both of which would experience a net decrease in underflow from Pine Valley. Under the Proposed Action, flow between the Pine Valley HA and the Beryl-Enterprise area HA would be reversed for a period of time. Hydrologic interaction between Pine Valley and the southern Snake Valley HA appears to be limited by range-front faults. IBF changes between more distant basins are more muted and delayed. The maximum changes in IBF are predicted to occur decades to several hundred years after pumping ceases, and residual changes are predicted to persist for hundreds of years. Under the Proposed Action, the IBF changes between the Beryl-Enterprise area HA and the Pine Valley HA are the largest, the first to reach a maximum (approximately 20 years after pumping ceases), and the first to substantially recover (approximately 200 years after pumping ceases). Under the ANWS Alternative, IBF with the Beryl-Enterprise area HA would be less, and IBF northward into Wah Wah Valley, the Sevier Desert HA, and the Tule Valley HA would experience a greater amount of depletion that would occur sooner than under the Proposed Action.

The cumulative effect of pumping in basins adjacent to Pine Valley on IBF is discussed in Section 4.3.3 of the *Groundwater Resources Impact Assessment* (available on ePlanning). The change induced by cumulative pumping on IBF is relatively small because pumping in the northern Beryl-Enterprise area HA and the southern Sevier Desert HA occurs from only a few wells that are located at a significant distance from the inter-basin boundaries with Pine Valley. In addition, pumping in Snake Valley, which is more widespread and substantial, is separated from Pine Valley by range-front faults and relatively low permeability rock units that provide a groundwater flow impedance, lessening the effect of this pumping on IBF. In addition, agricultural pumping on the Snake Valley side of Pine Valley-Snake Valley boundary would produce offsetting effects to PVWS Project pumping, lessening IBF depletion. Similar offsetting influences to IBF occur between Pine Valley and Wah Wah Valley and between Wah Wah Valley and the southern Sevier Desert HA during the early portion of the simulation. IBF depletion is predicted to occur between Snake Valley and Tule Valley as a result of pumping in Snake Valley; however, no additional depletion is predicted as a result of pumping for the PVWS Project. Finally, a modest increase in IBF depletion is predicted to occur between the southern Sevier Desert HA and Tule Valley.

Within Snake Valley, groundwater flows from the surrounding mountains toward the valley axis and northward out of the valley. Therefore, the net groundwater flux across the state boundary simulated in the GBCAAS model is from Nevada into Utah (Masbruch 2019). The actual direction and magnitude of groundwater flow across the state boundary is expected to be variable along its length and dependent on the locations of agricultural pumping centers and local areas of drawdown on either side of the state line. These flows may be variable and have not been evaluated in detail, and therefore, current direction and magnitude of interstate groundwater flows in Snake Valley remains unknown. Drawdown induced by the PVWS Project would change IBF between Pine Valley and Snake Valley slightly and would in turn result in a small change in the groundwater flow that currently takes place across the Nevada–Utah boundary. To estimate this change, the change in groundwater flow across the refined (child) model boundary west of the Project well field within the Snake Valley HA was evaluated. The magnitude of this change over time is shown graphically in Figure 4-6 of the *Groundwater Resources Impact Assessment* (available on ePlanning). The net amount of groundwater flow across the state boundary from Nevada into Utah is predicted to increase slightly after PVWS Project pumping begins. After 50 years of PVWS Project pumping, net groundwater underflow across the state line is predicted to increase by approximately 20 afy. The maximum predicted net underflow increase would occur approximately 170 years after pumping ceases and is approximately 170 afy. After this time, net underflow changes would gradually decrease, recovering by approximately 25 percent 450 years after pumping ceases. The actual boundary flow across the state boundary would be dominated by pumping patterns within Snake Valley.

Discussion and Conclusions

The following conclusions may be drawn regarding potential storage depletion and water budget impacts in the Pine Valley HA:

- Groundwater drawdown would increase the cost of groundwater supply development and pumping in the Pine Valley HA for the foreseeable future. In some areas around the PVWS Project well field, these effects would persist over 200 years after groundwater extraction under CICWCD's water right ceases. Potential adverse impacts to senior water right holders would be mitigated under the Interference Drawdown Monitoring and Mitigation Program described in the **Appendix F**. Potential impacts to junior water right holders are normal and expected result of prior groundwater supply development and are required to be borne by them under Utah water law

- Groundwater storage in the upper portion of the carbonate and alluvial aquifer system would be depleted by approximately 700,000 acre-feet after 50 years of Project pumping, recovering slowly to approximately 400,000 acre-feet approximately 200 years after pumping ceases. This finding is consistent with DWRi's conclusion that sufficient water is available for appropriation in the Pine Valley HA, provided that the Applicant-Provided Measures described in **Appendix C** and the mitigation measures described in the *Groundwater Resources Impact Assessment* (available on ePlanning) are implemented and exceedance of safe yield is avoided through implementation of the remaining mitigation measures described in the *Groundwater Resources Impact Assessment* (available on ePlanning)
- The net IBF is currently from Pine Valley HA into the surrounding basins and would decrease as a result of the Project. This would not result in adverse impacts to the Pine Valley HA. Potential adverse impacts to the surrounding HAs as a result of these changes are discussed further below

The following conclusions may be drawn regarding potential storage depletion and water budget impacts in the Beryl-Enterprise area HA:

- Groundwater drawdown would somewhat increase the cost of groundwater supply pumping for a few wells in the northern Beryl-Enterprise area HA. Because drawdown would be relatively limited, future groundwater supply development costs are not expected to be significantly increased. Potential adverse impacts to senior water right holders for affected wells would be mitigated under the Interference Drawdown Monitoring and Mitigation Program described in **Appendix F**. Reduced groundwater levels experienced by junior groundwater right holders are normal and the expected result of groundwater supply development and are required to be borne by them under Utah water law
- Under the Proposed Action and the ANWS Alternative, IBF from the Pine Valley HA into the Beryl-Enterprise area HA would decrease, and groundwater storage in the uppermost portion of the aquifer system underlying the northern Beryl-Enterprise area HA would be decreased. These effects would be less under the ANWS Alternative, but under either alternative, the predicted storage depletion represents a relatively small percentage of the total groundwater in storage in the basin, and the total IBF depletion is relatively small compared to the current net estimated groundwater demand (approximately 65,000 afy). However, this HA operates under a GMP that will sequentially reduce existing pumping until average annual groundwater extractions are decreased from the current estimated net of 65,000 afy to 34,000 afy by October 31, 2130. Although depletion in underflow and basin storage constitute an additional outflow from the groundwater resources in this basin, these factors are self-evident and were presumably considered by DWRi when it issued the 2014 Order approving CICWCD's water right application based on the points of diversion included in the Proposed Action. In addition, the DWRi indicated the same amount of groundwater was available for appropriation in the Pine Valley HA both before and after adoption of the GMP for the Beryl-Enterprise area. Therefore, as long as IBF and storage depletion do not exceed the predicted values, the PVWS Project is not expected to interfere with implementation of the GMP for the Beryl-Enterprise area HA, and no impairment of prior water rights would occur

- The cumulative effects of agricultural pumping in the northern Beryl-Enterprise area HA and the PVWS Project pumping in the Pine Valley HA result in a somewhat greater drawdown and storage depletion in this area. Predicted changes to IBF are slight. These effects were known and predictable when the GMP was adopted for the Beryl-Enterprise area HA, and the water rights were approved for the PVWS Project. As long as IBF and storage depletion do not exceed the predicted values, the PVWS Project is not expected to interfere with implementation of the GMP for the Beryl-Enterprise area HA, and no cumulative impairment of prior water rights would occur
- The data from the Well Field Construction Monitoring and Adaptive Management Program and the Well Field Operation Monitoring and Adaptive Management Program would be used to identify potentially adverse trends in groundwater levels and storage depletion and avoid potentially adverse impacts to the Beryl-Enterprise area HA. If these programs identify a likelihood that drawdown and storage depletion in the Beryl-Enterprise area HA would be greater than predicted for the Proposed Action, the Storage Depletion and Water Budget Impact Mitigation Measures described in **Appendix F** would be implemented to help ensure that adverse impacts to senior water right holders and implementation of the GMP are appropriately mitigated by providing alternative water sources or acquiring and retiring existing water rights

The following conclusions may be drawn regarding potential storage depletion and water budget impacts in other HAs surrounding the Pine Valley HA:

- Predicted drawdown in adjacent HAs under the Proposed Action and the ANWS Alternative would be limited to drawdown beneath the mountain blocks at the edges of the HAs or broader areas with less than 5 feet of drawdown. The amount and distribution of drawdown is not expected to lead to a significant increase in groundwater development or pumping costs
- Due to the effect of existing agricultural pumping, cumulative groundwater storage depletion under the Proposed Action is forecast to be much greater than the amount of storage depletion that can be exclusively attributed to PVWS Project at the end of the simulated pumping period. Existing pumping would account for approximately 99 percent of storage depletion in the Snake Valley, Sevier Desert, and Milford Area HAs; 94 percent of depletion in the Tule Valley HA; and about 60 percent of depletion in the Wah Wah Valley HA. Except for Snake Valley, where the cumulative storage depletion would exceed 450,000 acre-feet, these volumes are a very small percentage of the total groundwater in storage in these basins. Cumulative IBF depletion is predicted to be similar to depletion under the Proposed Action alone. None of these HAs currently operates under a GMP, and the predicted storage and IBF depletions are expected effects for the exercise of existing groundwater rights that were presumably considered in the DWRi's 2014 Order. For these reasons, we conclude the forecasted cumulative storage and IBF depletions would not impair prior groundwater rights in these HAs
- The ANWS Alternative would shift the contribution of PVWS Project-induced groundwater storage depletion to cumulative storage depletion northwards. This would result in a greater cumulative groundwater storage depletion impact in the Wah Wah and Tule Valley HAs. Cumulative IBF depletion impacts would be generally similar to those forecast for the ANWS Alternative. As such, cumulative impacts to the Wah Wah and Tule

Valley HAs would be somewhat greater than under the Proposed Action at the end of the pumping period, and somewhat less 200 years later. These volumes are a very small percentage of the total groundwater in storage in these basins. None of these HAs currently operates under a GMP, and the predicted IBF and storage depletions are expected effects that were presumably considered in the DWRi's 2014 Order. For these reasons, we conclude the forecasted storage and IBF depletions would not impair prior groundwater rights in these HAs

Well Interference Drawdown

As discussed in the *Groundwater Resources Impact Assessment* (available on ePlanning), drawdown induced by the PVWS Project would affect existing groundwater supply wells in the Pine Valley HA and, to a lesser extent, wells in the surrounding HAs. Drawdown imposed by a pumping well on another nearby pumping well can have adverse effects on the operation and performance of that well and is referred to as interference drawdown or well interference. Well interference effects are mutual; that is, each well imposes drawdown that affects the other well's performance. However, in an impact assessment, impacts are discussed in terms of potential adverse effects that a new well imposes on an existing well with senior water rights. The specific potential adverse effects of interference drawdown could include the following:

- The groundwater level in the aquifer could be drawn down below the screened or perforated interval of a well so that the well goes dry and must be deepened or replaced
- The pumping water level in a well could be drawn down so that the pump intake needs to be lowered in order for the well to remain operational or to maintain the well's pumping capacity
- The pumping water level in a well could be drawn down below the top of the well's screened or perforated interval, causing cascading of the water and increasing well maintenance costs, causing premature corrosion of the well or pump, or creating problems with entrained air in irrigation systems
- The pumping capacity of a well could be diminished to a point where the well can no longer produce the amount of water needed for a particular use and the well must be deepened or replaced
- A well may be able to continue operating and produce adequate amounts of water, but pumping must occur at either greater frequency or duration and/or water must be lifted to a greater height, resulting in greater operational costs

The Utah DWRi has not published specific guidance or regulations regarding interference drawdown; however, two existing GMPs for areas that are still open to limited new appropriation (i.e., Bountiful Sub-area of the East Shore area and Weber River Delta Sub-area of the East Shore area) set forth the state engineer's policy concerning the management of interference drawdown and establish a maximum of 15 feet of interference drawdown as acceptable (DWRi 1995a, 1995b). The plans state the following:

> *Wells shall be spaced so that under unconfined conditions they do not cause more than 15 feet of drawdown on any well with an earlier priority date. Users in a particular area may enter into an agreement to provide a variance from this requirement if it does not interfere with third-party rights and also subject to approval by the state engineer.*

Groundwater level fluctuations in the range of 15 feet or less are not uncommon as a result of regional groundwater level trends and pumping patterns and are not likely to result in a well going dry, a significant decrease in pumping capacity, or a change in the operating or maintenance costs of a well that is not reasonably anticipated. As such, interference drawdown less than 15 feet is not considered sufficient to impair the reasonable exercise of an existing groundwater right and is not considered an adverse impact.

An additional consideration in evaluating potential well interference impacts is the reasonable expected service life of an existing well. New wells drilled in the area affected by PVWS Project drawdown would presumably be constructed to adapt to the current and anticipated groundwater conditions and would be designed to avoid adverse effects from the predicted interference drawdown. The service life of a well depends on the age of the well, the methods and materials used in its construction, water quality, aquifer conditions, operational practices, and intended use (Driscoll 1986), and the service life can range from approximately 25 to over 100 years (Glotfelty 2017). During a well's operational life, well yield may be expected to decrease but can often be restored periodically using chemical or physical rehabilitation techniques (Driscoll 1986). Eventually, rehabilitation techniques decrease in their effectiveness over time and wells may fail. The reasonable planning estimate of well life adopted in some NEPA analyses is as little as 20 years. The *Groundwater Resources Impact Assessment* (available on ePlanning) anticipated a well service life of 50 years after the start of PVWS pumping and adopted such a timeframe to account for the range in potential well conditions and the amount of time that existing wells in the area have been under production.

As discussed in the *Groundwater Resources Impact Assessment* (available on ePlanning), a number of existing wells in the Pine Valley HA are predicted to experience well interference drawdown induced by the PVWS Project that could adversely affect their capacity, increase operating or maintenance costs, or cause them to go dry. Under the Proposed Action, six existing wells are predicted to experience interference drawdown ranging from approximately 20 to 120 feet. The locations of these wells are shown in Figure 4-8 of the *Groundwater Resources Impact Assessment* (available on ePlanning), and the amount of drawdown predicted at the well locations is presented in Table 23 of the *Groundwater Resources Impact Assessment* (available on ePlanning). The onset of this drawdown is predicted to range between 10 and 40 years of well field operation. Under the ANWS Alternative, 10 existing wells are predicted to experience interference drawdown ranging from approximately 20 to 50 feet. The locations of these wells are shown in Figure 4-9 of the *Groundwater Resources Impact Assessment* (available on ePlanning), and the amount of drawdown predicted at the well locations is presented in Table 24 of the *Groundwater Resources Impact Assessment* (available on ePlanning). The onset of this drawdown is also predicted to occur between 10 and 40 years of well field operation. In addition, Figure 4-18 of the *Groundwater Resources Impact Assessment* (available on ePlanning) shows three additional wells in the northern Beryl-Enterprise area HA that are predicted to experience cumulative interference drawdown impacts exceeding 15 feet under the Proposed Action.

Based on the available data, it is likely that at least some of the above wells would experience adverse impacts during their operational life, including potential loss of use, loss of productivity, or increased operating or maintenance costs. One of the wells projected to be impacted under the Proposed Action (Point of Diversion 14-121) is operated under a water right that is junior to the water right held by CICWCD for the PVWS Project. The remaining water right holders would be eligible to participate in the Well Interference Drawdown Monitoring and Mitigation Program described in **Appendix F**. This program would assure any impaired underground water right holder whose well is adversely affected is compensated for the cost of well replacement, modification, maintenance, or operation or is provided with an alternative water supply. In cases where multiple causes adversely affect a well (e.g., well interference from other wells), reimbursement would be provided to the extent that adverse impacts are attributable to the PVWS Project. With the implementation of this measure, adverse interference drawdown effects to senior water right holders resulting from the PVWS Project are expected to be fully mitigated.

Springflow Depletion

As discussed in the *Groundwater Resources Impact Assessment* (available on ePlanning), drawdown induced by the PVWS Project in the regional GBCAAS would extend beneath the mountains surrounding Pine Valley into the adjacent alluvial basins. As discussed previously, the available data indicate that springs and seeps in the mountain block areas surrounding Pine Valley rely on groundwater discharge from perched aquifers and would not be affected by drawdown in the regional aquifer system, but springs that are hydraulically connected to the regional aquifer system may experience a decline in discharge as groundwater levels decline, groundwater flow directions change, and groundwater discharge is intercepted by Project pumping. Decreased discharge from these regional springs could adversely impact vegetation and habitat areas that have developed around them and the species that depend on them. In addition, decreased spring flow could impair the beneficial use of spring water by senior water right holders. The specific potential adverse effects of interference drawdown include the following:

- Reduction or loss of supply availability by senior water right holders for stock, domestic or irrigation use, or wildlife guzzlers
- Decline in wetland area, functional components, and primary productivity
- Degradation or loss of groundwater-dependent ecosystems (GDEs), including:
    - Decline or loss of groundwater-dependent vegetation, or shift in species composition leading to habitat degradation
    - Diminished water sources for aquatic habitat, species, and bottom-up food webs
    - Decline or loss of nesting, roosting, or foraging habitat for avian species
    - Decline or loss of habitat, forage, and refugia for mammals and reptiles
    - Decline or loss of water supplies used by terrestrial wildlife for drinking, bathing, or basking
- Loss of sensitive or protected animal and plant species
- Changes in wetland water chemistry and water quality that could lead to degradation or loss of GDEs

The distribution of potential spring discharge depletion caused by the Project is illustrated in Figure 4-4 of the *Groundwater Resources Impact Assessment* (available on ePlanning), and the predicted spring flow depletion over time at the springs in the area is graphed on Figures 4-11 and 4-13 of the *Groundwater Resources Impact Assessment* (available on ePlanning). The only regional spring predicted to potentially experience a measurable or observable decline in discharge is Wah Wah Springs, which is further discussed below. The GBCAAS-PV model predicts a slight decrease in discharge from Dearden, Big, and Clay springs in the Snake Valley HA and Fish

Springs in Fish Springs Flat HA due to regional water budget adjustments; however, the modeled decreases range from approximately 0.1 to 0.9 percent of the total discharge at these springs and would not be measurable or observable. Based on the available data, the remaining springs within the area of predicted drawdown induced by the PVWS Project discharge water from local perched or semi-perched aquifer systems and are unlikely to be affected by Project pumping. However, some uncertainty remains in this conclusion due to the lack of aquifer stress and groundwater supply development in the hydrogeologic study area.

Potential Impacts to Wah Wah Springs

The predicted depletion of Wah Wah Springs discharge under the Proposed Action is approximately 14 percent of the total estimated discharge, and the predicted depletion under the ANWS Alternative is approximately 9 percent. This amount of spring flow depletion may be observable and measurable. Wah Wah Springs consists of a group of springs and seeps within an approximately 380-acre ET discharge area along the mountain front on the eastern slope of the Wah Wah Mountains. The location of the springs and seeps is thought to follow a structural contact of the carbonate and siliciclastic rocks prevalent in the northern portion of the range (Stephens 1974). In this setting, spring flow depletion in the range of 9 to 14 percent, or similar values, would be most likely to manifest itself either as a flow depletion at spring and seep discharge areas at the fringes of the entire discharge area, away from the primary spring orifices. These discharge locations are in more vulnerable positions along the discharge structure and therefore, more vulnerable to groundwater level decline. Spring flow depletion could also occur as a decrease in overflow from the spring areas to the surrounding groundwater-dependent phreatophyte vegetation. Water quality changes could also occur if discharge of deeper, older groundwater is preferentially depleted; however, such changes would be expected to result in improved water quality and would not result in an adverse effect. Potential adverse impacts could include the following:

- Declines in wetland area, aquatic habitat, emergent wetland vegetation, and phreatophyte vegetation surrounding more vulnerable spring areas
- Decrease in the area, vigor, and composition of phreatophyte and other groundwater-dependent vegetation around the edges of the ET discharge area
- Decreased availability of water for diversion to Wah Wah Ranch if diversions under the existing senior water right are curtailed to preserve the ecological integrity of the spring system

The Spring Flow Monitoring and Mitigation Program described in **Appendix F** was developed to identify the potential effects of spring flow depletion, focus investigation on areas of uncertainty and risk, and present an escalating framework of mitigation measures to address potential adverse impacts. With implementation of these measures, the above potential impacts of spring flow depletion are expected to be mitigated. The program allows for collection and evaluation of remote sensing data to support program implementation if the current property owner does not allow access.

Consistent with Stephens (1974), Wah Wah Springs is described by Gardner et al. (2020) as issuing from the base of the carbonate aquifer unit in the Wah Wah Mountains and draining a mountain aquifer unit perched on a siliciclastic unit; however, it is also acknowledged that water discharged at the springs includes a "thermal" component indicative of deeper circulation. The geochemical groundwater age dating information supports the presence of modern water; however, a fraction of pre-modern water is also interpreted to be present, and therefore, the discharge from Wah Wah Springs is interpreted as a mixture of modern and Late Holocene groundwater (Gardner et al. 2020). A principal uncertainty is the fraction of modern versus pre-modern water in the spring discharge, which would shed light on the amount of discharge derived from recent recharge to a perched mountain aquifer versus more deeply circulating groundwater from the regional aquifer system that could be affected by Project pumping.

In GBCAAS-PV, Wah Wah Springs is modeled as discharging entirely from the regional aquifer system. The modeling approach has been refined from GBCAAS v. 3.0 (Brooks 2017) as described in the *Groundwater Resources Impact Assessment* (available on ePlanning), which included the same assumption. This would appear to be a conservative assumption and could lead to over-estimating the amount of spring flow depletion that could result from pumping of the regional aquifer. However, the approach used to simulate discharge from Wah Wah Springs in the GBCAAS v. 3.0 and GBCAAS-PV models cannot be stress tested until the PVWS Project is implemented and thus, includes inherent uncertainties typical of modeling simulations. The monitoring and mitigation measures described for spring flow depletion in **Appendix F** would identify and appropriately respond to either over- or under-prediction of the potential impacts to discharge at Wah Wah Springs. With the implementation of these measures, potential adverse impacts to spring resources at Wah Wah Springs are unlikely.

Local Mountain Block Springs

The best available geochemical and geologic data indicate that springs in the mountain blocks surrounding Pine Valley discharge groundwater from local perched or semi-perched aquifers and would not be affected by groundwater pumping from the regional aquifer system (Brooks 2017; Gardner et al. 2020; Stephens 1976). This includes springs at higher elevations in the mountain blocks as well as springs which lie at lower elevations closer to the contact between the mountain blocks and the valley fill alluvium, as these springs are likely still controlled by the geologic structure of the mountain block and were found by Gardner et al. (2020) to be geochemically distinct. It is important to note, however, that this hydraulic disconnection from the regional aquifer system cannot be conclusively verified until the regional aquifer is significantly stressed by PVWS Project drawdown. For this reason, the Spring Discharge Mitigation and Monitoring Program described in **Appendix F** would identify potential changes in spring discharge, ET, vegetation, and habitat quality that could occur if the assumption of discharge from a regionally disconnected aquifer system is not correct or not completely correct. The program is designed to provide timely warning of potential impacts, identify and manage areas of risk and uncertainty that warrant more detailed investigation, and implement an escalating system of mitigation measures to protect spring-related resources. With implementation of the Spring Discharge Monitoring and Mitigation Program, potential adverse impacts to spring resources would be identified and mitigated.

Cumulative Impacts

The existing and projected pumping in the basins surrounding the Pine Valley HA is located at considerable distance from Wah Wah Springs and, based on the modeling study, is not expected to add to the amount of spring flow depletion. Conversely, pumping for the Project would not produce a measurable or observable depletion effect in the regional springs in Snake Valley. However, based on groundwater modeling, these springs are expected to experience substantial discharge depletions as a result of existing pumping in Snake Valley. Cumulative spring flow depletion over time for Big, Clay, Dearden, and Fish springs, which includes existing pumping and the small but unmeasurable predicted impact from the Project, is graphed in Figure 4-20 of the *Groundwater Resources Impact Assessment* (available on ePlanning). As shown in this figure, predicted discharge depletions for these spring resources are as follows:

- Discharge from Big Springs is predicted to decrease by about 22 percent from 7,404 afy to approximately 5,800 afy after 50 years of Project pumping. The component of spring flow depletion induced by the PVWS Project would begin slowly after Project pumping ceases and would not be measurable or observable (1 percent of total discharge after 200 years)
- Discharge from Dearden Springs is predicted to decrease by about 52 percent from 4,833 afy to approximately 2,300 afy after 50 years of Project pumping. The component of spring flow depletion induced by the PVWS Project would begin slowly after Project pumping ceases and would not be measurable or observable (approximately 0.1 percent of total discharge after 200 years)
- Discharge from Clay Spring (currently reported as 257 afy) is predicted to decrease approximately 250 afy after about 50 years of Project pumping. This is a 97-percent decrease in flow that would be overwhelming due to pumping with Snake Valley. The component of spring flow depletion induced by the PVWS Project would begin slowly after Project pumping ceases and would not be measurable or observable (approximately 0.2 percent of total discharge after 200 years)
- Fish Springs ET Area: The cumulative spring flow depletion from pumping in Snake Valley and the PVWS Project would be less than 0.2 percent of the total reported spring discharge and would not be measurable or observable

Based on the above information, it is likely that Big Springs, Dearden Springs, and Clay Spring would experience cumulative adverse impacts induced almost entirely by existing agricultural pumping, and these impacts would include:

- Loss of wetland area
- Loss and degradation of aquatic habitat and food webs
- Loss of habitat, forage, and water sources for terrestrial and avian species
- Loss and degradation of groundwater-dependent vegetation
- Impairment of prior water rights

Cumulative effects in the Snake Valley HA were simulated using the recent update to the USGS GBCAAS model developed by Masbruch (2019), which was thought to represent the most refined modeling tool available to evaluate the effects of pumping in that area. The spring flow depletions simulated using this model provide an adequate basis to conclude that significant adverse impacts to regional spring resources should be considered likely as a result of current and foreseeable groundwater pumping in Snake Valley. Further refinement of the model and the underlying water budget and demand assumptions may be needed in order to utilize it as a definitive tool to guide groundwater management decisions in that basin, and the GBCAAS-PV model is not intended to fulfill that purpose. Demand estimates and water budget calculations could be refined by additional land and water use analysis, remote sensing, and GIS evaluation. Forecast demand trends are similarly uncertain. Finally, the scope of this *Groundwater Resources Impact Assessment* (available on ePlanning) did not include a critical analysis of potential static and dynamic model refinements outside the focused model area of the GBCAAS-PV model.

Evapotranspiration Depletion

Groundwater ET discharge occurs in areas of a groundwater flow system where the depth to groundwater is shallow enough for plant rooting depths to utilize groundwater to meet vegetation water demand. Groundwater levels in the Pine and Wah Wah Valley HAs are too deep for groundwater to discharge locally. Groundwater flows northward out of these basins in the subsurface and ultimately discharges by ET from phreatophytes and other groundwater-dependent vegetation around Sevier Lake and in the Tule Valley HA, where groundwater levels are closer to the ground surface. As groundwater level drawdown propagates northward from the proposed PVWS Project well field over time, groundwater levels would be expected to decline and groundwater ET discharge to decrease. Potential impacts related to groundwater level decline and depletion of ET discharge include the following:

- Decline or loss of groundwater-dependent phreatophyte species and changes in shrub density or composition
- Decline or loss of alkali meadow areas
- Loss or degradation of wildlife foraging, nesting, roosting, and refugia habitat
- Increased erosion due to declining vegetation
- Air quality degradation due to increased wind erosion

In the Hydrogeologic Study Area, ET discharge of groundwater occurs at the northern extent of the regional groundwater flow system in the southern portion of the Sevier Desert HA around Sevier Lake and in the Tule Valley HA as shown on Figure 3-28 of the *Groundwater Resources Impact Assessment* (available on ePlanning). In these areas, USGS has mapped GDAs consisting of phreatophyte shrubs and, in a small portion of Tule Valley, alkali meadows. These areas are located remote from the proposed well field, and groundwater ET depletion effects are expected to be delayed, to increase gradually over a long period of time, and to be associated with small amounts of drawdown in the range of 1 foot or less. The distribution of groundwater ET-depletion impacts is illustrated in Figure 4-4 of the *Groundwater Resources Impact Assessment* (available on ePlanning), and ET depletion over time is graphed in Figures 4-14 and 4-15 of the *Groundwater Resources Impact Assessment* (available on ePlanning). Under the Proposed Action, groundwater ET depletion is predicted to begin after the end of the 50-year pumping period and to increase slowly over a period of about 250 to 300 years to a maximum of about 70 afy around Sevier Lake and 340 afy in the Tule Valley HA. The forecast depletion represents about 5 percent of the total estimated groundwater ET around Sevier Lake and 0.9 percent of the total groundwater ET in the Tule Valley HA. Under the ANWS Alternative, groundwater ET depletion is predicted to begin sooner and to be somewhat greater. Groundwater ET depletion is predicted by the GBCAAS-PV model to begin after about 20 years of pumping and to increase slowly over a period of about 150 to 200 years to a maximum of about 110 afy around Sevier Lake and 590 afy in the Tule Valley HA. The forecast depletion represents about 8 percent of the total estimated groundwater ET around Sevier Lake and 1.5 percent of the total groundwater ET in the Tule Valley HA. While this is somewhat greater than the predicted groundwater ET depletion under the Proposed Action, it still represents a relatively small amount of the total groundwater ET theorized for the area and would likely be spread over a larger area.

The GBCAAS v. 3.0 and GBCAAS-PV models simulate groundwater ET discharge areas in Sevier and Tule valleys using the MODFLOW EVT package, which assigns ET rates to saturated intervals above a static extinction depth below which no groundwater ET can occur. A recent study near Baker Ranch in Snake Valley demonstrated that phreatophyte shrubs were able to adapt and maintain groundwater connectivity and plant vigor during a 6-year period of steady, pumping-induced groundwater level decline of over 4 feet (Devitt and Bird 2016). Since the EVT package cannot simulate the ability of phreatophytes to adapt to changing groundwater conditions, it would tend to over-predict groundwater ET depletion. Therefore, it is reasonable to expect that groundwater ET depletion would be less in magnitude and spread over a larger area than simulated. The GBCAAS v. 3.0 and GBCAAS-PV models have also adopted the assumption that the ET demand of phreatophyte shrubs around Sevier Lake is met entirely by groundwater from the regional aquifer system. Recent investigations for the CPM Project at the Sevier Lake playa concluded that phreatophyte shrubs in this area derive at least part of their ET demand from local perched aquifers and would not be affected by local groundwater pumping for this Project (Whetstone Associates and ENValue 2019). Given the geologic setting of this playa, this interpretation seems plausible and, if correct, would further decrease the potential for ET depletion in this area. Finally, only a portion of the vegetation ET demand in the GDAs would be expected to be met by groundwater, with soil moisture from precipitation making up the rest and lessening the impacts to vegetation.

Based on the available information, it is unlikely that drawdown associated with the PVWS Project would result in a measurable decline in groundwater-dependent vegetation or habitat quality in the GDAs mapped around Sevier Lake and in Tule Valley. Correspondingly, increased erosion and air quality degradation impacts are also unlikely. Nevertheless, an ET Discharge Monitoring Program would be implemented as described in **Appendix F**. If this monitoring program or other studies were to identify a potential concern related to groundwater ET discharge at the GDAs in Tule Valley and around Sevier Lake, under Utah water law, the junior groundwater right recently granted to the CPM Project would be curtailed prior to the right granted to CICWCD. Since pumping for the CPM Project is more proximal to the GDAs, curtailment of pumping at this location would be expected to have a greater and more immediate effect, further decreasing the chances of an adverse groundwater ET depletion impact related to the PVWS Project.

The cumulative groundwater ET depletion estimates for the Sevier Desert and Tule Valley HAs, which include effects from existing pumping in adjacent HAs and from other projects, are somewhat higher than the estimates for the PVWS Project alone. The following summary information is provided:

- Groundwater ET depletion around Sevier Lake would be dominated by near-term effects caused by groundwater extraction for the CPM Project followed by effects due to the PVWS Project. Under the Proposed Action, cumulative groundwater ET depletion is predicted to reach a maximum of about 115 afy (8 percent of the total ET discharge around Sevier Lake) about 10 years after the 50-year pumping period for the PVWS Project ceases. The contribution to groundwater ET discharge decline induced by the PVWS Project would reach a maximum depletion of 70 afy (about 5 percent of the total ET discharge) roughly 300 years after Project pumping stops. Under the ANWS Alternative, early-term effects would remain the same, and groundwater ET depletion induced by the PVWS Project would reach a maximum of 115 afy about 200 years after Project pumping stops. Under this alternative, overlap between the effects of the CPM Project and the PVWS Project would increase the maximum cumulative ET depletion to about 130 afy (about 9 percent of total groundwater ET discharge) roughly 10 years after pumping stops

- Cumulative groundwater ET discharge in Tule Valley would be affected by the PVWS Project and, to a lesser extent, by pumping for the CPM Project and pumping in Snake Valley. Under the Proposed Action, cumulative depletion would reach a maximum of 400 afy 250 years after PVWS Project pumping stops. This represents about 1 percent of the total annual groundwater ET discharge in the Tule Valley HA. Of this total, groundwater ET depletion induced by the PVWS Project would account for up to about 350 afy. Under the ANWS Alternative, groundwater ET depletion by the PVWS Project would begin earlier and be greater than under Proposed Action. Cumulative groundwater ET discharge would increase to about 485 afy 20 years after pumping stops and would reach a maximum of about 680 afy 150 years after pumping stops. Of this total, groundwater ET depletion induced by the PVWS Project would account for up to 600 afy about 150 years after Project pumping stops. The maximum cumulative depletion would increase to about 2 percent of the total groundwater ET discharge in the Tule Valley HA
- Cumulative groundwater ET discharge in Snake Valley would be affected primarily by existing pumping in Snake Valley. Under both the Proposed Action and the ANWS Alternative, the contribution of the PVWS Project to groundwater ET discharge depletion in Snake Valley would be less than 0.02 percent, which is negligible. ET depletion induced by existing agricultural pumping is predicted to begin shortly after PVWS Project pumping begins and to increase relatively rapidly to a maximum of 15,000 afy after 50 years of PVWS Project pumping. This represents about 22 percent of the total annual groundwater ET discharge in the Snake Valley HA

Although the cumulative groundwater ET depletion estimates for the Sevier Desert and Tule Valley HAs are somewhat higher than the estimates for the PVWS Project alone, they are still relatively limited, and as noted above, actual groundwater ET depletion effects are likely to be less and to be more spread out in space and time. Furthermore, phreatophyte shrubs in this area have been found to be able to adapt to gradual declines in groundwater level over 4 feet, which is greater than the predicted groundwater level declines in the area. In addition, the ET demand of vegetation in the GDAs is met partially by precipitation, lessening the effect of groundwater ET depletion. Finally, effects related to the CPM Project would occur earlier than the effects of the PVWS Project, giving added opportunity for potential course corrections relative to the curtailment of junior water rights if the monitoring program presented in **Appendix F** suggests that measurable ET depletion is occurring. For these reasons, we conclude that adverse cumulative impacts to phreatophytes and other groundwater dependent vegetation in the GDAs around Sevier Lake and in the Tule Valley HA are unlikely.

The predicted cumulative groundwater ET depletion in GDAs in the Snake Valley HA are several times higher than those predicted for the Sevier Desert and Tule Valley HAs and represent a much higher percentage of the total simulated ET in this area. Based on this information, we conclude that adverse impacts to phreatophytes and other groundwater-dependent vegetation are possible in Snake Valley as a result of existing local pumping but pumping for the PVWS Project would not contribute cumulatively to such impacts.

Effects of Climate Change

Climate change may affect and magnify the cumulative impacts of the proposed PVWS Project due to factors such as declines in snowpack; changes in the timing, amount, and intensity of precipitation; increased climatic variability and drought frequency; and increased temperatures and ET. Conversely, warmer temperatures may cause more rainfall because warmer air holds more water vapor than colder air. While climate projections forecast an increase in average temperatures, the effect of climate change on precipitation is not well understood, and no changes in precipitation are forecast (see *Effects of Climate Change* subsection above). Warm weather precipitation may increase, but so would ET. Thus, the effect of climate change on groundwater recharge in these basins is not clear. It is likely that increased potential ET would result in some decrease in the amount of groundwater available for mountain recharge, but the distribution, magnitude, and timing of this effect is uncertain.

It is unlikely that pumping-related impacts from the PVWS Project would be significantly affected by climate change. The amount of municipal pumping associated with the PVWS Project is limited by water right and does not change with climate. Water budget effects related to changes in recharge and discharge are expected to take a substantial amount of time to manifest themselves and propagate through the groundwater flow system. Such changes are unlikely to affect the maximum predicted impacts or their timing, which are based on groundwater extraction during the pumping period and aquifer conditions but could affect the time for conditions to recover from impacts induced by the PVWS Project.

Increased ET and changes in precipitation and temperature could induce long-term stress that leads to changes in plant composition and vigor. These changes could affect vegetation in GDAs and could work cumulatively with groundwater discharge changes, or independent of them. Long-term climate, ET, and Leaf Area Index monitoring data would help to distinguish these effects. Changes in mountain snowpack temporal and spatial patterns could lead to near-term changes in the discharge of local springs, which have shorter response times than regional flow systems. Long-term spring discharge, climate, ET, and LAI monitoring data would help to distinguish these effects.

Water Quality Impacts

Groundwater extraction from wells changes regional groundwater gradients and flow patterns and can cause the migration, capture, or trapping of dissolved solutes; contamination; and water with inferior water quality, leading to water quality degradation. In addition, groundwater wells can create pathways for vertical migration of contaminants and solutes through intra-borehole flow. Potential groundwater quality impacts from groundwater extraction include the following:

- Development of a cone of depression in and around Pine Valley could lead to long-term increasing solute concentrations in the local aquifer system through internal trapping of salt loading from recharge sources
- Zones or pockets of lower-quality groundwater or degraded groundwater could migrate into unaffected areas as a result of groundwater extraction
- Construction of wells with long screen intervals that cross regional aquitards could potentially serve as pathways for vertical migration of groundwater of different quality via intra-borehole flow under ambient (non-pumping) conditions

- Capture of degraded groundwater by production wells could result in the requirement for additional treatment
- Changes in regional groundwater quality could change the quality of groundwater discharged from springs, resulting in potential impacts to aquatic habitat, groundwater-dependent vegetation, and phreatophytes

Information regarding existing water quality conditions is discussed in Section 2.11.2. Distinct areas with poor or degraded water quality were not identified. A large cone of depression would form around the PVWS Project well field. However, this cone of depression would capture only existing long-term precipitation recharge sources to the aquifer system and is not expected to capture sources with elevated solute concentrations or other contaminants. No water is imported to Pine Valley for irrigation purposes, and no fertilizers are applied. The only known source of potential solute loading would be the Pine Valley Hardpan, which occasionally receives surface water with elevated solute concentrations as a result of evaporation and is located at the northern end of Pine Valley. The Pine Valley Hardpan is not considered as a significant source of recharge to the groundwater system under GBCAAS v. 1.0 (Brooke et al. 2014), GBCAAS v. 3.0 (Brooks 2017), or in water budget studies performed for Pine Valley (Gardner et al. 2020; Stephens 1976). In addition, groundwater flow from this area would continue in a northward direction under both the Proposed Action and the ANWS Alternative. For these reasons, groundwater quality degradation through the internal trapping of salt loading sources is not expected to occur.

Although groundwater quality is somewhat variable throughout the Pine Valley HA (Ensign 2018; Gardner et al. 2020), likely depending on the age of groundwater in the aquifer system and the parent material of the aquifer sediments (i.e., volcanic rocks versus carbonate or siliciclastic rocks), no distinct pockets or zones of impacted or inferior quality groundwater have been identified. The groundwater generally meets Primary and Secondary MCLs for drinking water established by the EPA. It is likely that the Pine Valley Hardpan is underlain by salt accumulations from evaporative concentration, as is the case for numerous playas in the Great Basin. However, this portion of the valley is also most likely to be underlain by the greatest accumulation of fine-grained sediments in the basin, and it is expected that the net groundwater flow beneath the hardpan would continue to be northward.

Individual wells and the PVWS well field as a whole would draw water from a wide source area in all directions from the extraction well or area. If local water quality variations exist, they are unlikely to result in distinct water quality impacts that violate water quality standards. In addition, there are no known lateral or vertical migration pathways from degraded groundwater sources that would affect existing wells, and no data that would suggest vertical zonation of water quality that could be mobilized or cross-connected by new well completions of pumping for the PVWS Project.

Except for Wah Wah Springs, is it unlikely that the Project would affect the springs surrounding Pine Valley. Wah Wah Springs could experience a measurable change in water quality if the regional aquifer component of the spring discharge is depleted while the local perched aquifer component remains; however, the likely effect would be an improvement in water quality as older groundwater discharging from the regional aquifer is preferentially depleted.

Based on the available information, adverse water quality changes are not anticipated because of the PVWS Project. Water quality monitoring would be conducted as discussed in **Appendix F** to address potential data gaps and uncertainties and address potential risks.

Cumulative groundwater quality impacts could occur when 1) an action or Project releases contamination or causes water quality impacts that are then acted upon by groundwater extraction associated with the PVWS Project; 2) multiple groundwater extraction projects act together to change groundwater flow patterns and capture contamination, draw it into uncontaminated areas, or trap degraded groundwater; or 3) a project interferes or conflicts with an existing or planned cleanup, waste management strategy, or water quality management plan. No pumping projects are planned that would cause recharge from the Pine Valley Hardpan to be internally trapped in the basin. There are no other known releases or areas of contaminated or degraded groundwater that could be acted upon by the PVWS Project either by itself or in combination with other pumping. The Project would not conflict with any known or planned groundwater cleanups, waste management plans, or water quality management plans. Based on this information, adverse cumulative water quality impacts are not anticipated.

Subsidence

Land subsidence may result from groundwater level decline in the alluvial aquifer systems underlying Pine Valley in areas where significant thicknesses of potentially compressible clays occur. Potential impacts of land subsidence include:

- Changes in elevation and slope of the ground surface possibly affecting drainage patterns and creating new playa areas or areas prone to flooding
- Damage to existing linear surface infrastructure, such as roads, pipelines, and buried utilities
- Damage and diminished or loss of function of surface conveyance infrastructure, such as ditches, drains, storm sewers, or sanitary sewers
- Damage to buildings, pavements, and other surface infrastructure
- Failure of well casings due to compaction of the basin-fill alluvium
- Reduced long-term storage capacity
- Formation of fissures that damage infrastructure or are a hazard to public health, stock, or wildlife

Based on the available information regarding the geology of Pine Valley, the area most susceptible to subsidence is the north-central portion of the valley in the vicinity of the playa. This area appears to have served as a depocenter throughout the geologic history of the basin and is a location where significant thicknesses of lacustrine clay strata susceptible to subsidence are likely to occur. The amount of drawdown predicted in the north and central portions of Pine Valley under the Proposed Action reaches a maximum of about 10 to 20 feet about 75 to 200 years after pumping ceases (Figure 4-1 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). Under the ANWS Alternative, the maximum drawdown in the north and central portions of Pine Valley is predicted to be about 10 to 50 years after the end of the 50-year pumping period (Figure 4-2 of the *Groundwater Resources Impact Assessment* [available on ePlanning]). Based on available data for Escalante Valley and Cedar Valley, groundwater drawdowns of as much as 100 feet have been reported as being associated with up to approximately 3 feet of subsidence, which is roughly 1 foot of subsidence per 30 feet of drawdown. Although this information is insufficient to establish a reliable correlation between predicted drawdowns and subsidence in Pine Valley, the subsidence history of nearby basins in a similar geologic setting provides a useful perspective regarding the general subsidence risk in the area.

Based on this information, engineering judgment, and the predicted drawdown for the PVWS Project compared to drawdown experienced in Escalante Valley and Cedar Valley, pumping of groundwater for the PVWS Project may cause anywhere from a few inches to 2 feet of subsidence in northern and central Pine Valley. Depending on the thickness and compressibility of the sediments underlying the well field areas in the southern portion of Pine Valley, subsidence in this area could locally range from a few inches to 3 feet or more. The significant depth to groundwater and the sediments that would undergo compression would be expected to decrease and delay the effect of subsidence at the ground surface. In general, based on the available data, the subsidence risk associated with the Proposed Action appears to be lower than the ANWS Alternative based on the likely distribution of compressible clays in the alluvial valley fill.

Drawdown induced by the Project in the adjacent HAs would primarily affect bedrock and upper alluvial fan and middle alluvial fan areas, which are generally not susceptible to subsidence. As such, although drawdown induced by the Project would interact with the edges of cones of depression in the adjacent HAs, it would not extend into areas where drawdown is sufficient to induce subsidence and where compressible sediments would be more likely to occur. Based on the available data, the risk of potential subsidence would be limited to the floor of Pine Valley, and cumulative drawdown in this area would not be measurably affected by pumping outside the basin.

Surface infrastructure in Pine Valley potentially sensitive to damage from subsidence is relatively limited due to a general lack of development in the area. Potential infrastructure that could be damaged includes State Route 21, which is the only paved road in Pine Valley and bisects the north central portion; the Desert Experimental Range station, which is located in the north central portion of the valley and includes several buildings and dirt roads, various dirt roads, and ditches that lead to stock ponds; and East Pine Reservoir in the northern portion of the valley where subsidence is more likely, but drawdown would be more limited. Potential impacts include local damage to roads and other infrastructure, local fissure formation, and local changes in drainage patterns. The Subsidence Monitoring and Mitigation Program described in **Appendix F** would identify the effects of subsidence in a timely fashion, allow timely readjustment of well field operation to avoid potential adverse impacts, and effectively mitigate the limited anticipated infrastructure and surface damage that may result when avoidance is not possible.

Scoping-Level 200-Year Model Run Results

A GBCAAS-PV model run was completed based on the assumption that pumping would continue at the full diversion volume each year for 200 years, followed by 200 years of recovery, without any adaptive management provisions or State of Utah intervention. The results are available in the *Supplemental 200-Year Analysis*, available on the BLM's ePlanning website. The results of this model run showed the following.

- Drawdown in the project wells is predicted to increase by more than 50 percent between the end of the 50-year and the end of the 200-year simulation periods. Based on the available information, it is reasonable to assume the proposed project pumping rate can be maintained for 50 years but may require some well or wellfield modifications as part of the adaptive management program. In contrast, it is more uncertain whether the proposed pumping rate could be maintained for 200 years.

- After 200 years, drawdown induced by PVWS Project pumping in Snake and Hamlin valleys to the west would likely occur mainly in Hamlin Valley away from sensitive groundwater dependent resources. However, drawdowns of up to 10 to 25 feet would near the existing agricultural pumping wells in the southern part of the valley. Only a 1-foot drawdown attributable to the project was predicted in Snake Valley close the nearest identified regional springs. Predicted spring flow depletion for regional springs in Snake Valley would comprise 0.4 to 1.6 percent of reported discharges, which would not be measurable or observable.

- After 200 years, predicted drawdown near the ET discharge (phreatophyte) areas in Tule Valley and Sevier Desert would be up to approximately 3 feet and 5 feet, respectively.

- Near the existing wells in the northern portion of the Beryl-Enterprise area, predicted drawdowns would range from approximately 10 to 50 feet.

- Spring flow depletion at Wah Wah Springs, assuming it is regionally connected, is predicted to be up to 64 percent.

- Simulation of pumping in Snake Valley indicates that in the absence of pumping by the PVWS Project, continuing to pump at current rates in Snake Valley is predicted to result in significant adverse depletion of discharge from regional springs after 50 years, which would become more severe after 200 years. The predicted contribution of PVWS pumping to these impacts would not be measurable or observable.

The 200-year analysis predicts that pumping effects would develop substantially during the first few decades of project pumping, which would allow time for adaptive management to address or avoid future impacts. The adaptive management strategy (see **Appendix F**) is a component of both action alternatives to provide consistent monitoring to verify whether the actual impacts of the project match what was forecasted by the model. The strategy will proactively identify responsive measures to ensure that any unanticipated impacts are addressed quickly once they are recognized and addressed in a manner that prevents the impact from worsening. This adaptive approach is designed to manage the uncertainty between the predicted impacts and what occurs through implementation.

Monitoring data that would be collected in the next 50 years would be used to refine expected impacts from continued groundwater pumping. The project proponent has committed to installation of monitoring locations in Pine Valley that allow early and ongoing assessment of whether the basin is behaving as predicted and allow early warning of potential impacts that exceed those predicted by the model, allowing adaptive management to be implemented to minimize or avoid these impacts. Monitoring wells close to the hydrologic divide between the Beryl-Enterprise area and Pine Valley to the south, between the well field the ET discharge areas in Tule Valley HA and Sevier Desert HA, and between the wellfield and Snake Valley to the west and Wah Wah Valley to the east, would provide early warning of unexpected impacts to adjacent hydrologic basins as part of the adaptive management approach. If the monitoring results show a potential for unacceptable impacts, the adaptive management program included in the proposed action would be triggered. If, in 50 years at the time when project reauthorization is being considered, groundwater modeling utilizing updated assumptions and information indicates that continued pumping would have unacceptable impacts to the Pine Valley aquifer system or to other aquifers within the Great Salt Lake Flow System, the authorized project pumping schedule would be adjusted to prevent these impacts.

If groundwater pumping is required to be limited or curtailed pursuant to the monitoring and mitigation program (see **Appendix F**), such actions would need to be coordinated with the DWRi through a groundwater management plan, since DWRi is the agency with authority to limit water rights granted by the state.

CHAPTER 4 CONSULTATION, COORDINATION, AND PUBLIC OUTREACH

4.1 Cooperating Agencies

The following federal and state agencies contributed to the development of this EIS: the USGS, USFWS, Utah's Public Lands Policy Coordinating Office, State Historic Preservation Office (SHPO), SITLA, and Nevada Department of Wildlife. Local cooperating agencies include the Enoch City, Iron County, Beaver County, Millard County, and White Pine County. Each agency participated in the review and findings in this EIS such that each can draw from it to support their separate decisions.

4.2 Interagency Consultations

Technical reports to support interagency consultations were developed to analyze impacts Project-wide, including a Biological Assessment (available on ePlanning) to support Section 7 consultation under the ESA and a Cultural Resources Inventory Report to support Section 106 consultation under the NHPA.

The USFWS is the lead federal agency for Section 7 consultation. The Biological Assessment includes the scope of consultation and analysis for this Proposed Action. The USFWS issued a concurrence letter after reviewing the Biological Assessment agreeing with the determination that the Project "may affect but is not likely to adversely affect" listed species.

The BLM has followed the Section 106 process, submitting the Project-wide Cultural Resources Inventory Report to the SHPO.

The BLM consulted with the National Park Service regarding the Old Spanish Trail.

4.3 Tribal Consultations

A Cultural Resources Inventory Report has been completed. As part of NHPA Section 106 compliance, the report was submitted to the Cedar Band of Paiutes, the Kanosh Band of Paiute Indians, and the Confederated Tribes of the Goshute Reservation for concurrence on site eligibility and Project effect. In response to public scoping, the Kanosh Band of Paiute, Cedar Band of Paiute, and Confederated Tribes of the Goshute Reservation submitted comments. As part of scoping, the BLM mailed letters dated September 3, 2020, to the following American Indian Tribes to inform them of and determine their interest in the Project: Cedar Band of Paiutes, Kanosh Band of Paiute Indians, Indian Peaks Band of Paiutes, Moapa Band of Paiute Indians, Paiute Indian Tribe of Utah, Shivwits Band of Paiutes, Ute Indian Tribe, Kaibab Band of Paiute Indians, Pueblo of Zuni, Confederated Tribes of the Goshute Reservation, Hopi Tribe, Navajo Nation, San Juan Southern Paiute Tribe, Southern Ute Indian Tribe, and Ute Mountain Ute Tribe.

On September 17, 2020, the Hopi Cultural Preservation Office responded to the scoping letter and requested consultation on the cultural resources survey report for review and comment. The report was submitted on November 24, 2020; a concurrence letter was received on December 4, 2020; and a letter stating concurrence with the SHPO finding of No Adverse Effect was signed by the Tribe on December 4, 2020.

The Navajo Nation Heritage and Historic Preservation Department replied to the September 3, 2020, scoping letter with no concerns and without further consultation requested.

Roy Plank, CCFO archeologist, met in person with Dorena Martineau of the Paiute Indian Tribe of Utah to review the Project, including results of the cultural resource inventory. On February 7, 2020, the Tribe stated in writing that they had no objections to the Project moving forward. They also responded to the September 3, 2020, scoping letter with no objections.

Through ongoing consultation, the Kanosh Band and Cedar Band of Paiutes were invited to a cooperating agency meeting on December 17, 2020. Following the meeting, the Paiute Indian Tribe of Utah expressed an interest in participating in the Project. During the Cooperating Agency meeting, the Tribe stated concerns with the Project, requested further consultation, and requested that the BLM present the Project at the next tribal council meeting. On February 1, 2021, the BLM presented the Project to the Tribal Council of the Paiute Indian Tribe of Utah to update them on the status of the Project and discuss the Tribe's concerns. On April 1st, 2021, the Paiute Indian Tribe of Utah sent a letter to the BLM State Office and the CCFO office unanimously voting in opposition to the PVWS Project.

Government-to-government consultation under Section 106 of the NHPA is ongoing with the Tribes listed below (**Table 25**). The BLM sent formal consultation letters, as described in the Scoping Summary Report.

Table 25. Tribes Consulted

Tribes	Tribes
Cedar Band of Paiutes	Confederated Tribes of the Goshute Reservation
Kanosh Band of Paiute Indians	Hopi Tribe
Indian Peaks Band of Paiutes	Kaibab Band of Paiute Indians
Moapa Band of Paiute Indians	Navajo Nation
Paiute Indian Tribe of Utah	San Juan Southern Paiute Tribe
Shivwits Band of Paiutes	Southern Ute Indian Tribe
Ute Indian Tribe	Ute Mountain Ute Tribe
Pueblo of Zuni	-

4.4 Public and Agency Scoping

The scoping period for the PVWS Project began on July 15, 2020, with the publishing of the Notice of Intent in the *Federal Register*. The scoping period lasted 35 days, concluding on August 19, 2020. The public was notified by listing the Project on the BLM ePlanning website on February 4, 2020. Agencies and private landowners crossed by the alignment were mailed a scoping letter; specifically; 12 mailings were sent to ROW holders and 20 mailings to grazing permittees.

The BLM hosted one online public scoping meeting on August 5, 2020. Approximately 40 members of the public were in attendance. The recording of the online scoping meeting has been viewed 62 times on YouTube. Representatives from the BLM, Transcon Environmental, and the

CICWCD attended the meeting. The Scoping Summary Report includes details on the scoping process, including outreach and responses.

4.4.1 Scoping Comments Received

A total of 98 comment letters were received from the public, agencies, and Tribes, including 11 from federal, state, or local agencies or elected officials; 3 from Native American Tribes; 11 from non-governmental organizations; and the remaining 83 from private landowners or citizens. A total of 51 unique comments were recorded. All written comments received—whether from agencies, Tribes, or the public—were collected and considered in this analysis. See the *Scoping Report* (available on ePlanning).

CHAPTER 5 LIST OF PREPARERS

Table 26. List of Preparers

Name	Organization, Title	Sections
Third-Party NEPA Preparer		
Tim Green	Transcon, Project Manager	Overall quality assurance/quality control (QA/QC)
Ian Snyder	Transcon, Planner and Project Coordinator	Overall QA/QC; Chapter 2; Chapter 3; Appendix B—Air Quality and Greenhouse Gases, Land Use and Planning, Lands with Wilderness Characteristics, Soils, and Wild Horses sections
Brian Parker	Transcon, Senior Biologist	Chapter 3—Special Status Wildlife
Ben Lardiere	Transcon, Senior Biologist	Chapter 3; Appendix B—Fish and Wildlife, Migratory Birds, Special Status Plants, Special Status Wildlife, and Vegetation Communities sections
Lindsey Evenson	Transcon, Senior Archaeologist, Principal Investigator	Chapter 3; Appendix B—Cultural Resources and Native American Religious Concerns
Laura Cannon	Transcon, Archaeologist	Chapter 3; Appendix B—Cultural Resources and Native American Religious Concerns
Ron Bolander	Transcon, Wildlife Biologist	Chapter 1; Chapter 3; Appendix B—Soils, Wild Horses, Land Use and Planning, Lands with Wilderness Characteristics, and Rangeland Health Standards sections
Dwayne Winslow	Transcon, Wildlife Biologist	Chapter 2
Mike Tietze	Formation Environmental, Senior Hydrogeologist	Chapter 3—Water Resources and others
Pete Townsend	Formation Environmental, Principal Hydrogeologist	Chapter 3—Water Resources and others
David Tufte	Southern Utah University	Chapter 3—Environmental Justice and Socioeconomics
Agency Reviewers and Contributors		
Brooklynn Cox	Realty Specialist	Project Lead, Lands and Realty
Michelle Campeau	Realty Specialist	Project Lead, Lands and Realty
Gina Ginouves	Planning and Environmental Coordinator	Overall Review

Name	Organization, Title	Sections
Gloria Tibbetts	District Manager	Overall Review
Dan Fletcher	Assistant Field Office Manager	Overall Review
Paul Briggs	Field Office Manager	Overall Review
Erica Shotwell	Rangeland Management Specialist	Air Quality, Farmlands, Invasive Species, Livestock Grazing, Soils, Vegetation, Wetlands/Riparian Zones
Dave Jacobsen	Recreation Specialist	Special Designations, Lands with Wilderness Characteristics, Recreation, Visual Resources, Riparian
Meghan Krott	Aquatic Biologist	Aquatic Species
Roy Plank	Archeologist	Cultural Resources, Native American Religious Concerns
Dustin Schaible	Wildlife Biologist	Fish and Wildlife, Sensitive Species
Mark Dean	Hydrologist	Floodplains, Water Resources
Melanie Mendenhall	Natural Resource Specialist (Retired)	Fuels and Wildlife Management
Ed Ginouves	Mining Engineer	Mineral Resources and Paleontology
Roy Smith	Water Rights, Instream Flow Protection, Wild and Scenic Rivers	Water Resources and Hydrology
Douglass Bayles	Rangeland Management Specialist	Special Status Plant Species
Derek Christensen	Wildlife Biologist	Threatened, Endangered, and Candidate Species; Migratory Birds
Travis Carlson	Safety Specialist	Hazardous Waste, Public Safety
Chad Hunter	Wild Horse Specialist	Wild Horses
Colby Peterson	Forestry Specialist	Forest and Woodland Resources
Jared Dalebout	Hydrologist	Floodplains, Water Resources

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APPENDIX A

PROJECT MAPS

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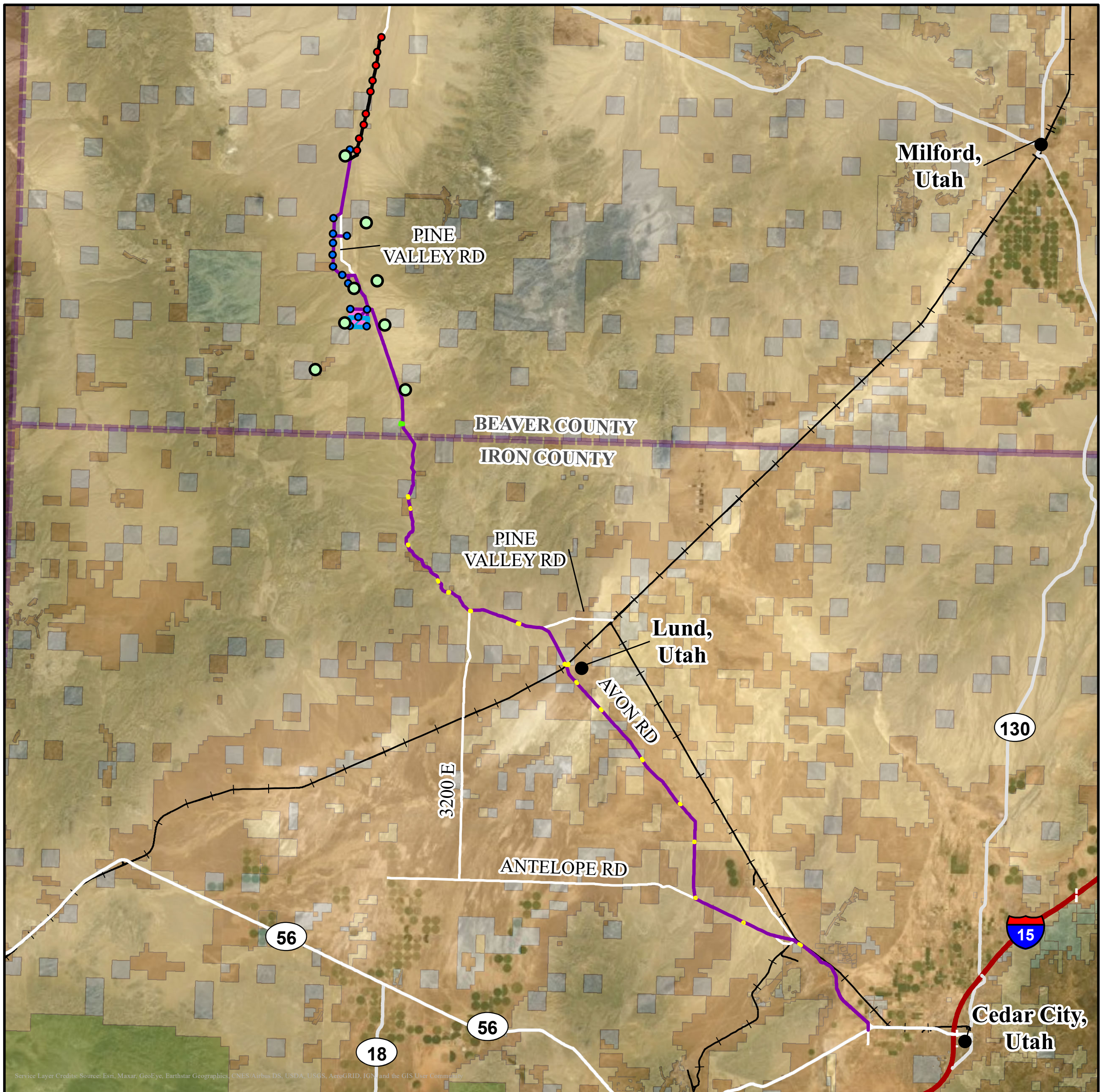

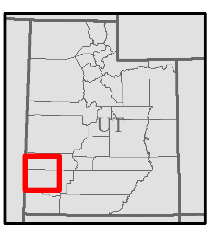

Legend

- Monitoring Wells
- Well Parcels
- Proposed ANWS Well Locations
- Proposed ANWS Alignment
- Solar Power Generation Site
- Staging Area
- Tank Site
- Proposed Alignment
- CICWCD Parcel
- Union Pacific Railroad
- BLM
- Private
- SITLA
- UDOT
- UDWR
- USFS

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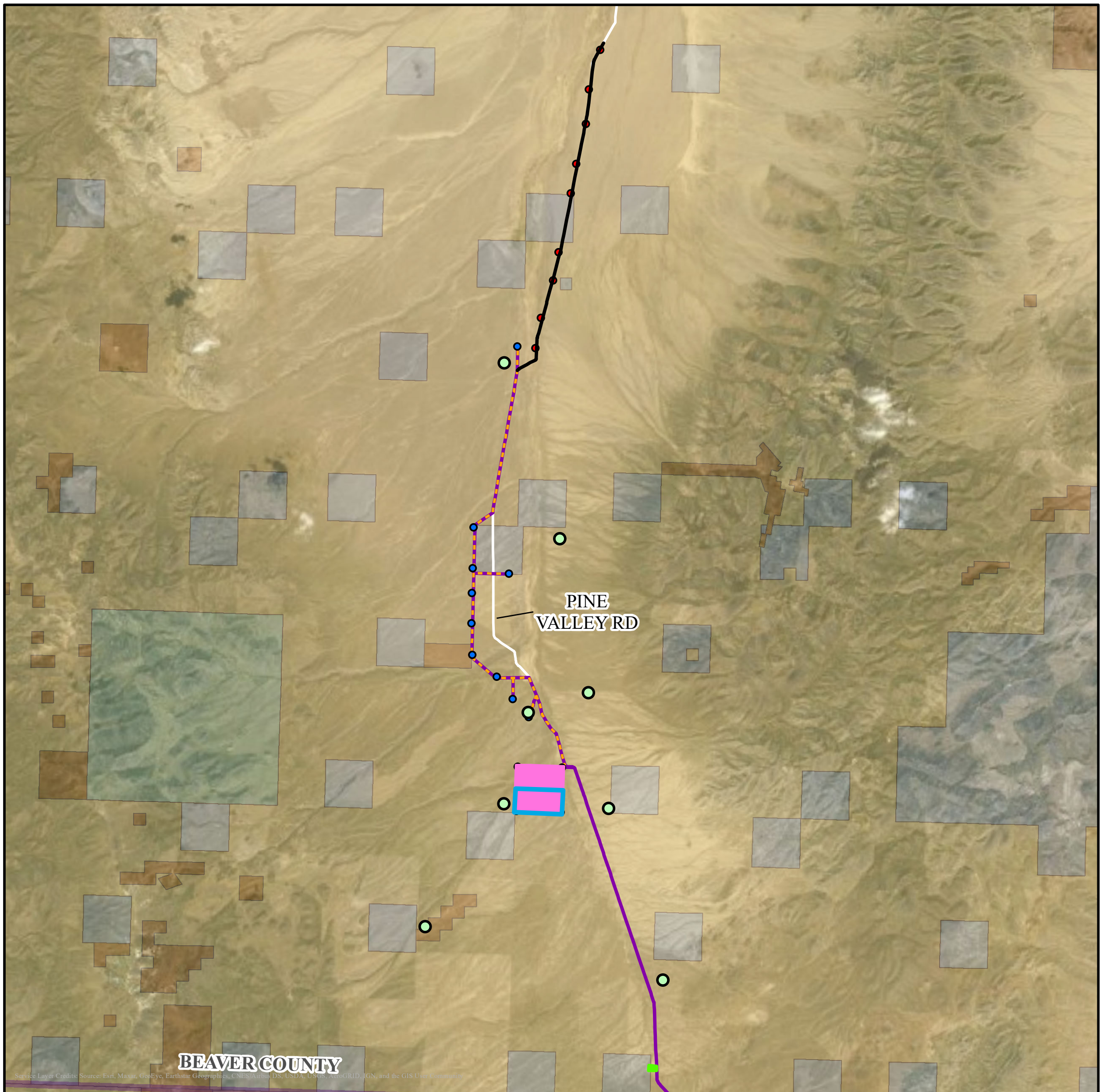
Project Overview

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 1

Transcon environmental | Planners & Scientists



Legend

- Monitoring Wells
- Well Parcels
- Proposed ANWS Well Locations
- Proposed Alignment
- Proposed ANWS Alignment
- Electrical Transmission Line
- Staging Area
- Tank Site
- Solar Power Generation Site
- CICWCD Parcel
- BLM
- Private
- SITLA
- UDWR

Project Detail

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 2

Transcon environmental | Planners & Scientists

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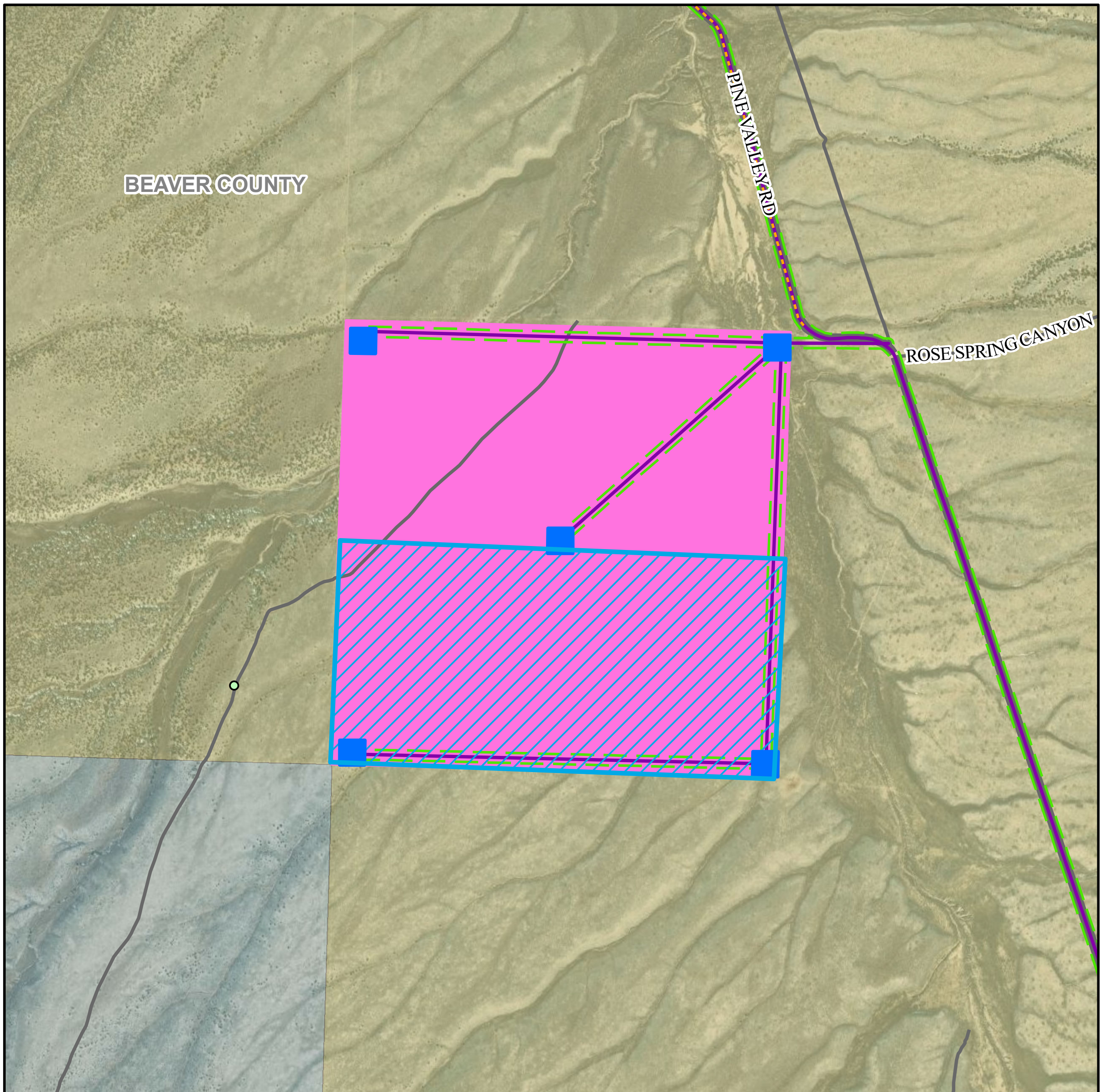

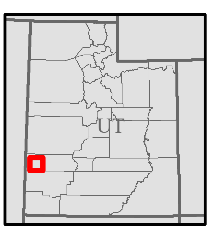

Legend

- Monitoring Wells
- Well Parcel
- Solar Power Generation Site
- Electrical Transmission Line
- Proposed Alignment
- Disturbance Area
- Roads
- CICWCD Parcel
- BLM
- Private
- SITLA

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CICWCD Parcel & Solar Field Detail Map

CICWCD

Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 3

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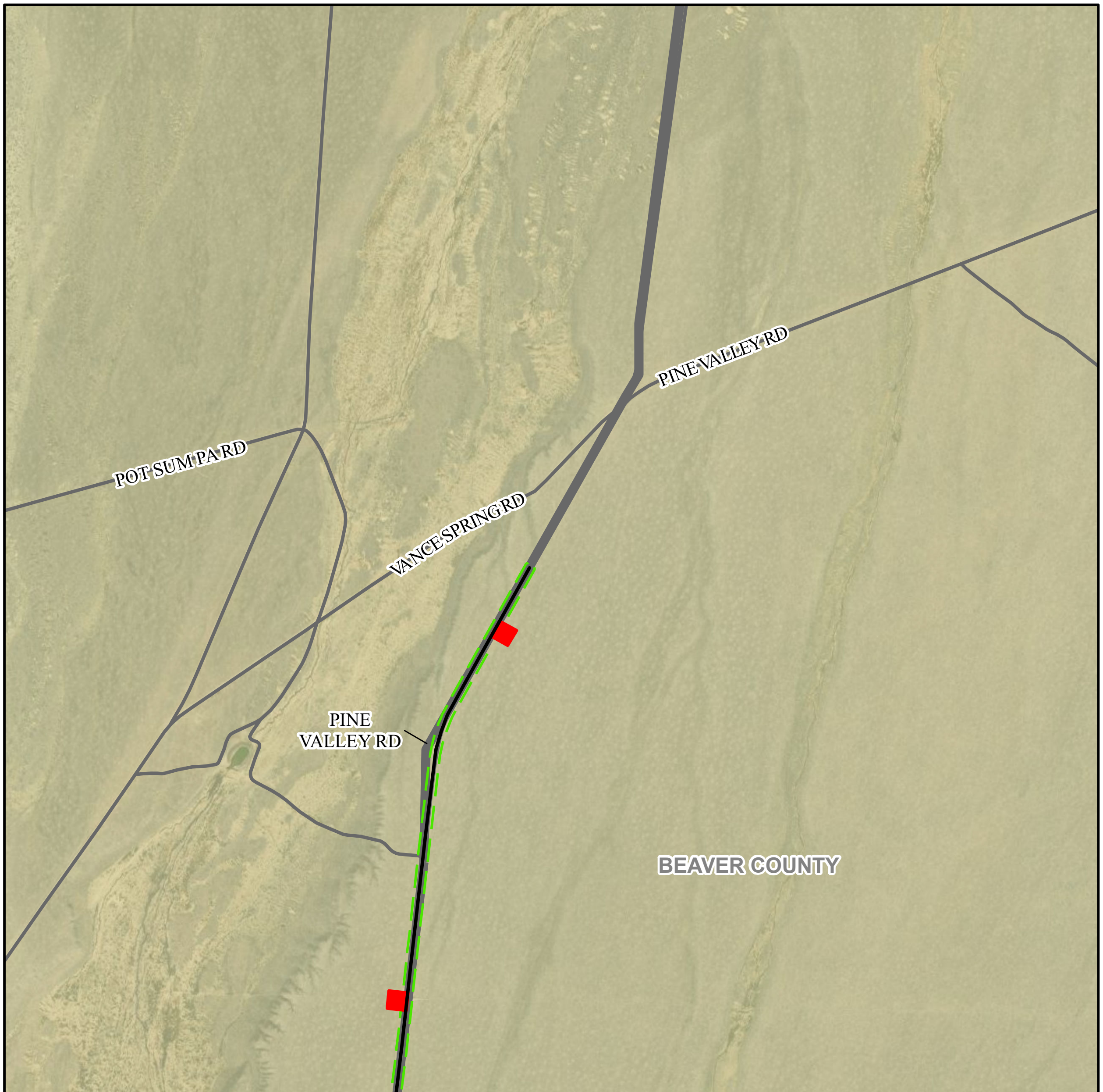

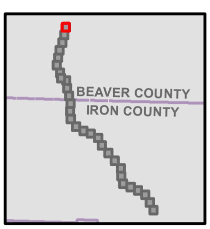

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Legend

- Proposed ANWS Well Location
- Proposed ANWS Alignment
- Disturbance Area
- Roads
- BLM

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 1

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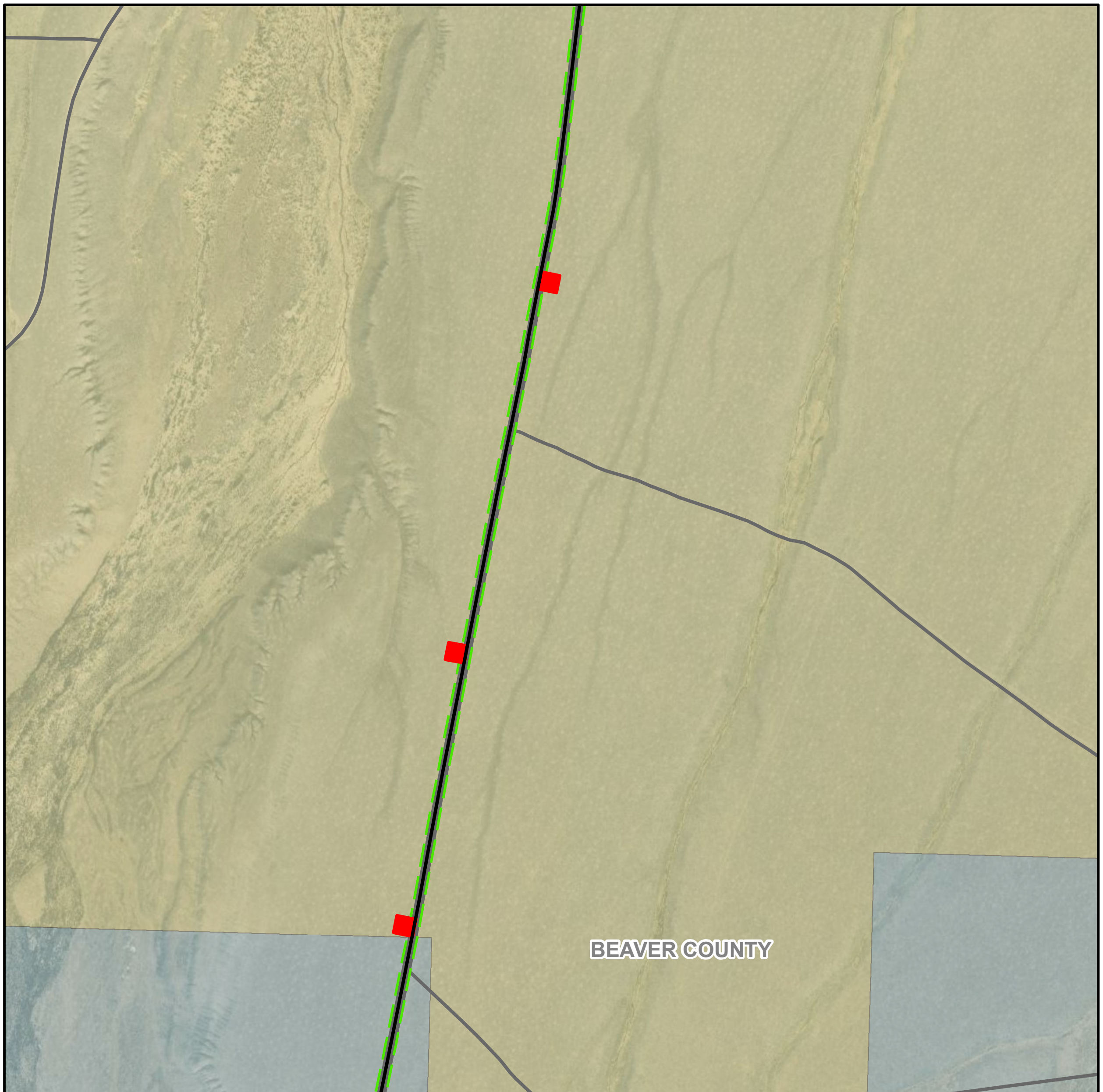

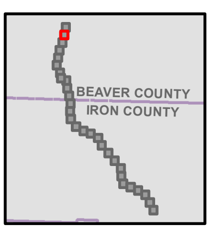

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Legend

- Proposed ANWS Well Location
- Proposed ANWS Alignment
- Disturbance Area
- Roads
- BLM
- SITLA

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 2

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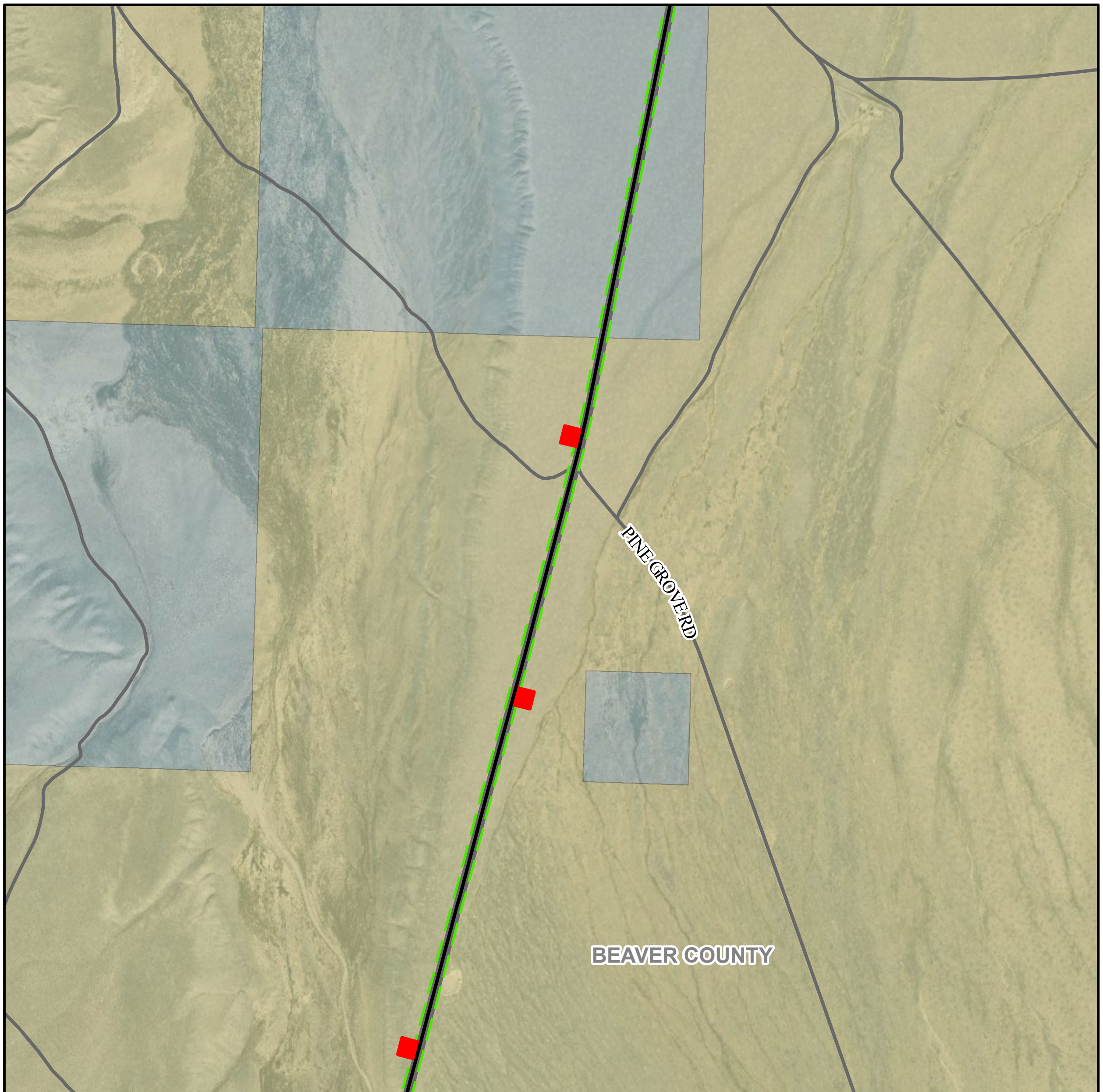

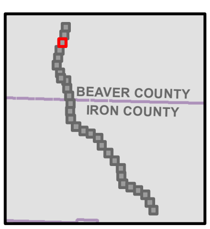

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Legend

- Proposed ANWS Well Location
- Proposed ANWS Alignment
- Disturbance Area
- Roads
- BLM
- SITLA

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Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 3

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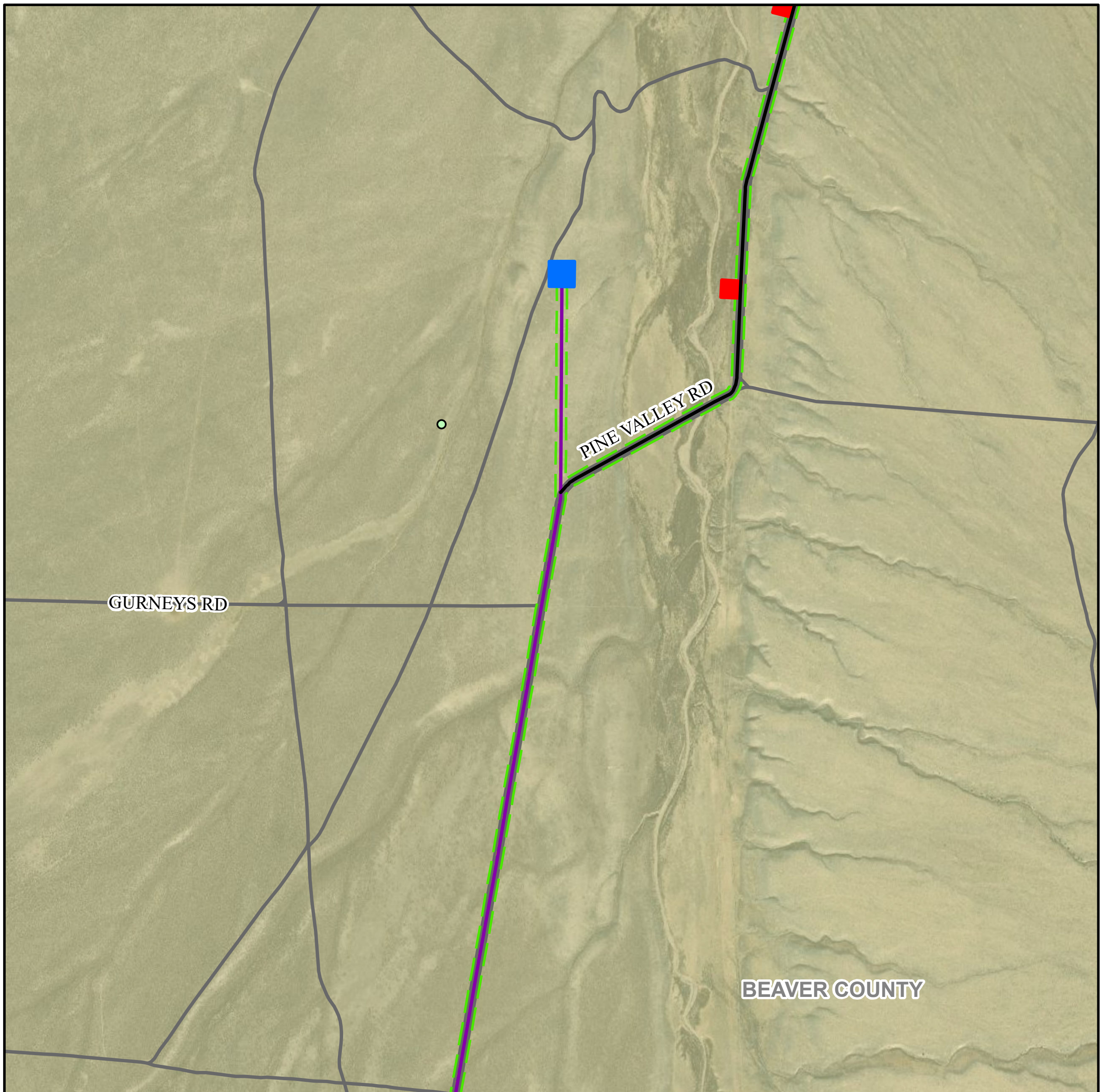

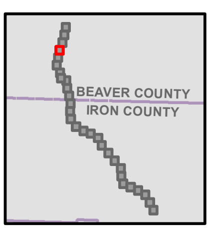

Legend

- Monitoring Wells
- Well Parcel
- Proposed ANWS Well Location
- Proposed ANWS Alignment
- Electrical Transmission Line
- Proposed Alignment
- Disturbance Area
- Roads
- BLM

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Project Overview Panel Maps

CICWCD

Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 4

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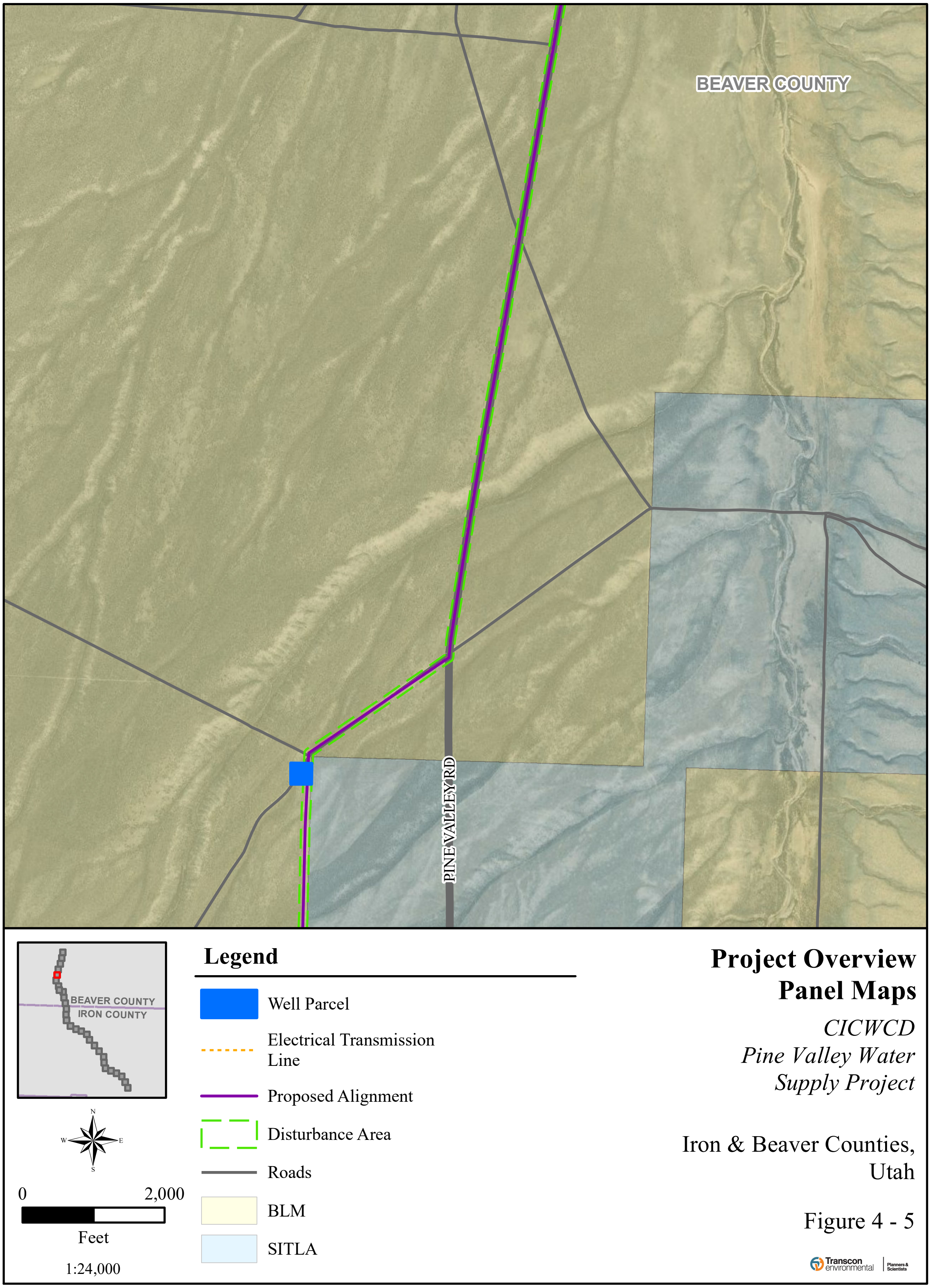

Project Overview Panel Maps

CICWCD Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 5

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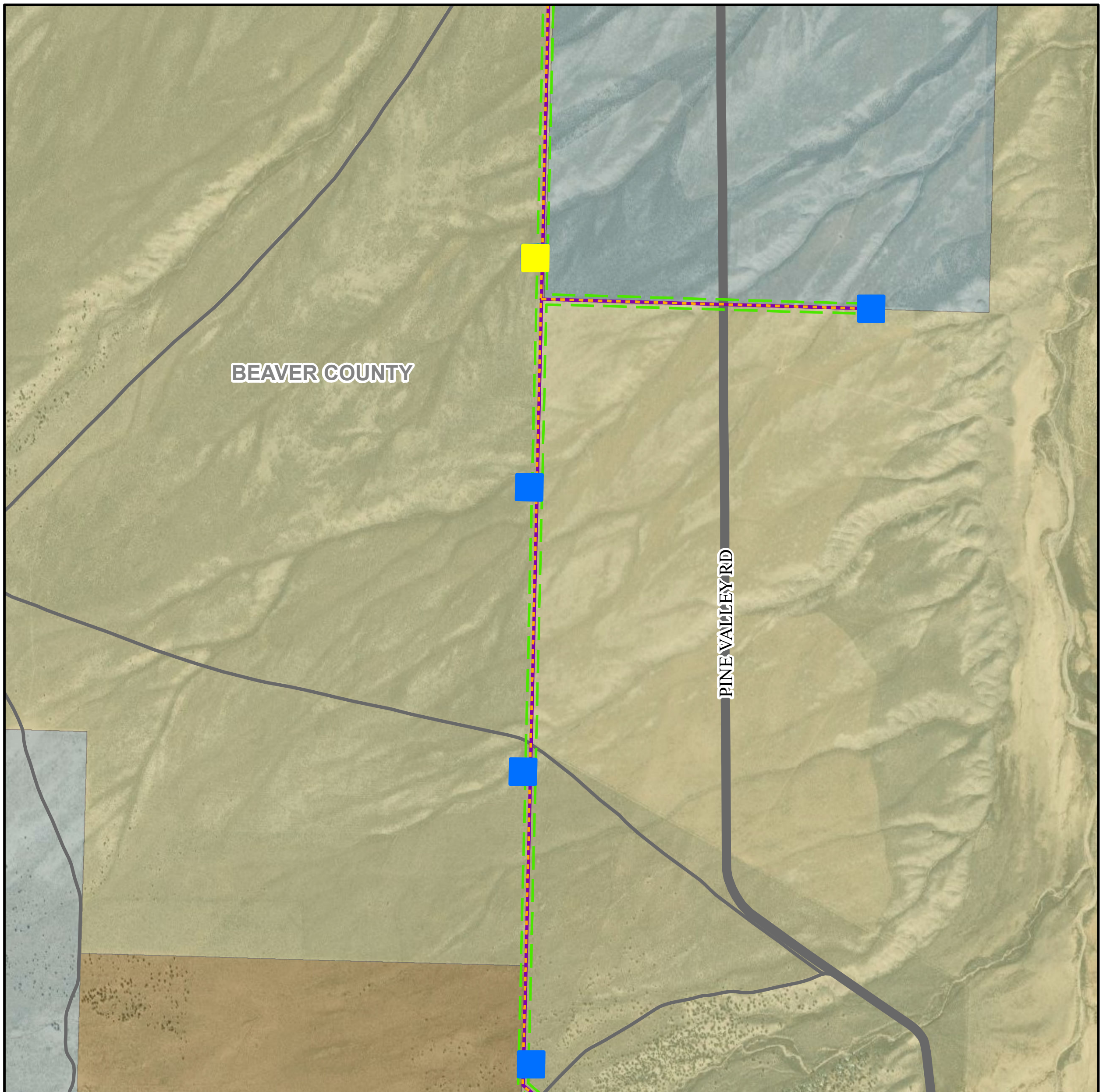

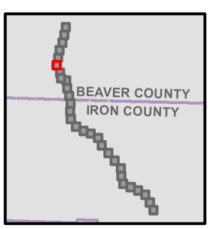

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Legend

- Well Parcel
- Staging Area
- Electrical Transmission Line
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private
- SITLA

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 6

Transcon environmental

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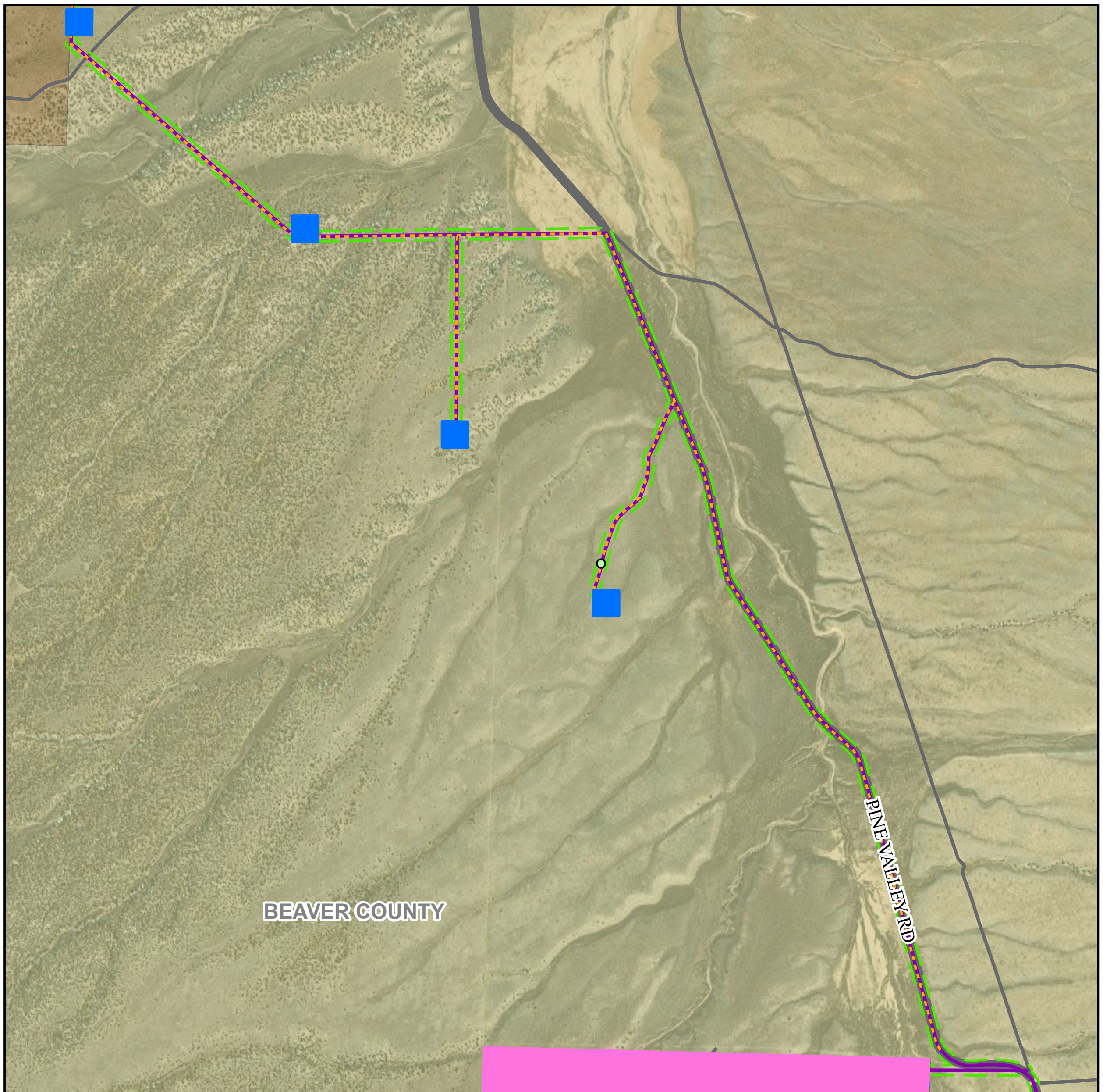

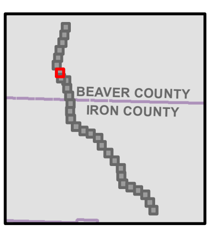

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Legend

- Monitoring Wells
- Well Parcel
- Electrical Transmission Line
- Proposed Alignment
- Disturbance Area
- Roads
- CICWCD Parcel
- BLM
- Private

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 7

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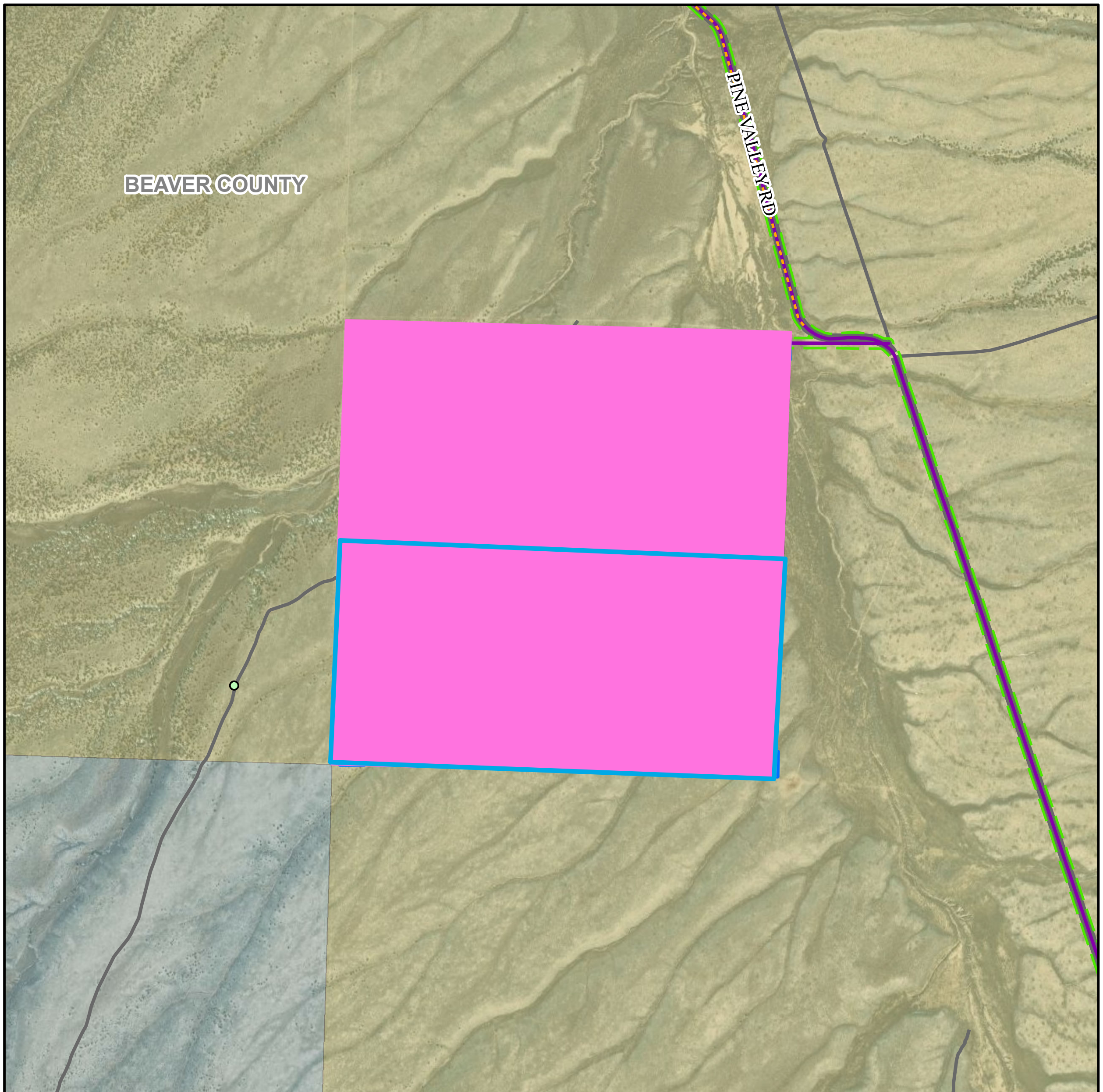

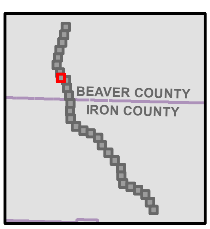

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Legend

- Monitoring Wells
- Well Parcel
- Solar Power Generation Site
- Electrical Transmission Line
- Proposed Alignment
- Disturbance Area
- Roads
- CICWCD Parcel
- BLM
- Private
- SITLA

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 8

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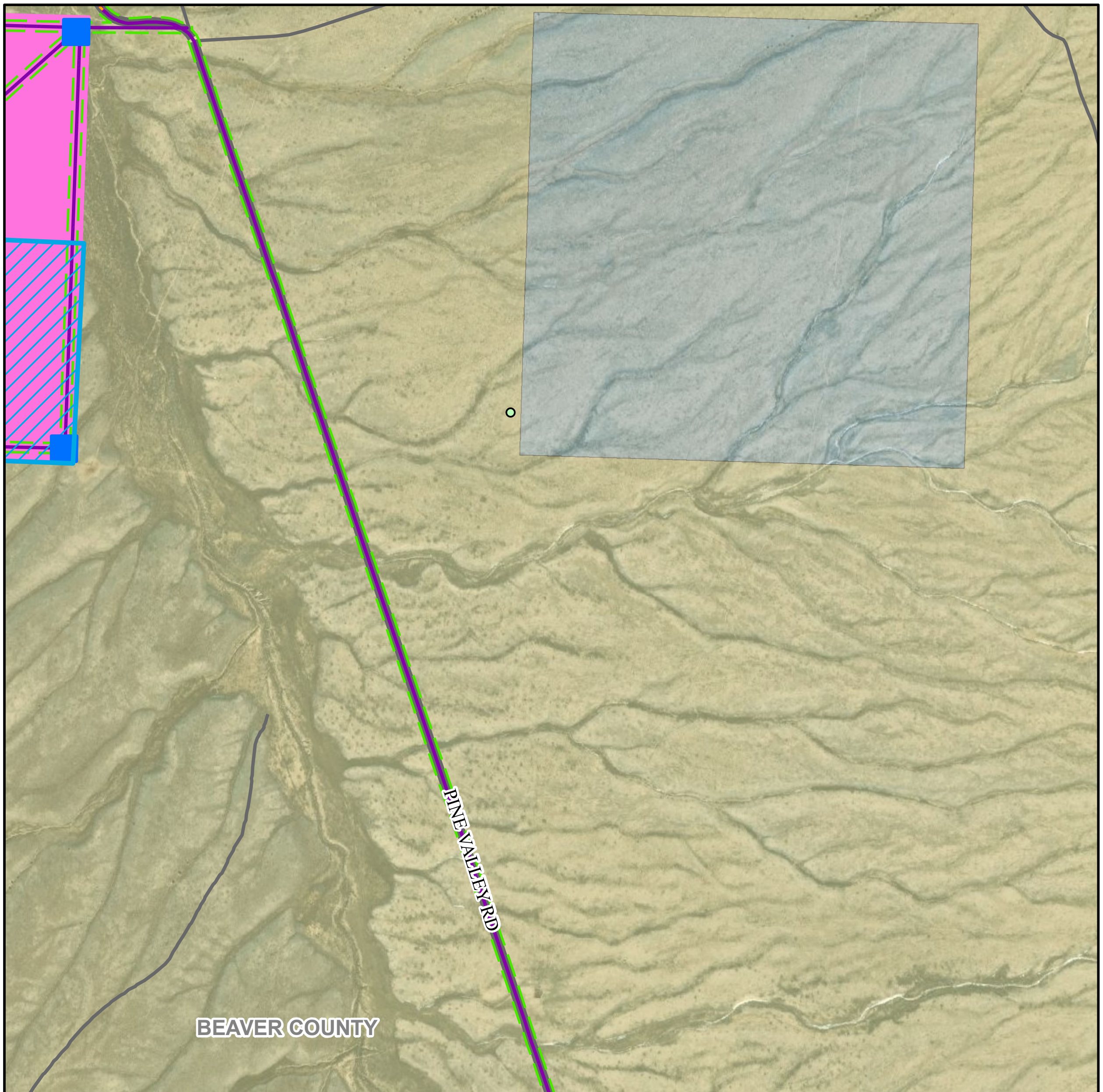

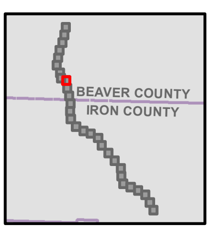

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Legend

- Monitoring Wells
- Well Parcel
- Solar Power Generation Site
- Electrical Transmission Line
- Proposed Alignment
- Disturbance Area
- Roads
- CICWCD Parcel
- BLM
- Private
- SITLA

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 9

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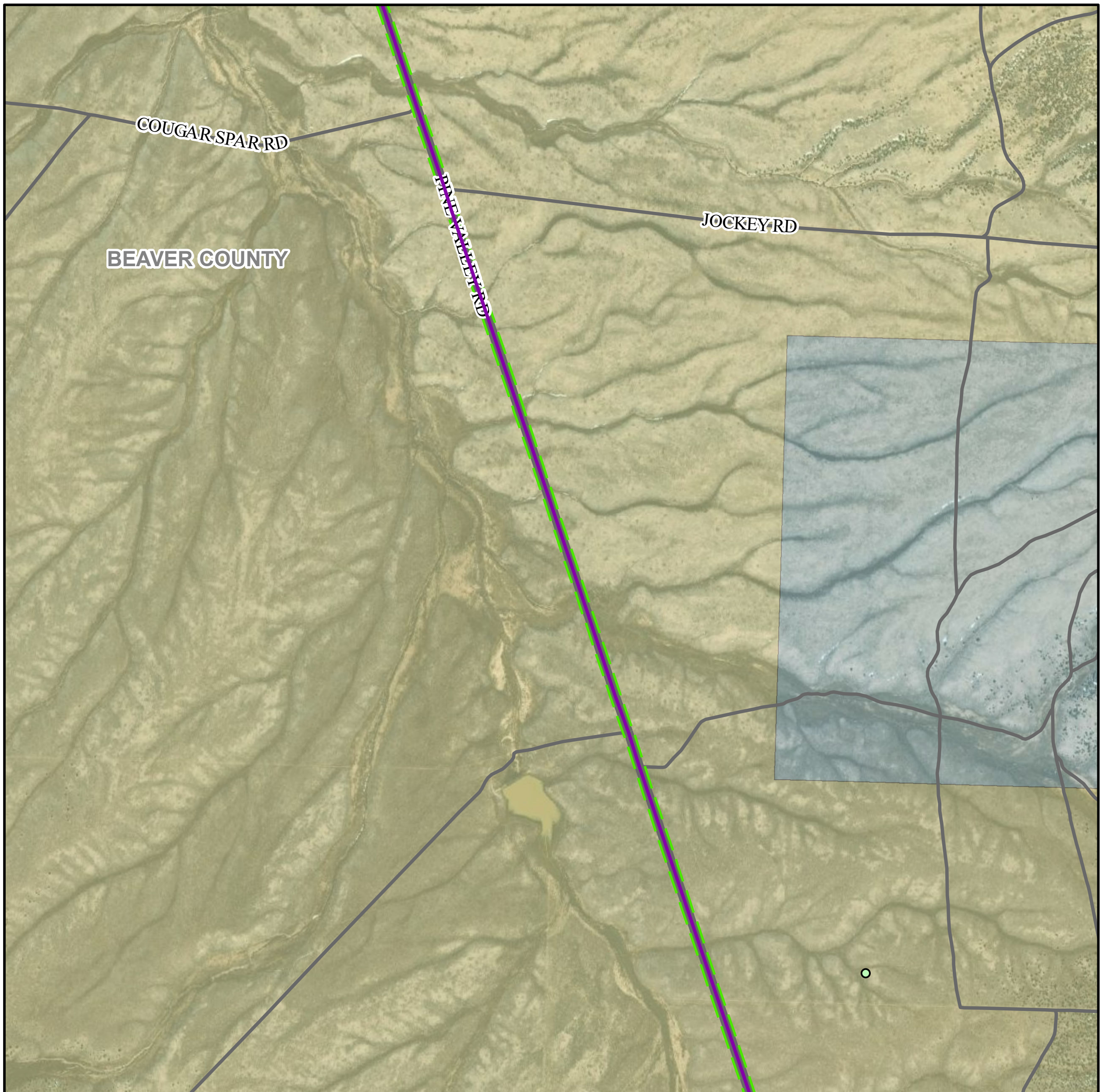

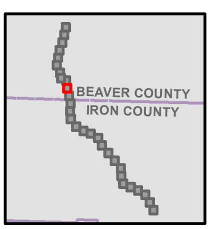

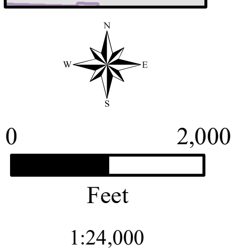

Legend

- Monitoring Wells
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- SITLA

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 10

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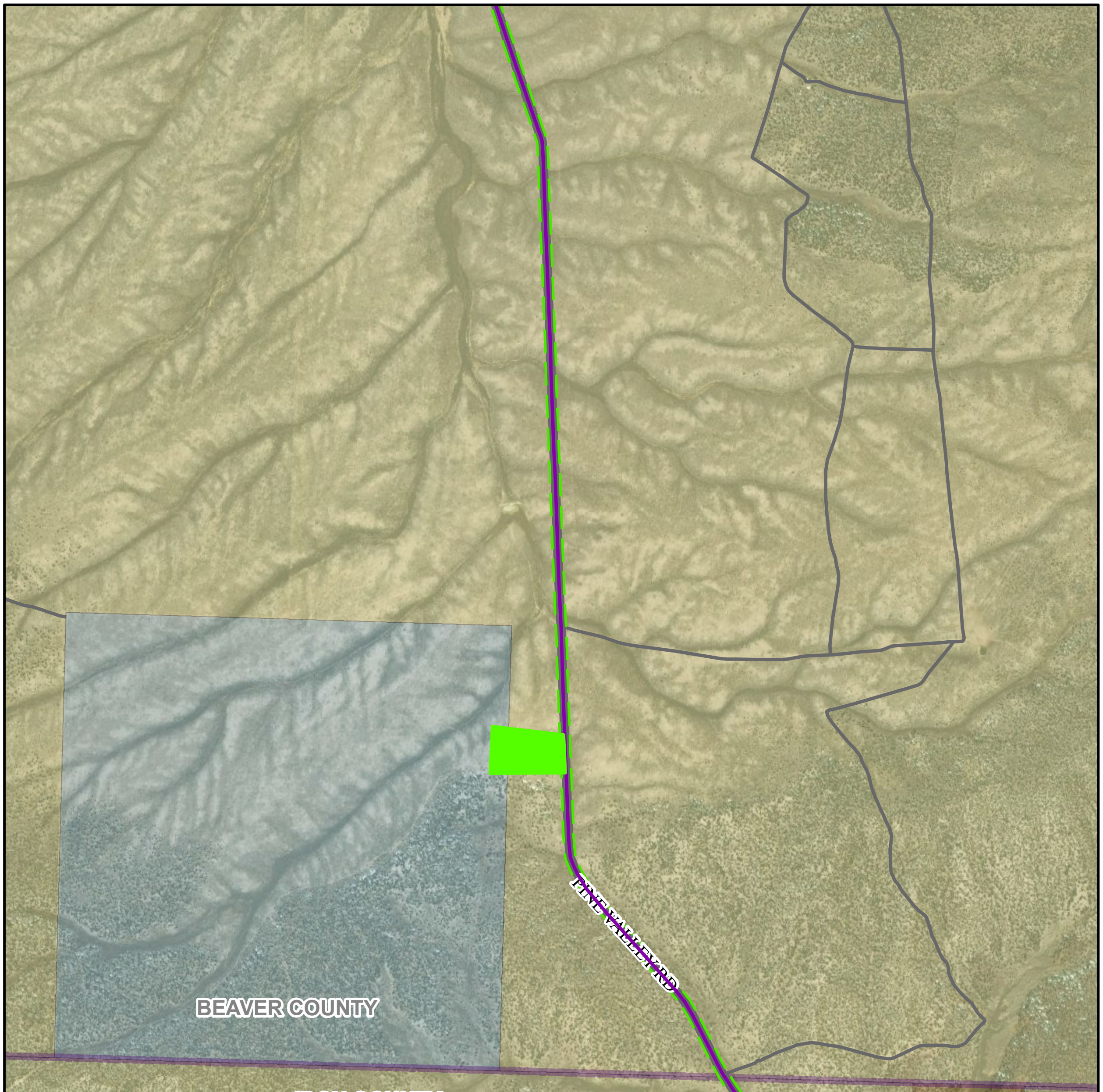

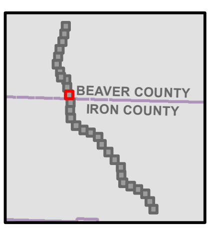

Legend

- Tank Site
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private
- SITLA

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Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 11

Transcon environmental | Planners & Scientists

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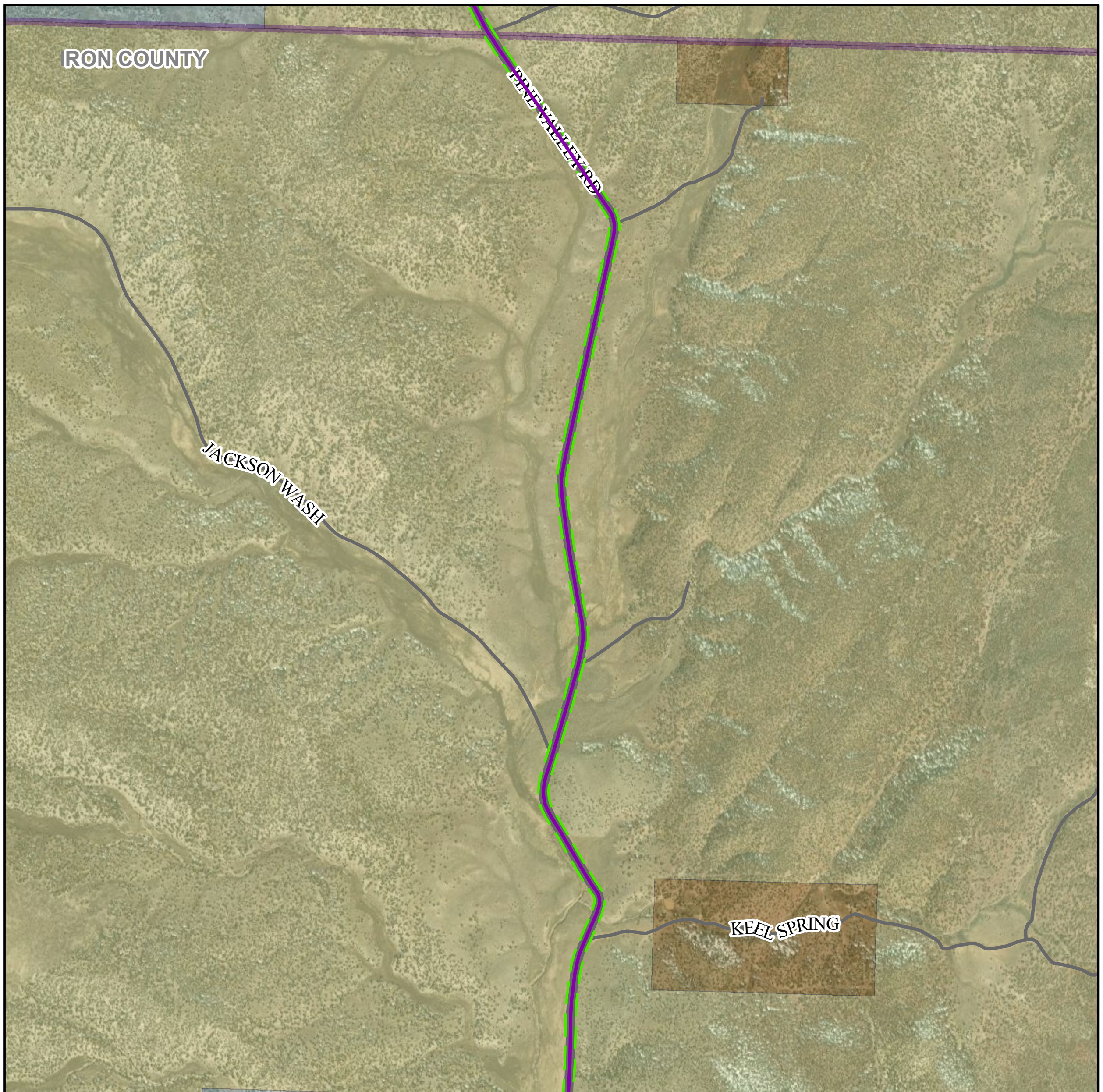

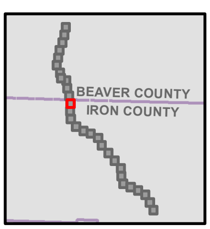

Legend

- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private
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Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 12

Transcon environmental | Planners & Scientists

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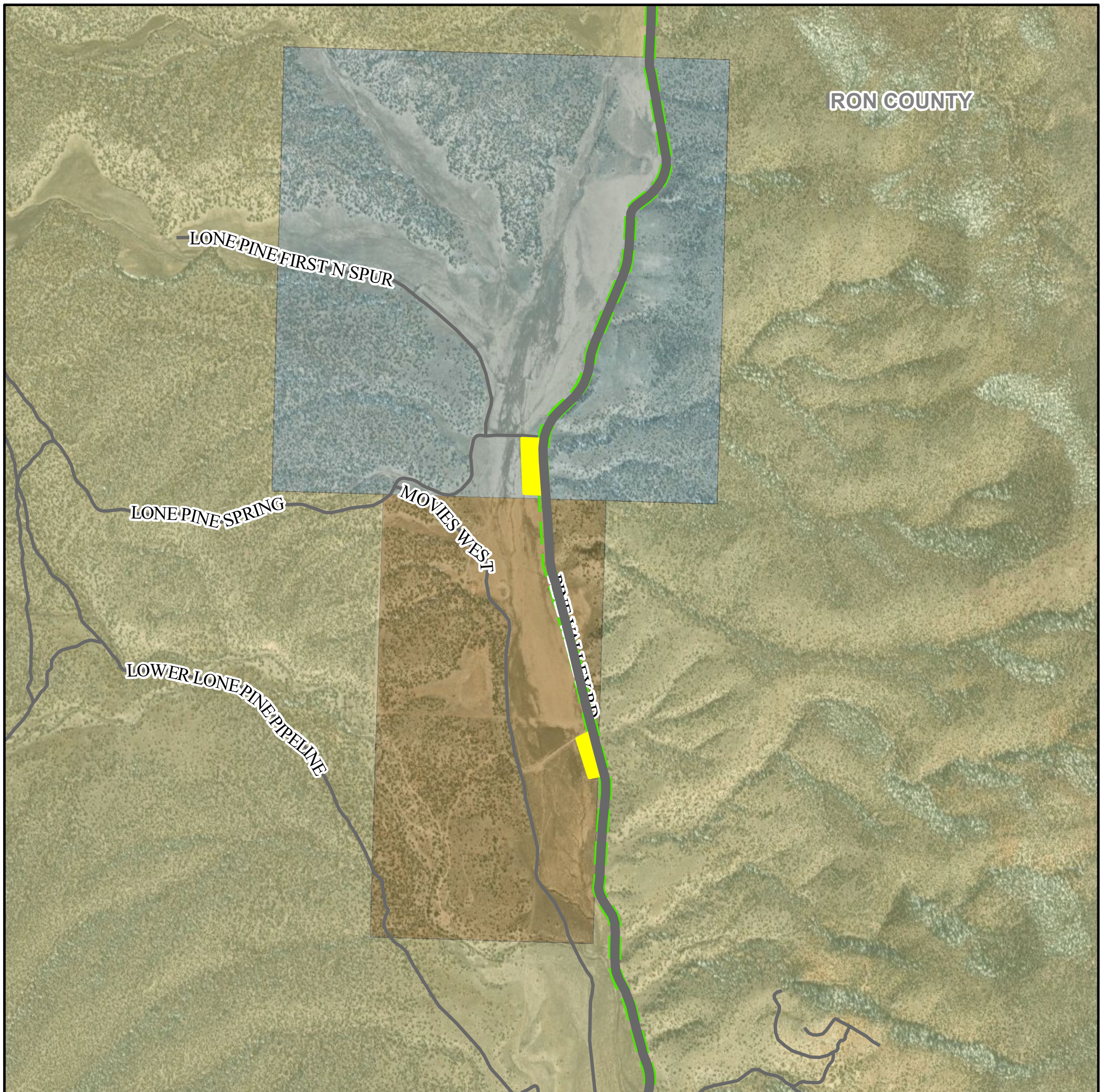

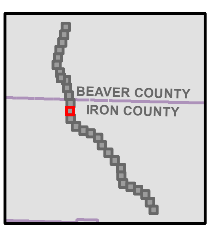

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Legend

- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private
- SITLA

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 13

Transcon environmental | Planners & Scientists

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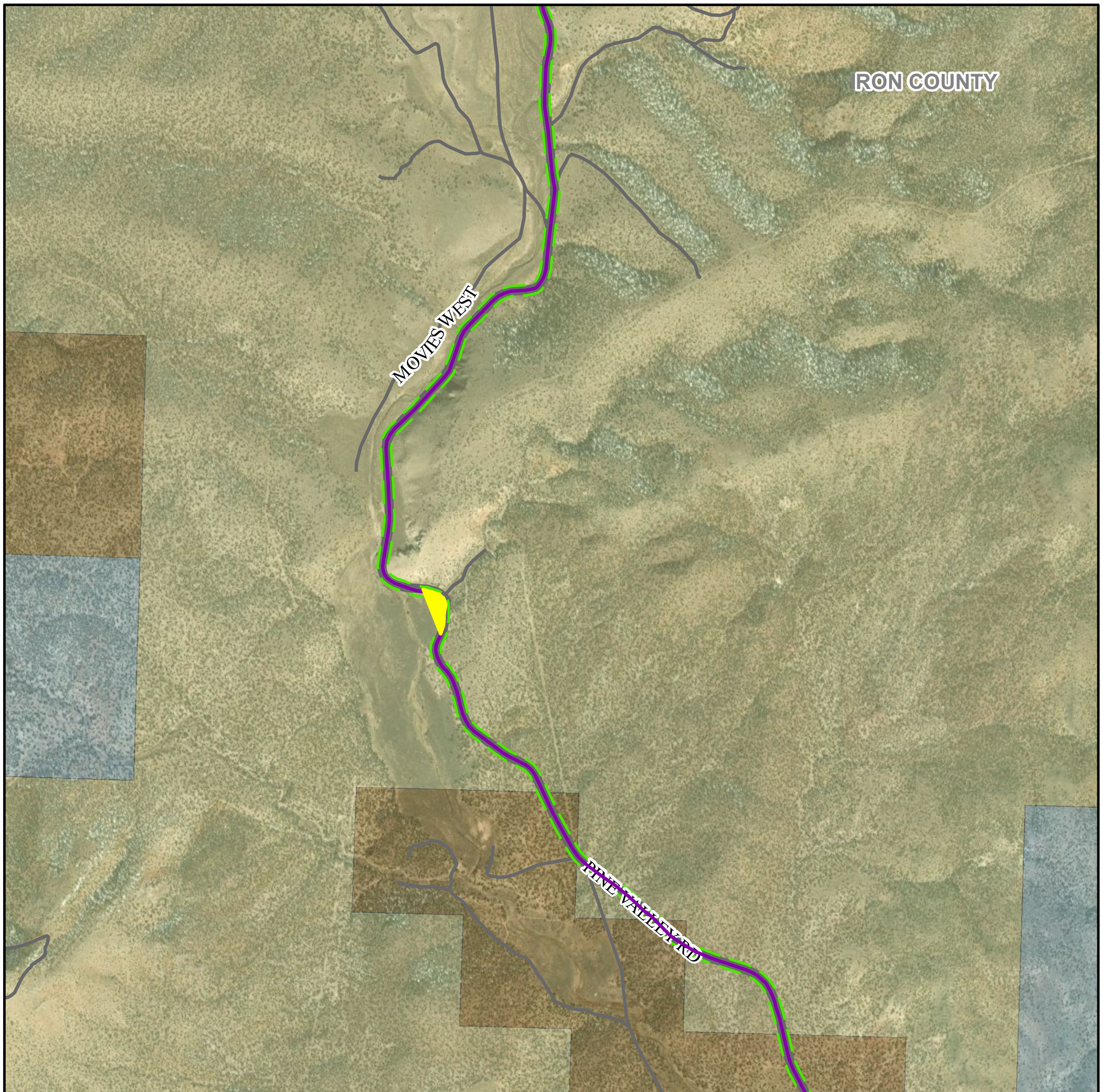

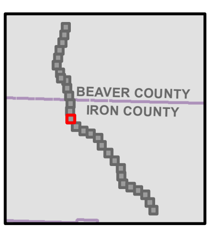

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Legend

- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private
- SITLA

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 14

Transcon environmental | Planners & Scientists

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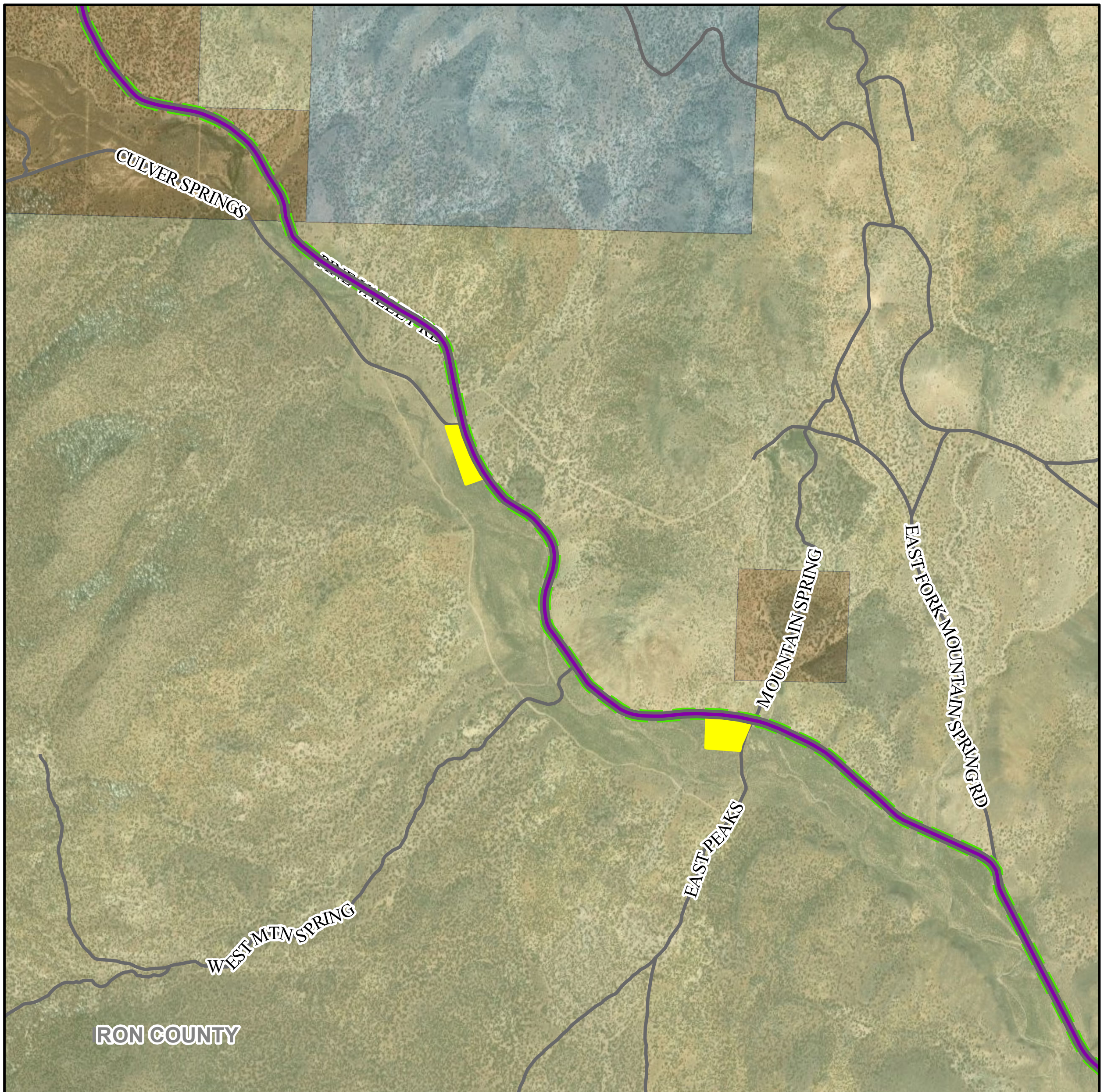

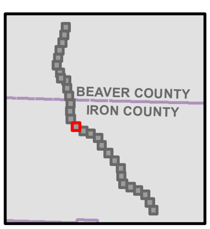

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Legend

- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private
- SITLA

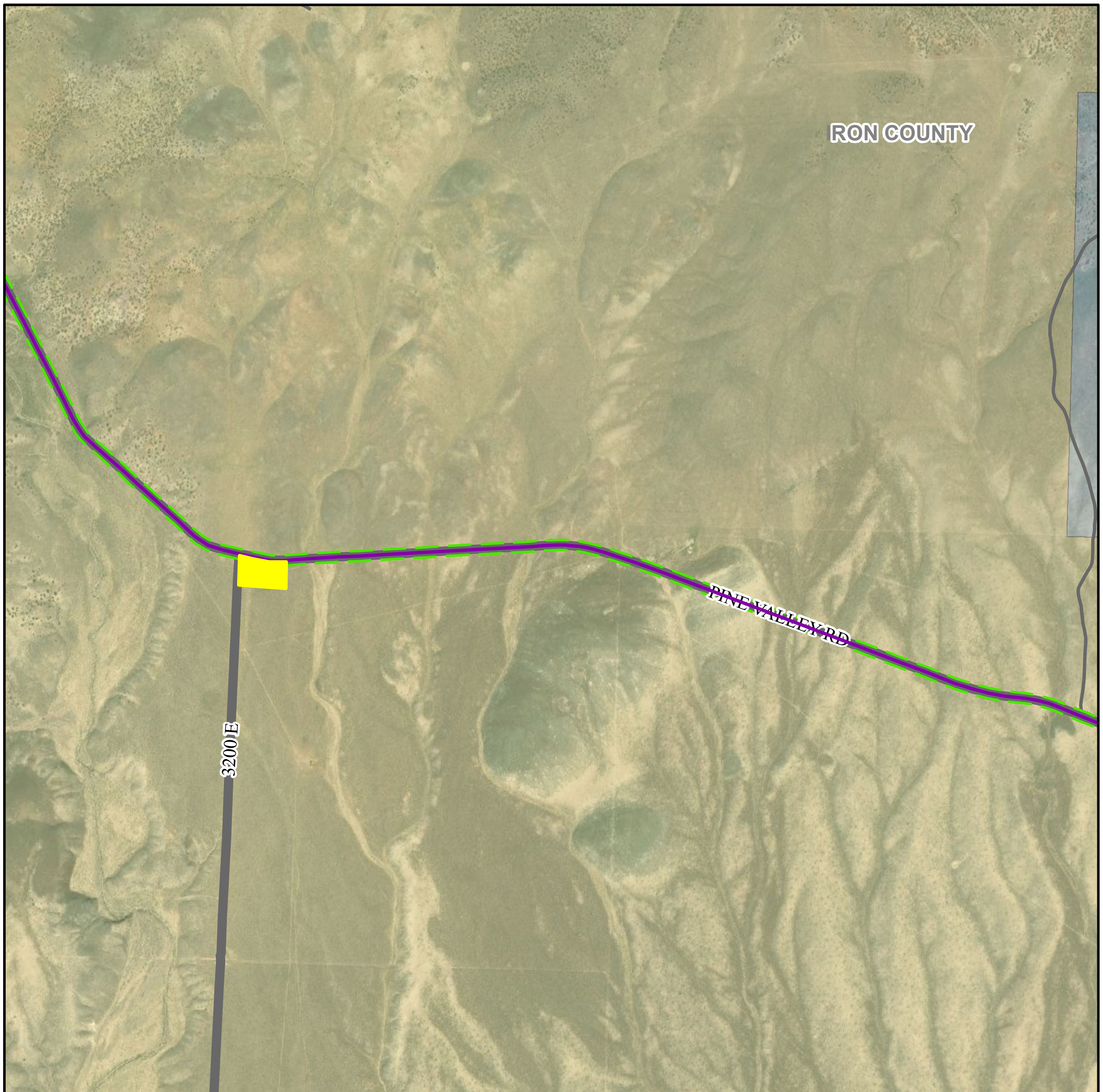
Project Overview Panel Maps

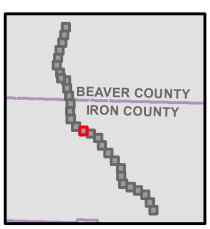
CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 15

Transcon environmental | Planners & Scientists





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Legend

- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- SITLA

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 16

Transcon environmental | Planners & Scientists

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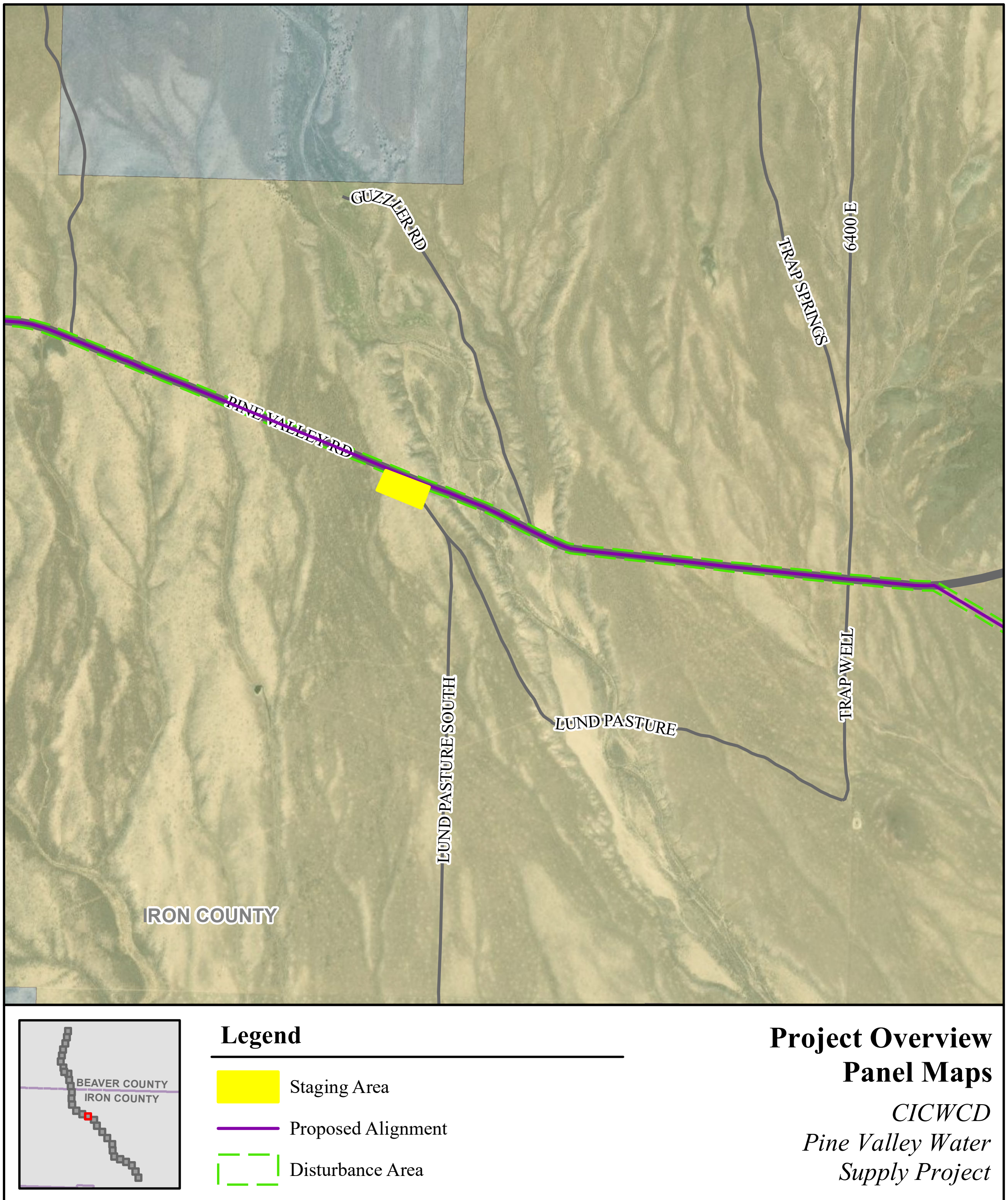

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Legend

- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private
- SITLA

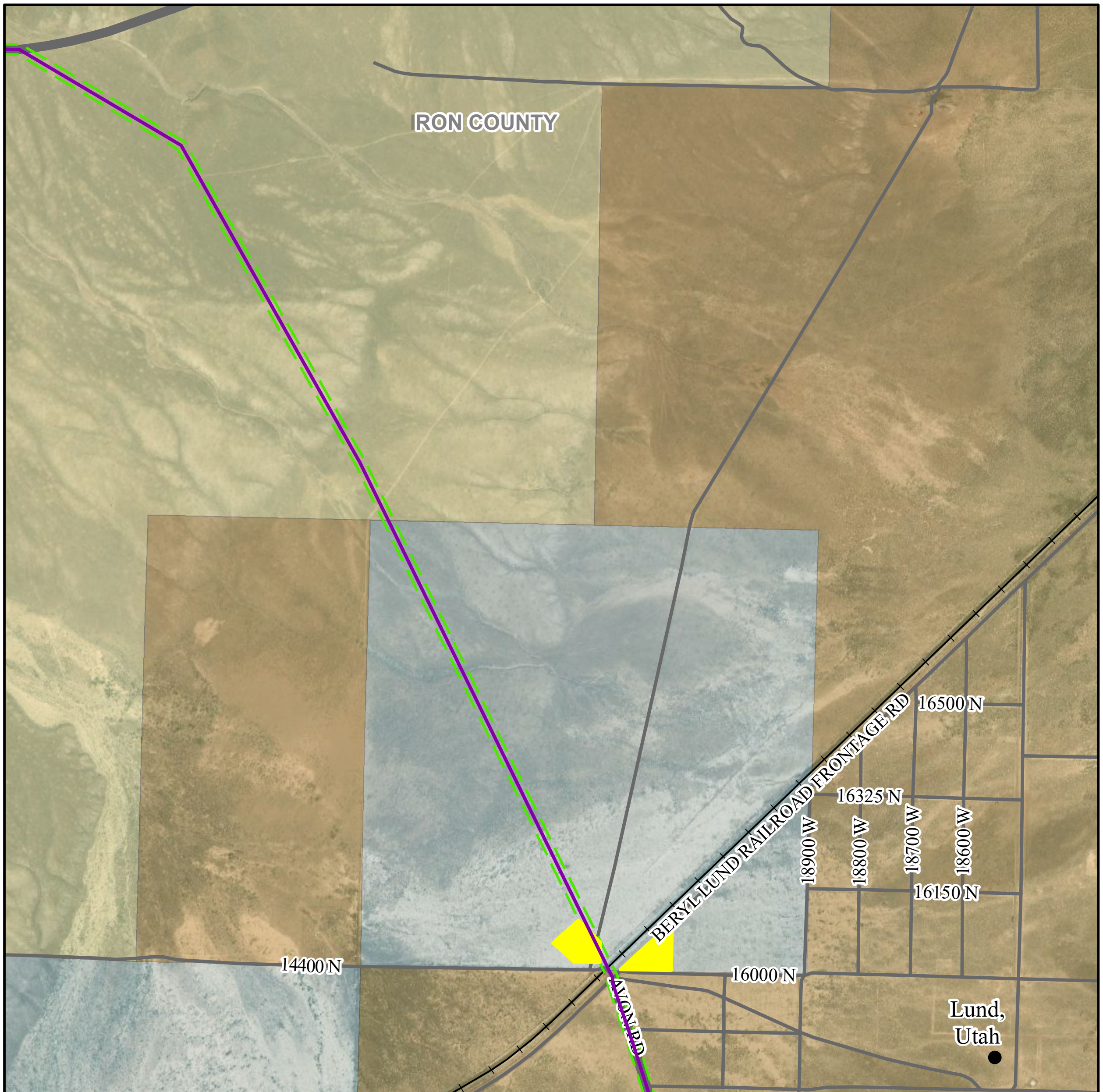
Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 17

Transcon environmental | Planners & Scientists



Legend

- Cities
- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- Union Pacific Railroad
- BLM
- Private
- SITLA

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 18

Transcon environmental | Planners & Scientists

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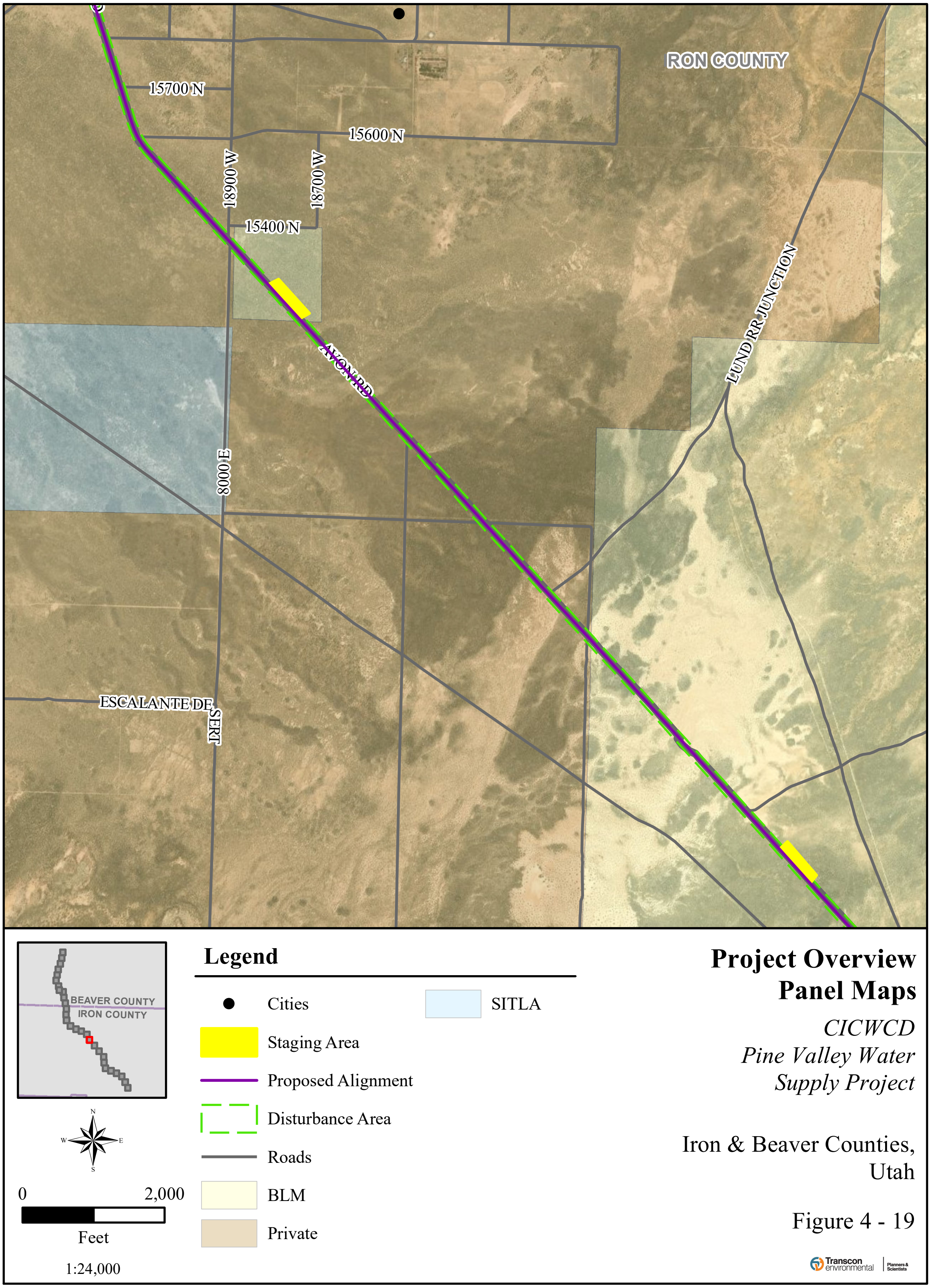

Project Overview Panel Maps

CICWCD Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 19

Transcon environmental | Planners & Scientists

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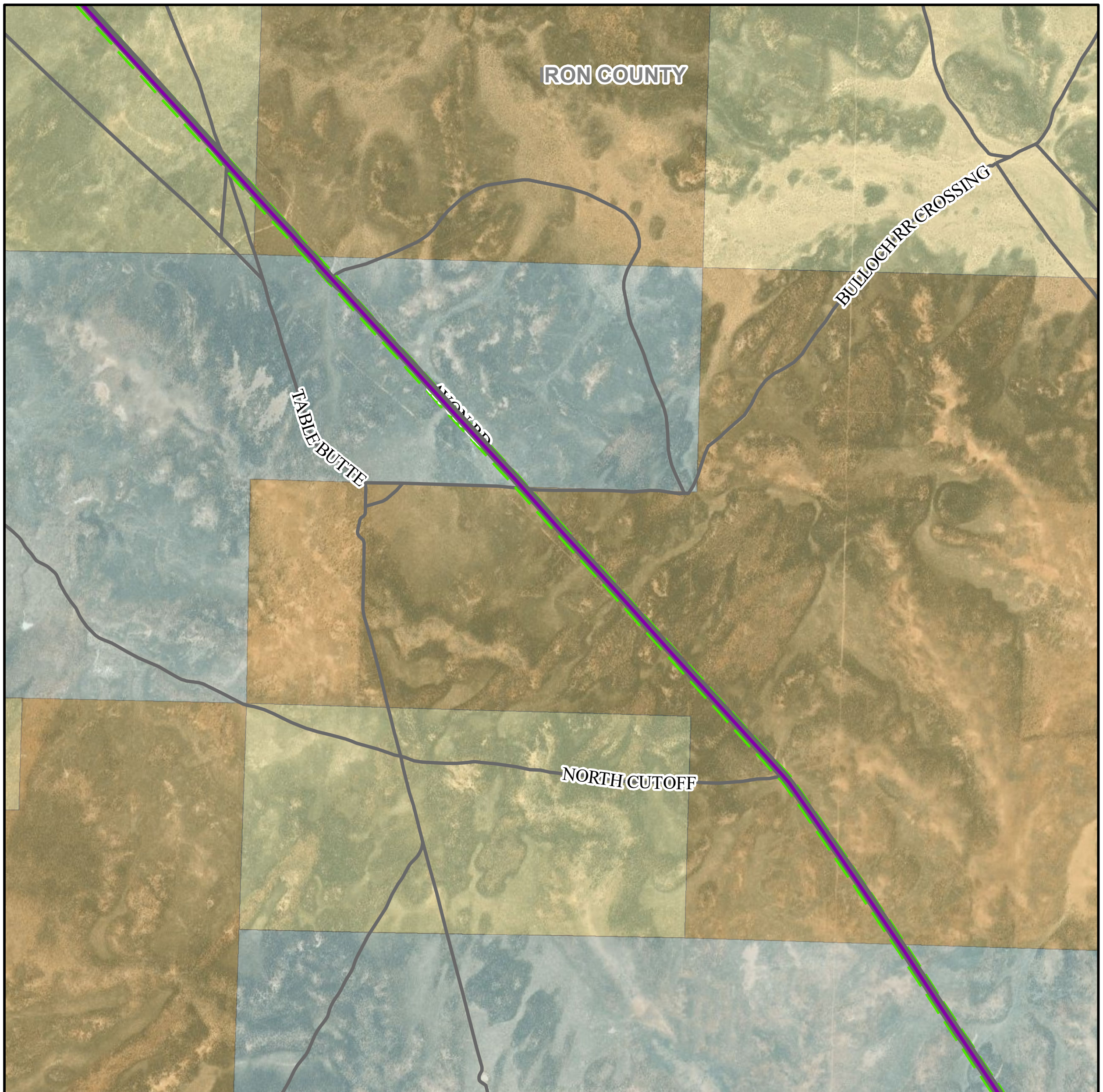

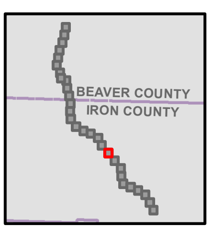

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Legend

- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private
- SITLA

Project Overview Panel Maps

CICWCD

Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 20

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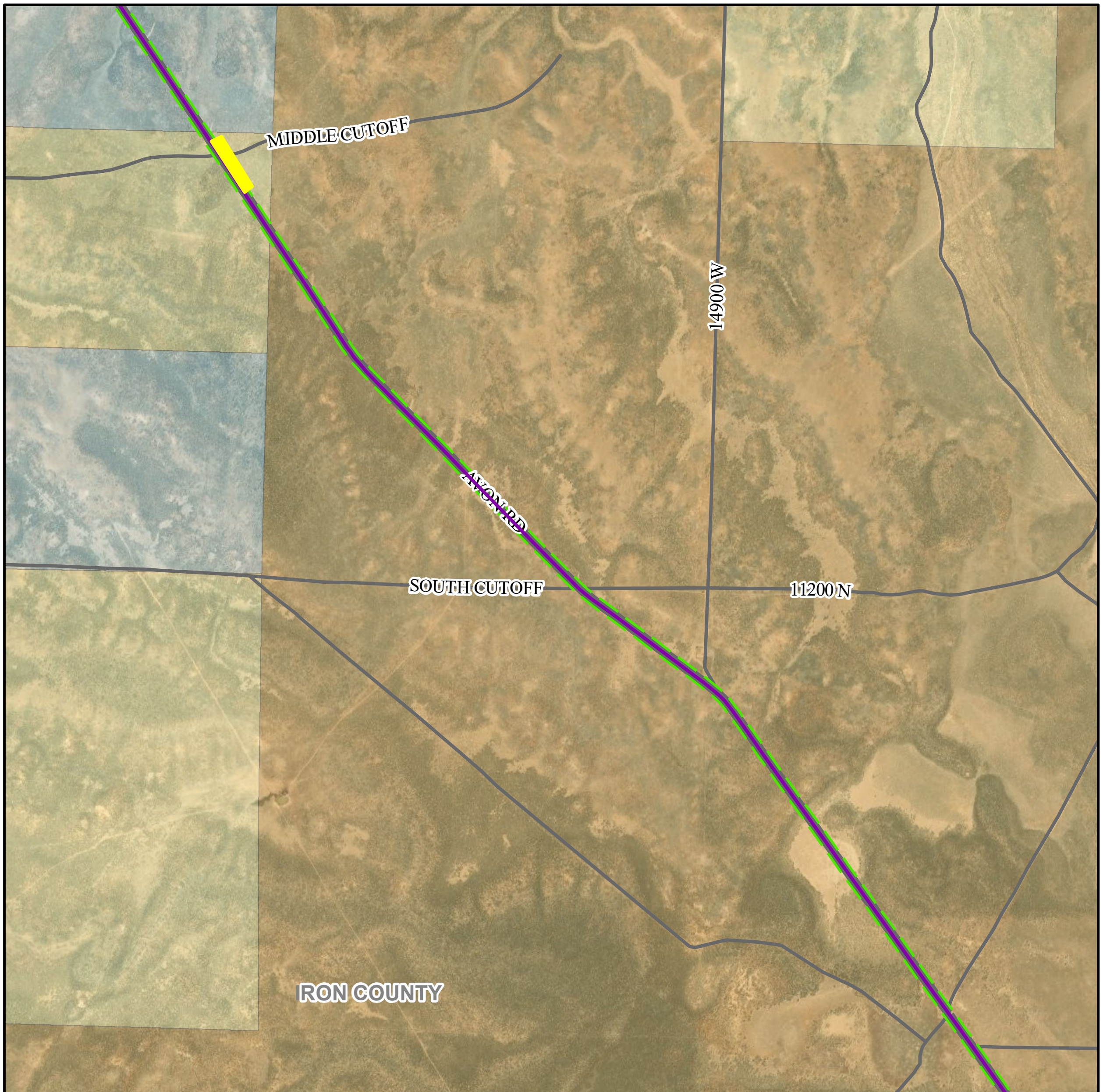

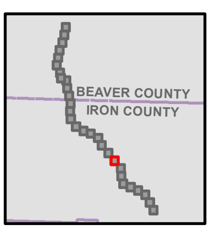

Legend

- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private
- SITLA

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Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 21

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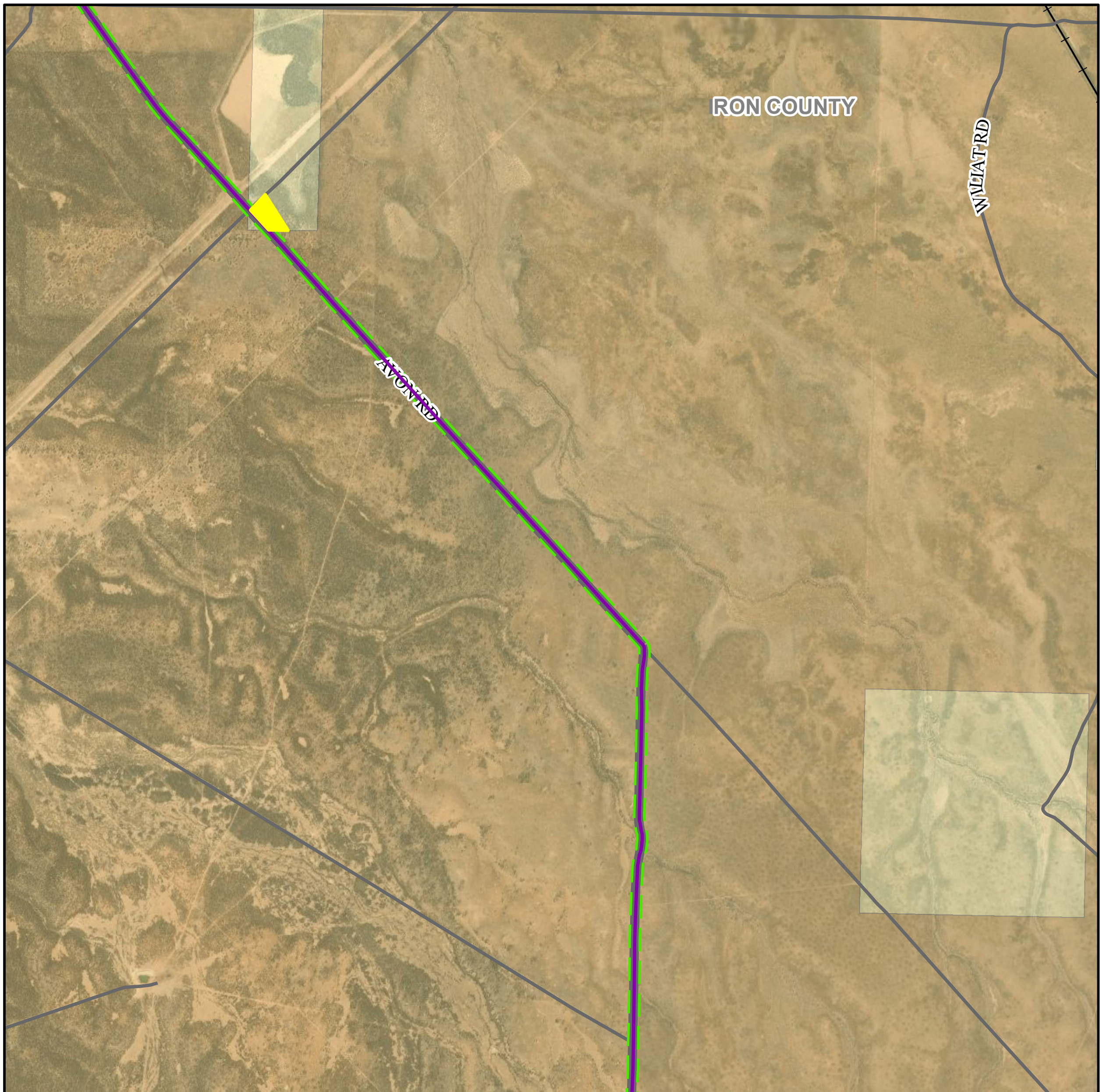

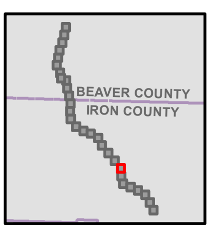

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Legend

- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- Union Pacific Railroad
- BLM
- Private

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 22

Transcon environmental | Planners & Scientists

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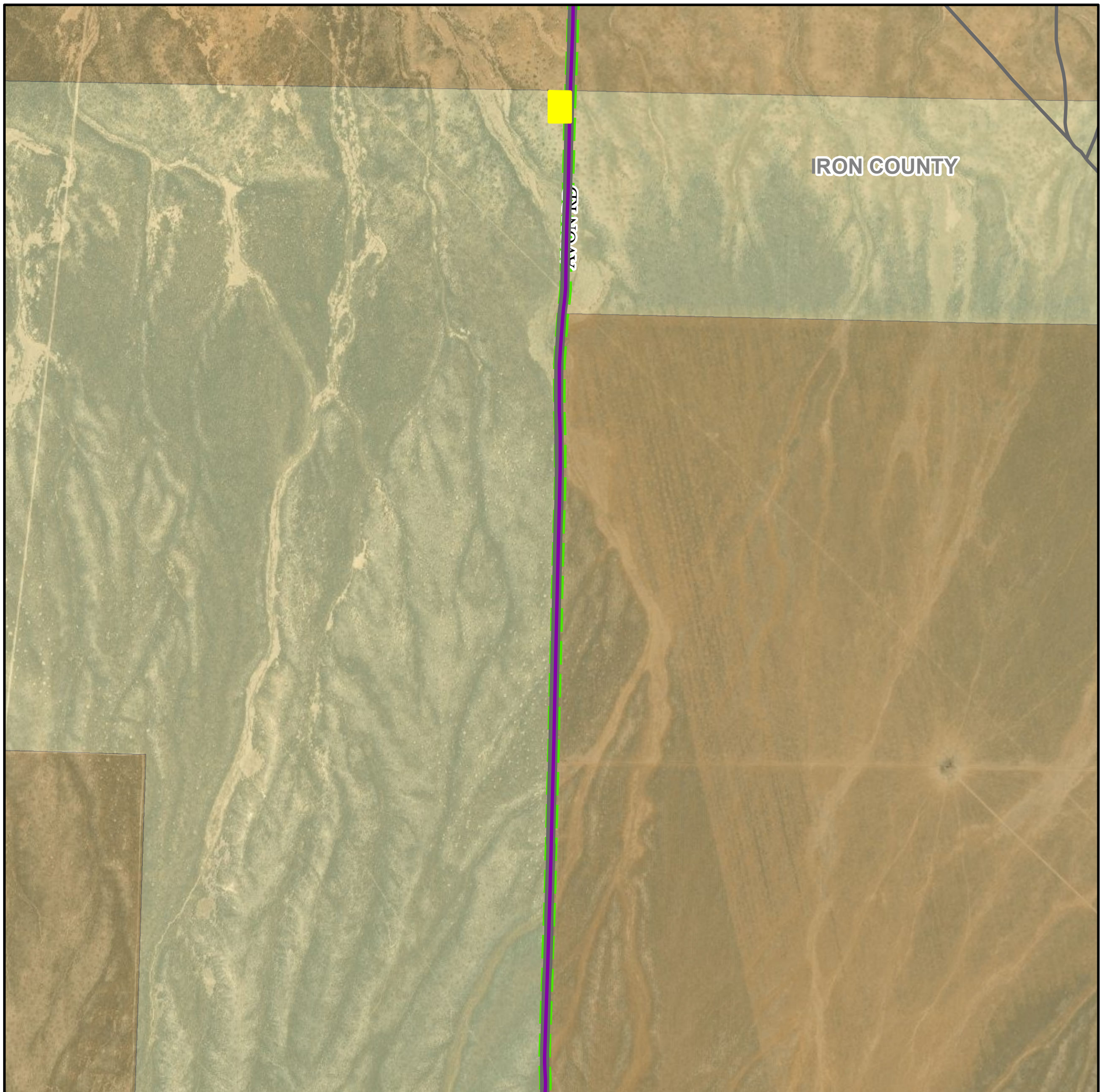

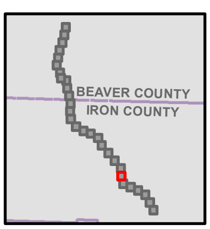

Legend

- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private

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Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 23

Transcon environmental | Planners & Scientists

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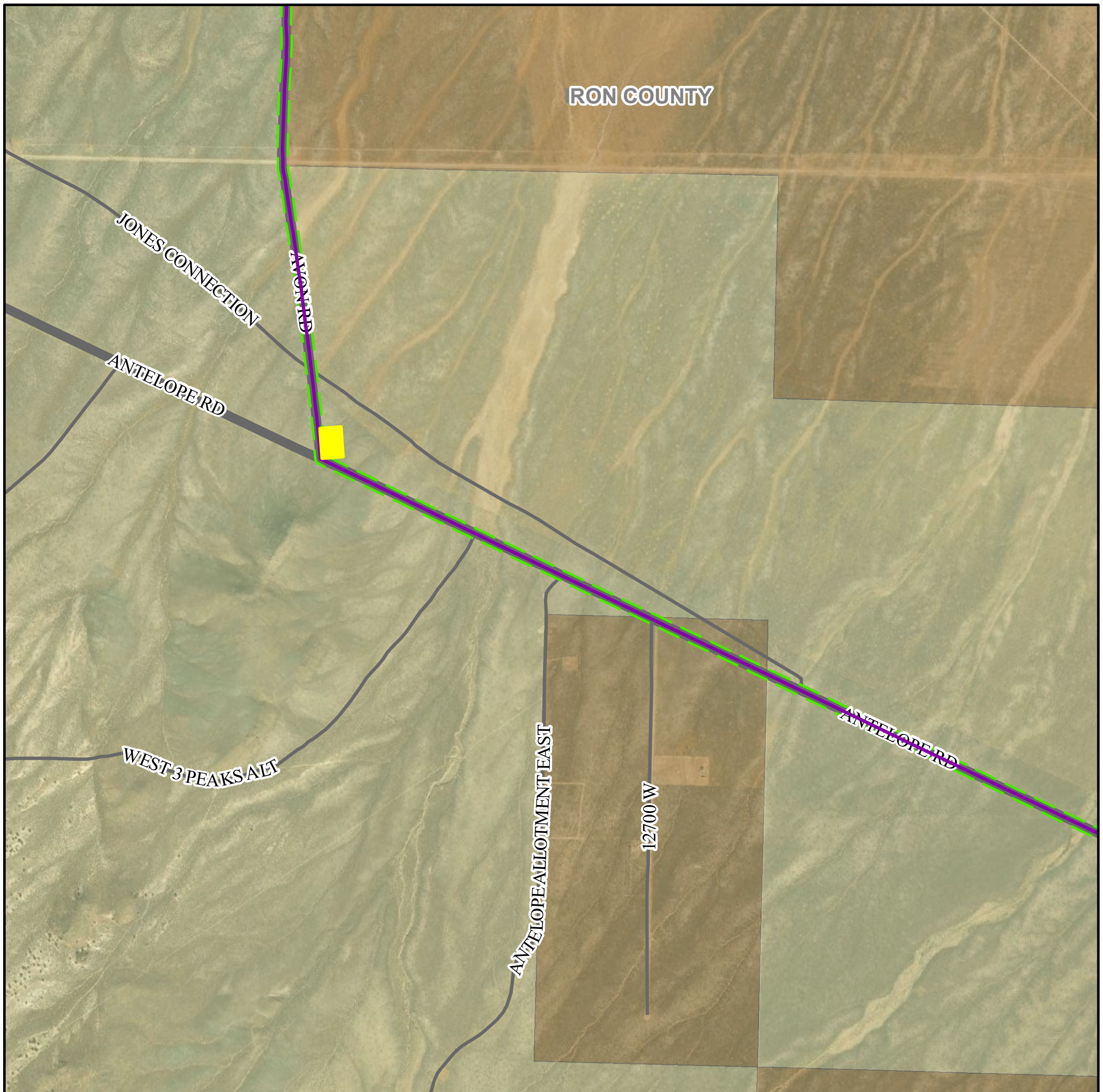

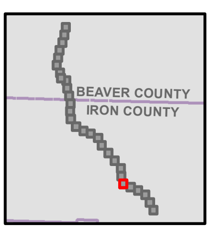

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Legend

- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 24

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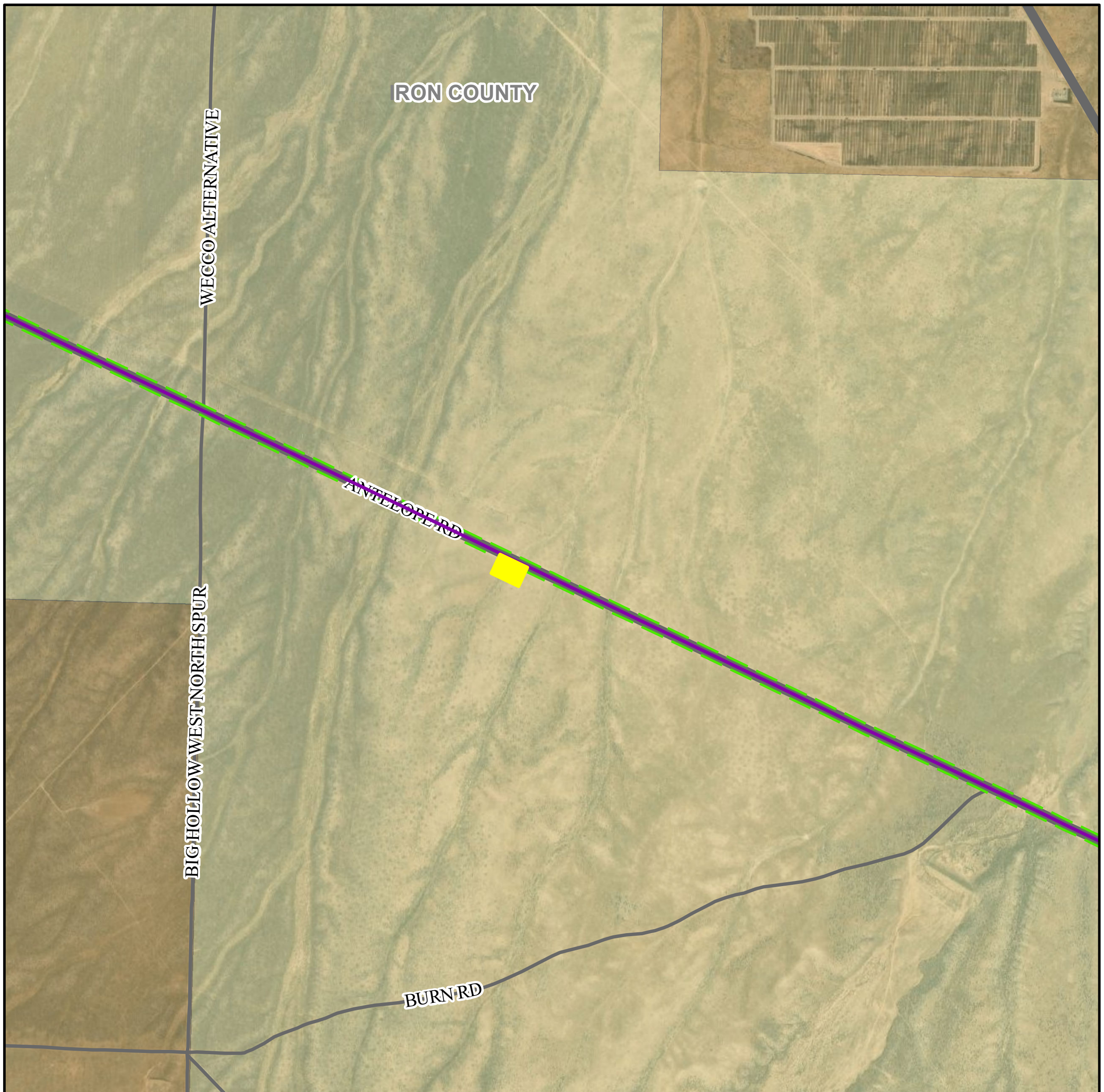

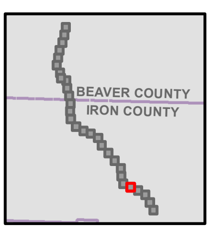

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Legend

- Staging Area
- Proposed Alignment
- Disturbance Area
- Roads
- BLM
- Private

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 25

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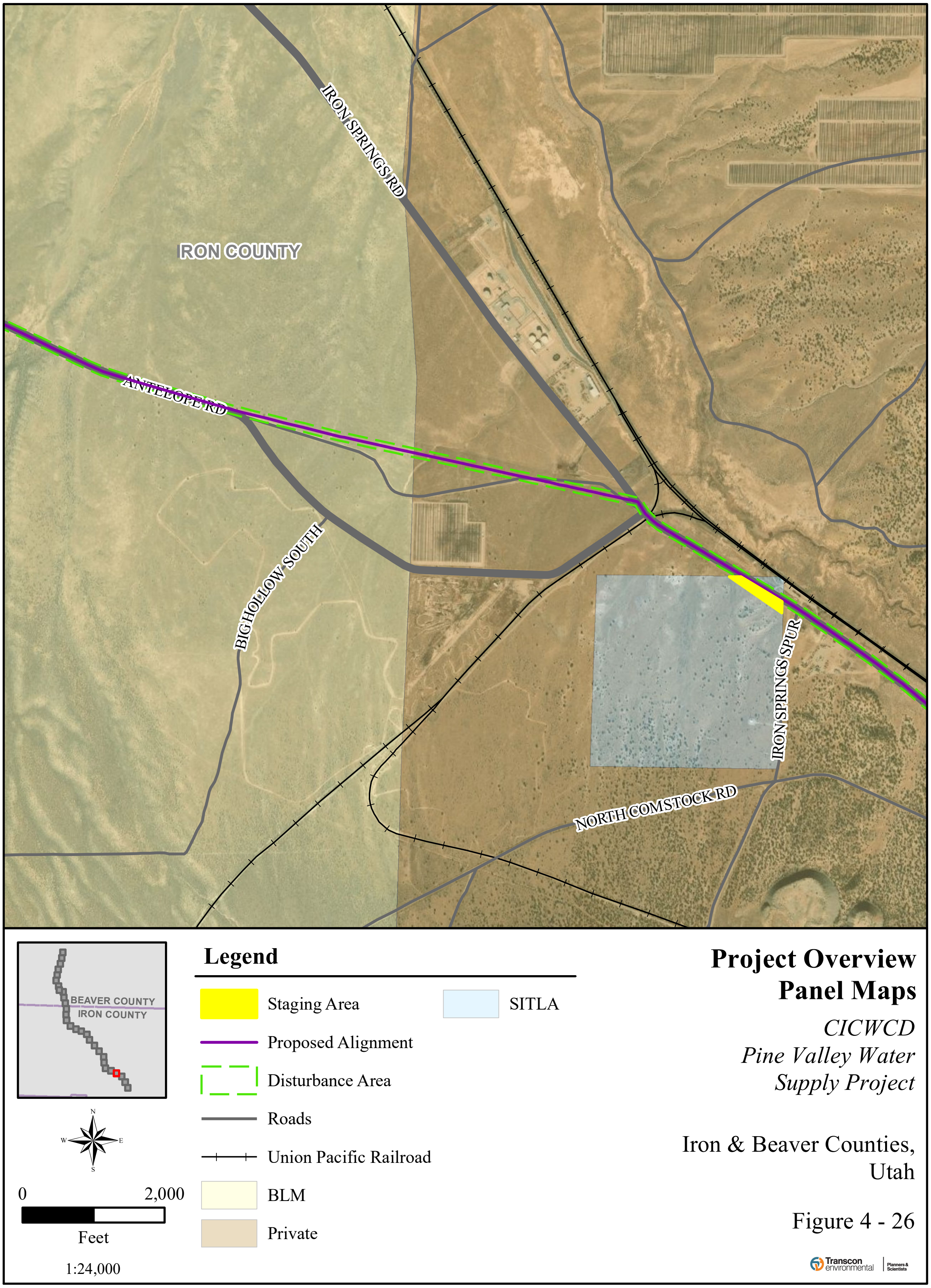

Legend

- Staging Area
- SITLA
- Proposed Alignment
- Disturbance Area
- Roads
- Union Pacific Railroad
- BLM
- Private

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 26

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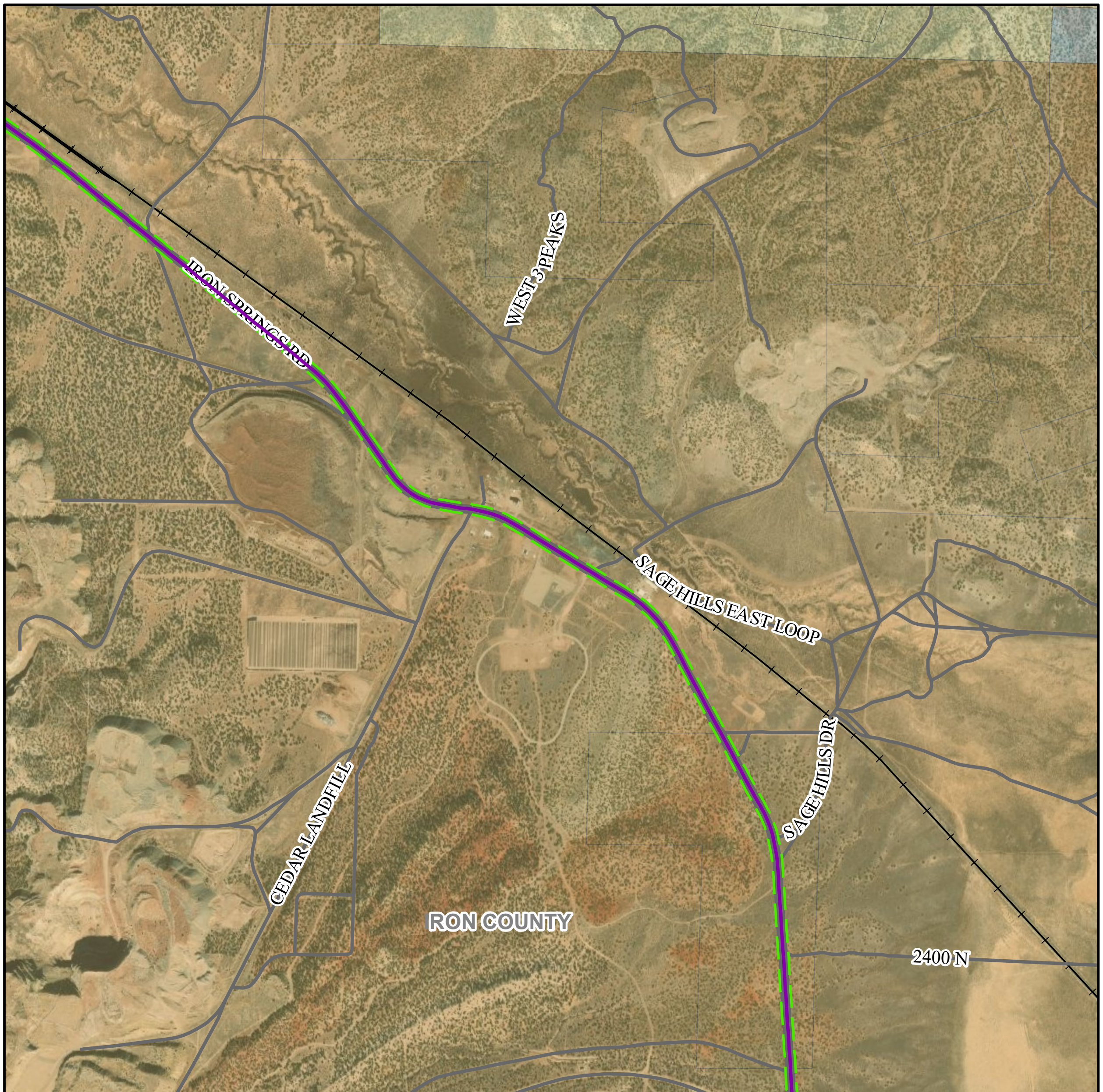

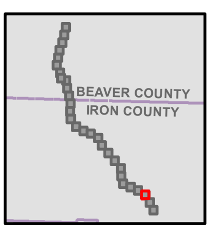

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Legend

- Proposed Alignment
- Disturbance Area
- Roads
- Union Pacific Railroad
- BLM
- Private
- SITLA

Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 27

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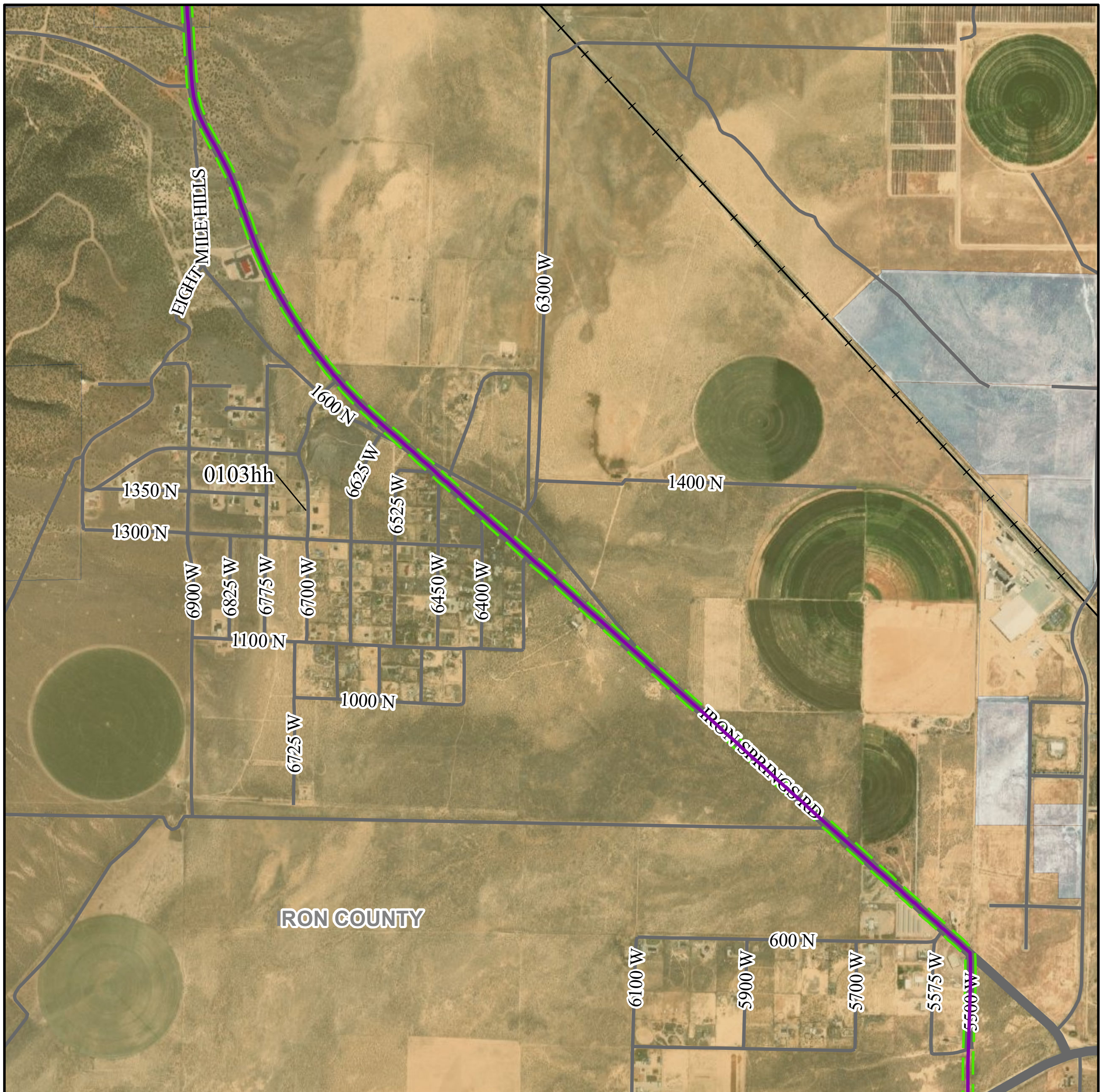
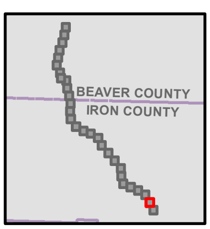
May 20, 2021 G:\Projects\CICWCD\Pine Valley Water Pipeline\Maps\EIS_20201002\P13_02_Pine_EIS_24k_Panels.mxd





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Legend

- Proposed Alignment
- Disturbance Area
- Roads
- Union Pacific Railroad
- Private
- SITLA

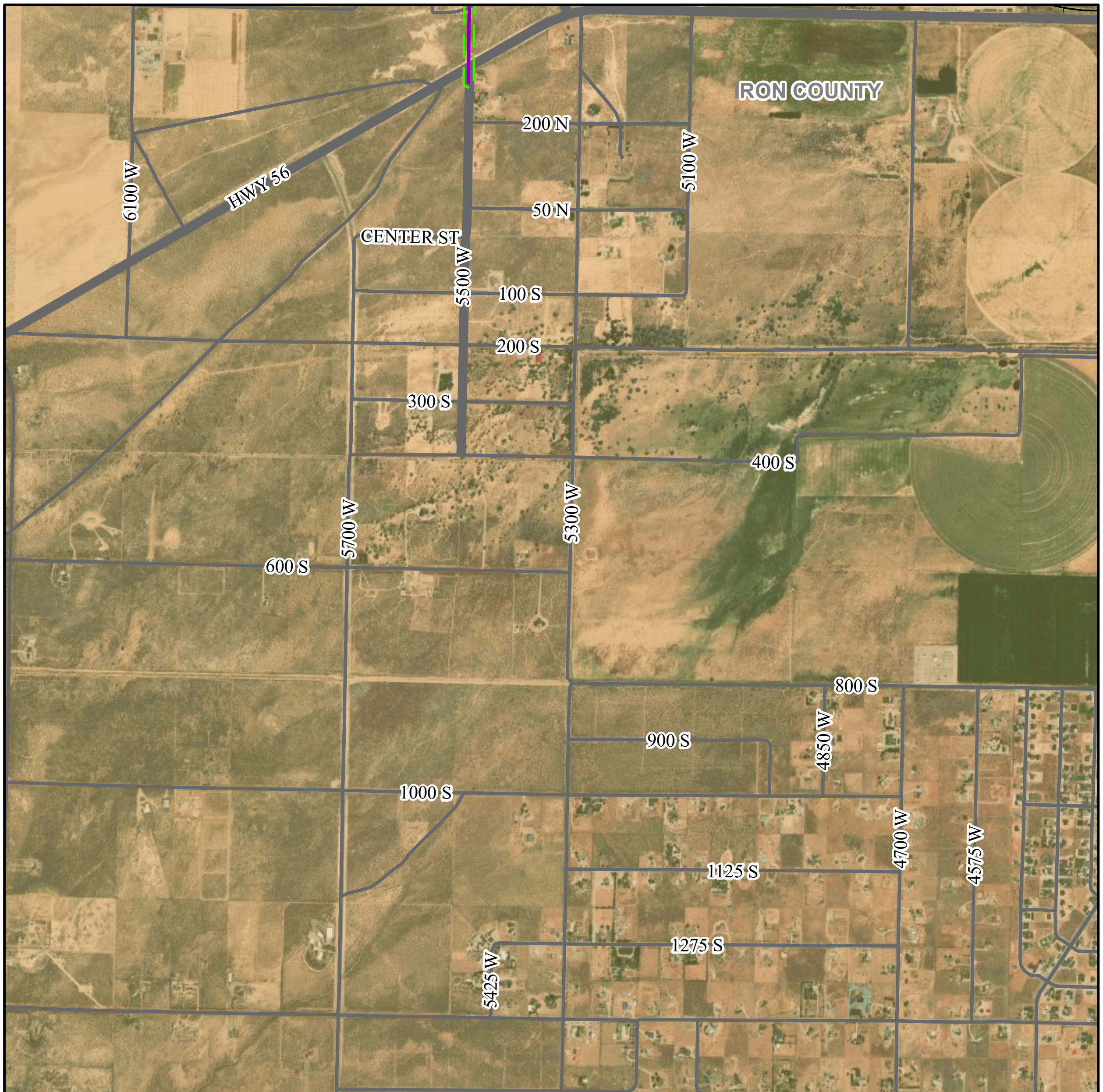
Project Overview Panel Maps

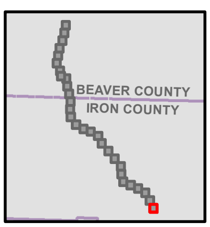
CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

Figure 4 - 28

Transcon environmental | Planners & Scientists





Legend

- Proposed Alignment
- Disturbance Area
- Roads
- Union Pacific Railroad
- Private

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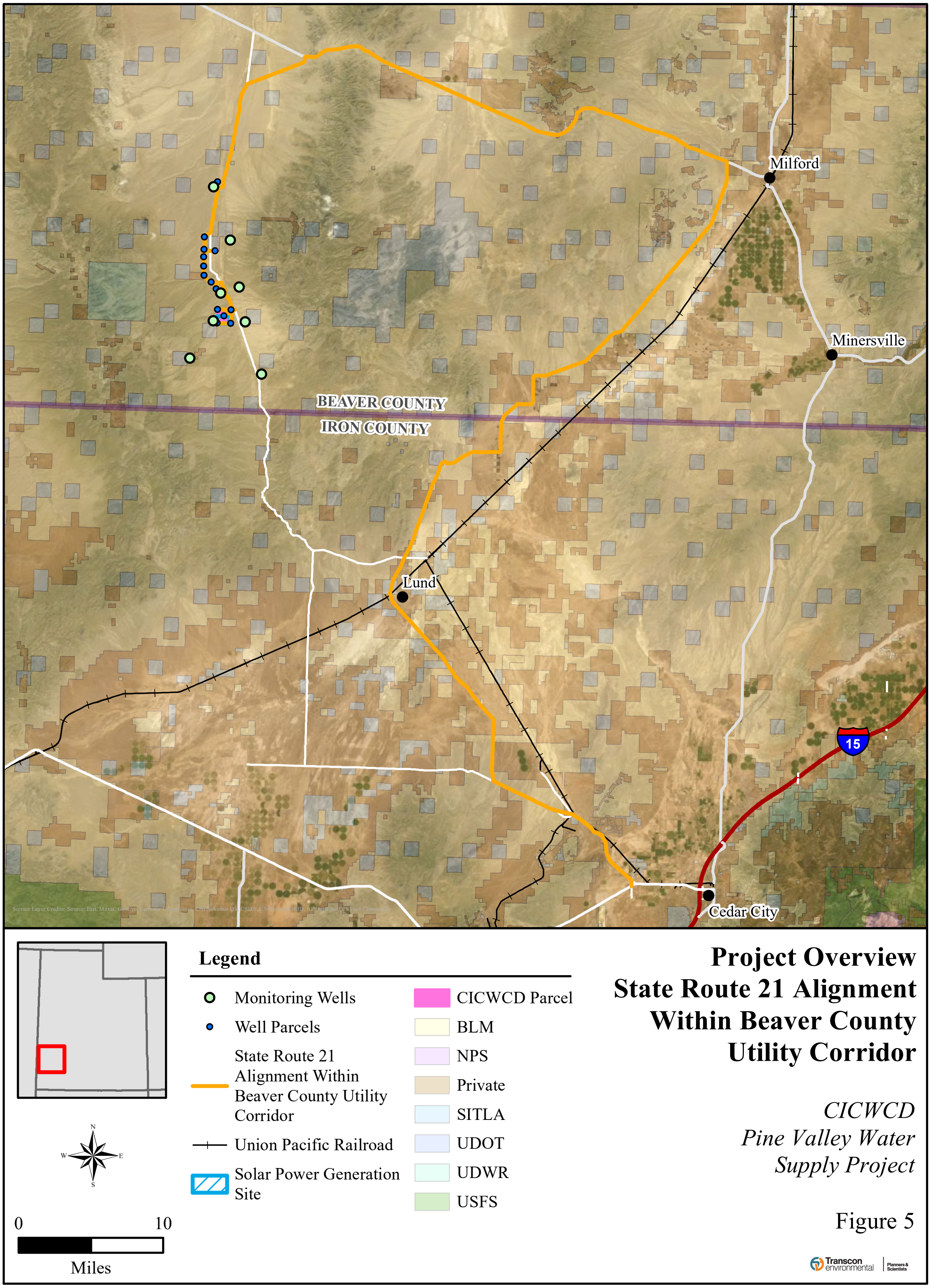
Project Overview Panel Maps

CICWCD
Pine Valley Water Supply Project

Iron & Beaver Counties, Utah

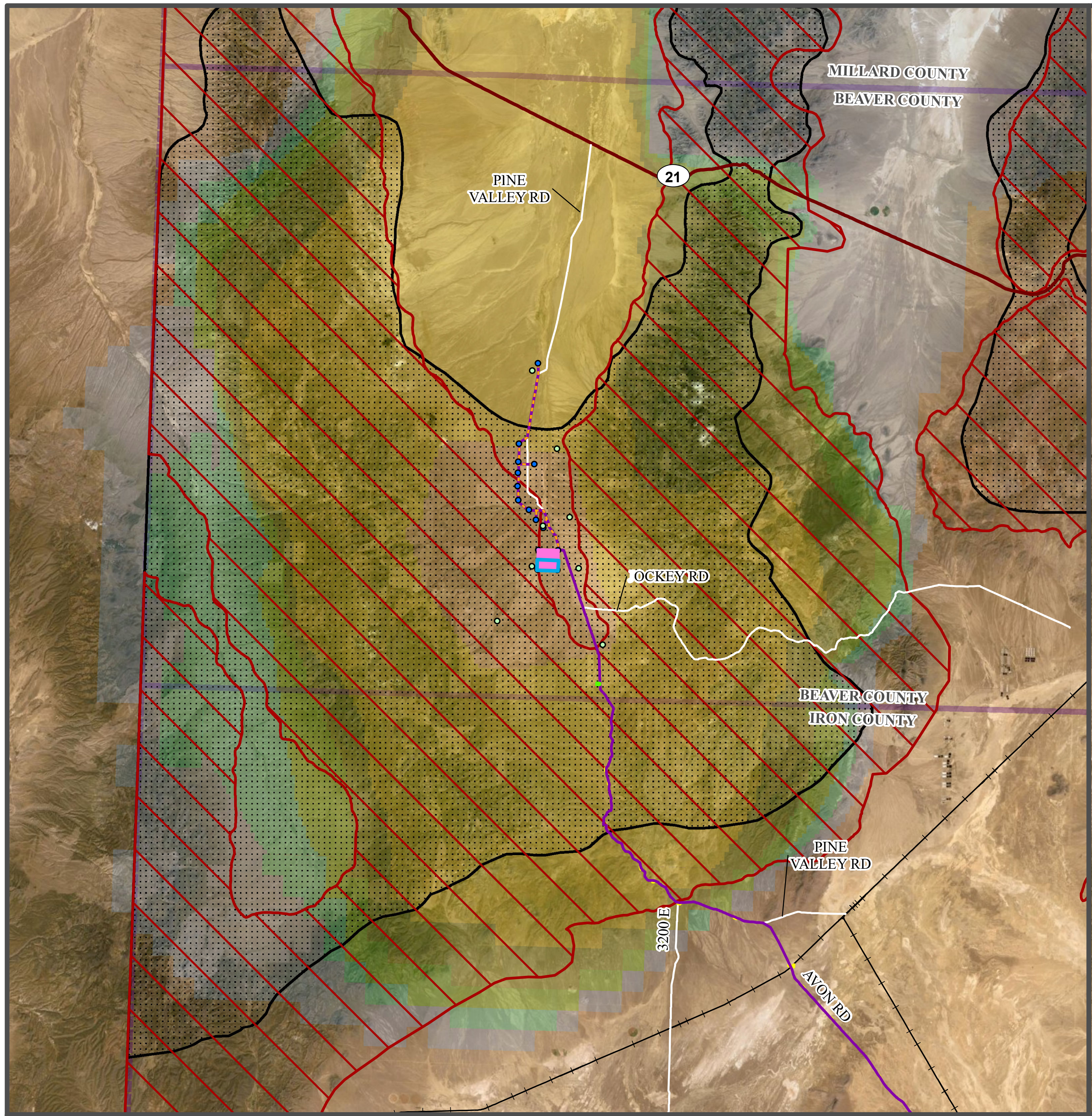
Figure 4 - 29



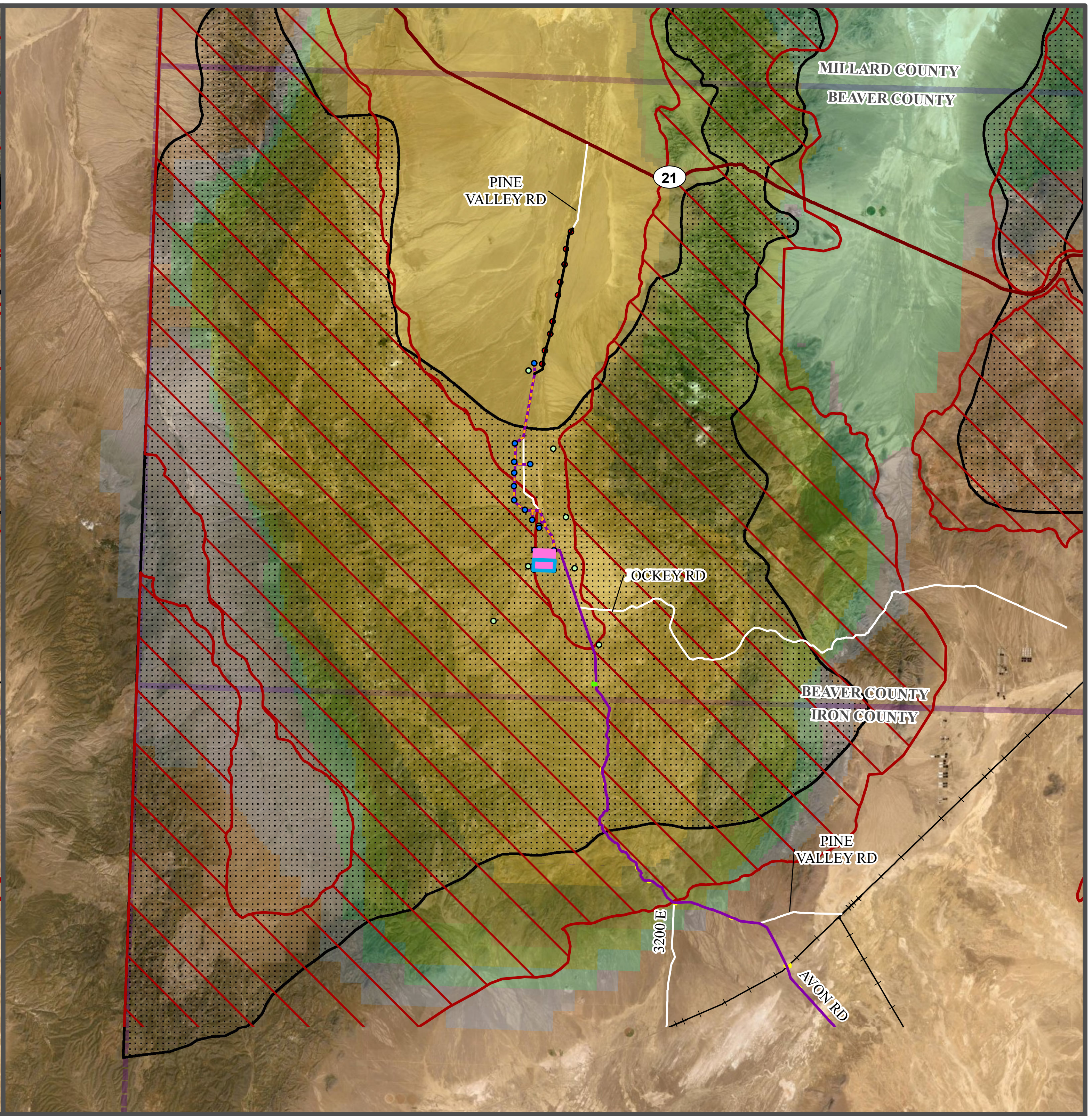
Project Overview State Route 21 Alignment Within Beaver County Utility Corridor

CICWCD
Pine Valley Water Supply Project

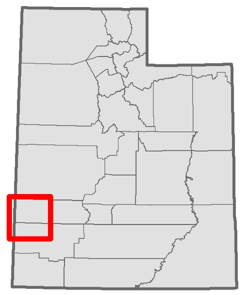
Figure 5

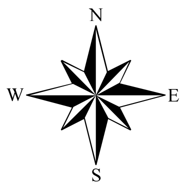


Proposed Action Alternative



Adaptive Northern Well Sites Alternative





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Legend

- Well Parcels
- Monitoring Wells
- Proposed ANWS Well Locations
- Proposed Alignment
- Proposed ANWS Alignment
- Electrical Transmission Line
- Staging Area
- Tank Site
- Solar Power Generation Site
- CICWCD Parcel
- Union Pacific Railroad
- Mule Dear Habitat
- Elk Habitat
- < 1' Drawdown
- 1' - 2' Drawdown
- 2' - 3' Drawdown
- 3' - 5' Drawdown
- 5' - 10' Drawdown
- 10' - 50' Drawdown
- 50' - 100' Drawdown
- 100' - 500' Drawdown
- > 500' Drawdown

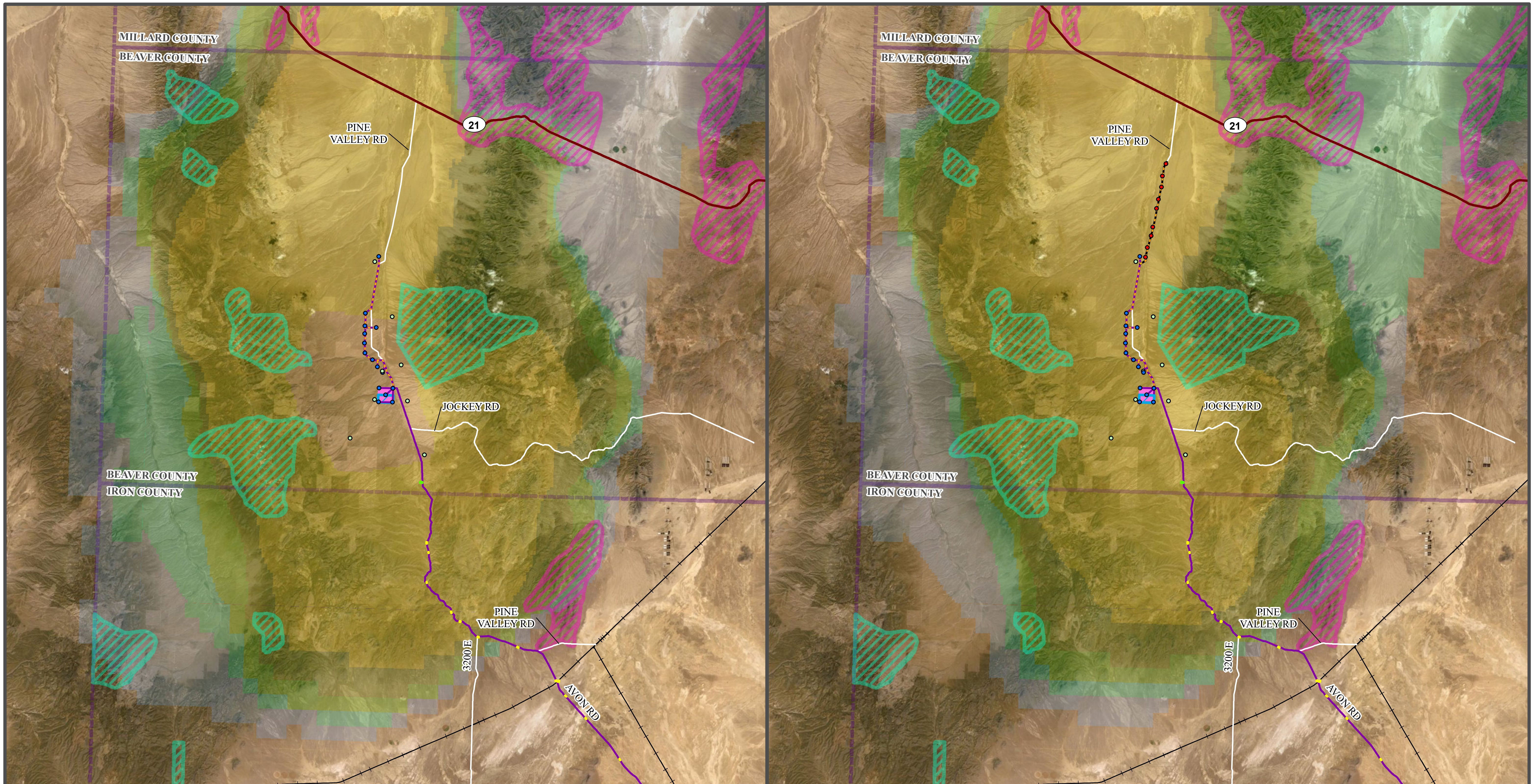
* The entire map extent is general deer and pronghorn habitat

Big Game Habitat

CICWCD
Pine Valley Water
Supply Project

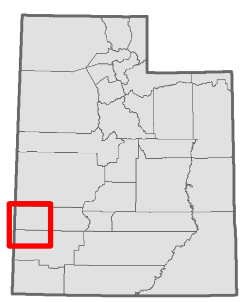
Figure 6

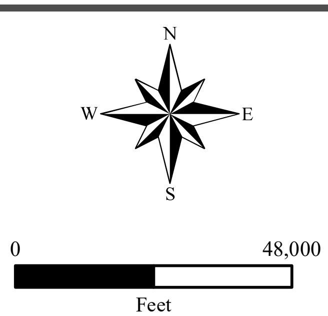
Transcon environmental Planners & Scientists



Proposed Action Alternative

Adaptive Northern Well Sites Alternative





Legend

Well Parcels	Staging Area	1' - 2' Drawdown	100' - 500' Drawdown
Monitoring Wells	Tank Site	2' - 3' Drawdown	> 500' Drawdown
Proposed ANWS Well Locations	Solar Power Generation Site	3' - 5' Drawdown	Chukar Partridge Habitat
Proposed Alignment	CICWCD Parcel	5' - 10' Drawdown	Wild Turkey Habitat
Proposed ANWS Alignment	Union Pacific Railroad	10' - 50' Drawdown	
Electrical Transmission Line	< 1' Drawdown	50' - 100' Drawdown	

Bird Habitat

CICWCD
Pine Valley Water
Supply Project

Figure 7

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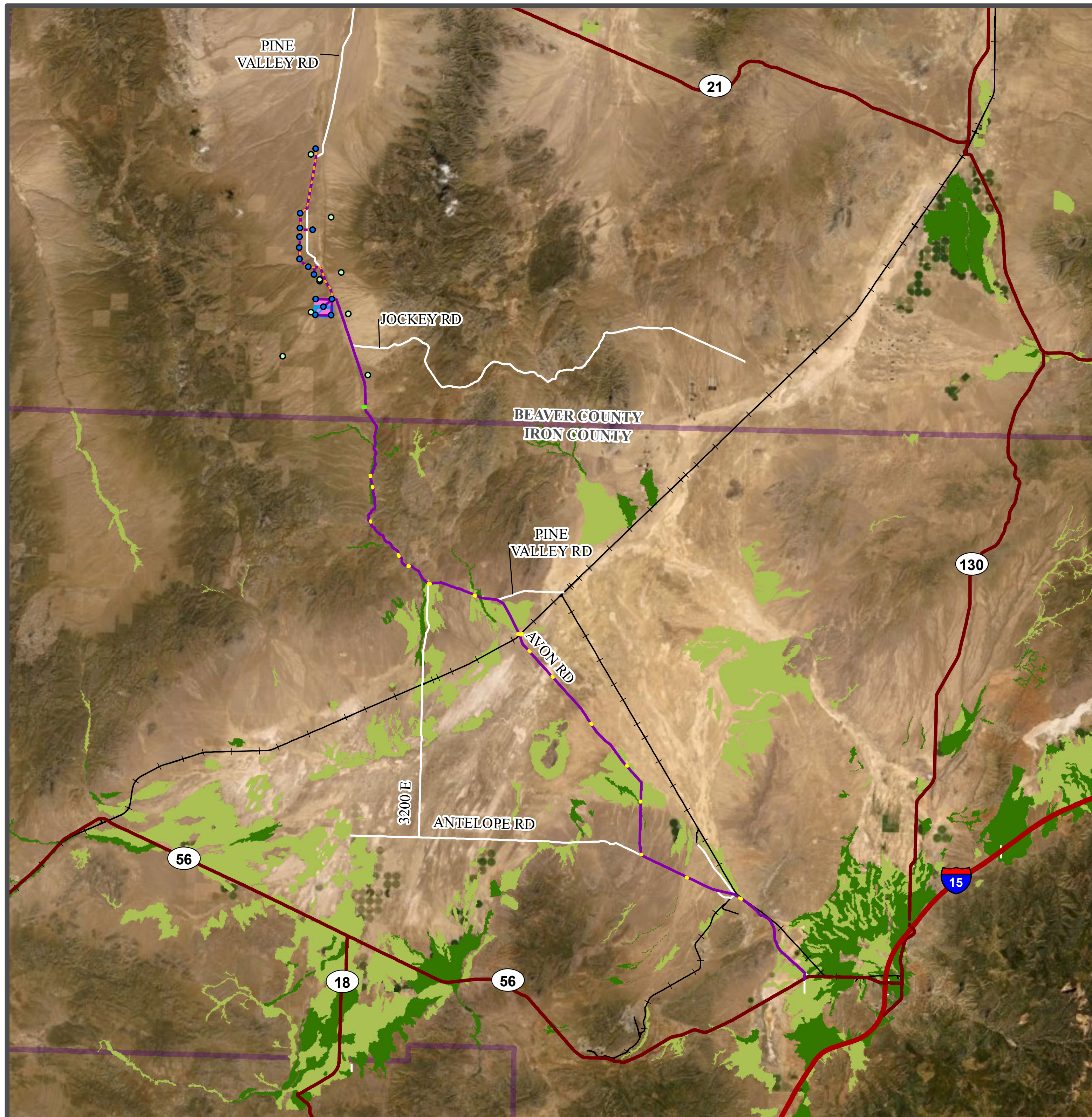
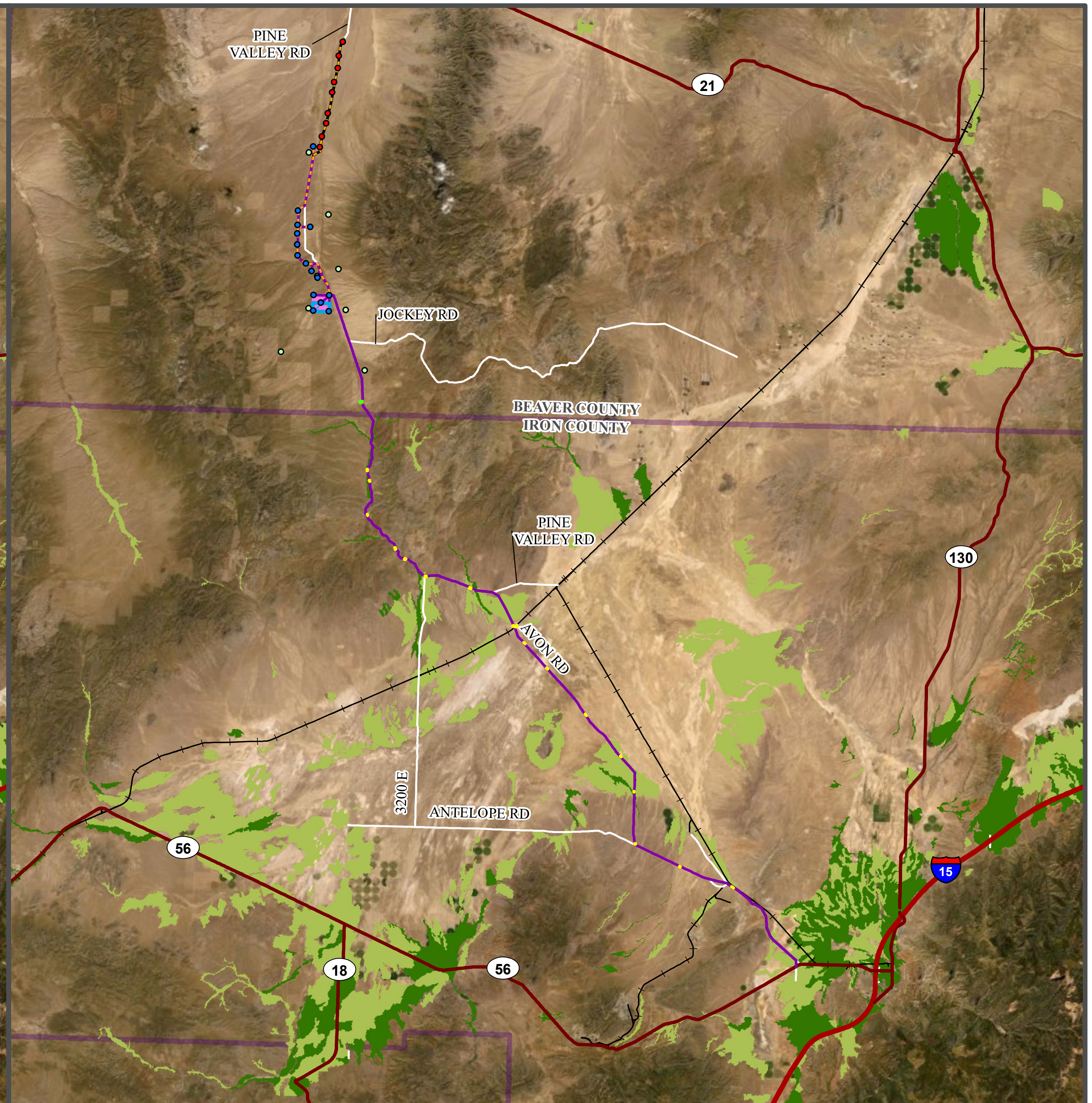
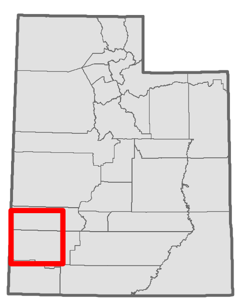


Proposed Action Alternative



Adaptive Northern Well Sites Alternative



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Legend

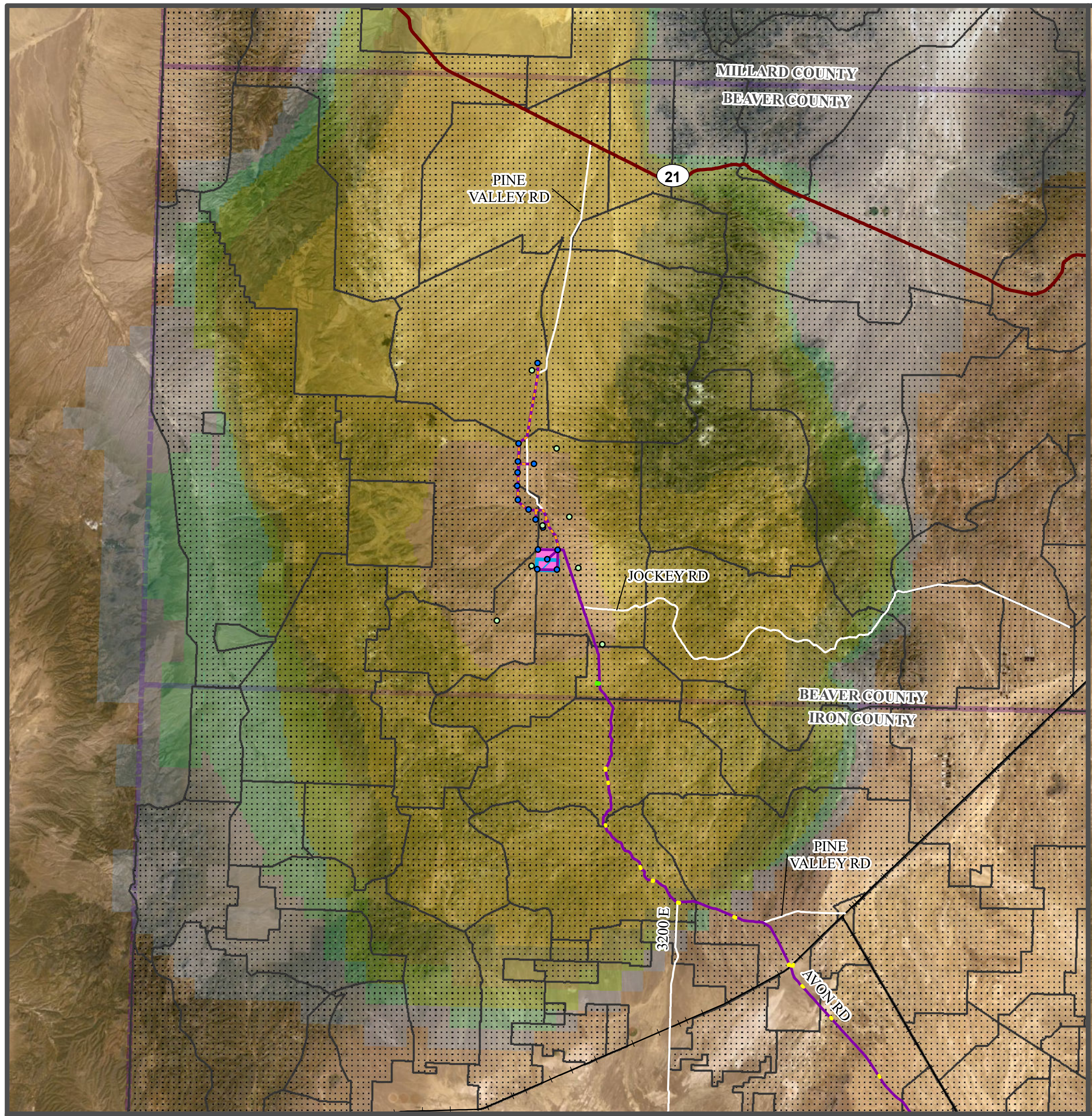
Well Parcels	Electrical Transmission Line	Union Pacific Railroad
Monitoring Wells	Staging Area	Prime Farmland
Proposed ANWS Well Locations	Tank Site	Farmland of Unique Importance
Proposed Alignment	Solar Power Generation Site	Farmland of Statewide Importance
Proposed ANWS Alignment	CICWCD Parcel	Farmland of Local Importance

Prime and Unique Farmland

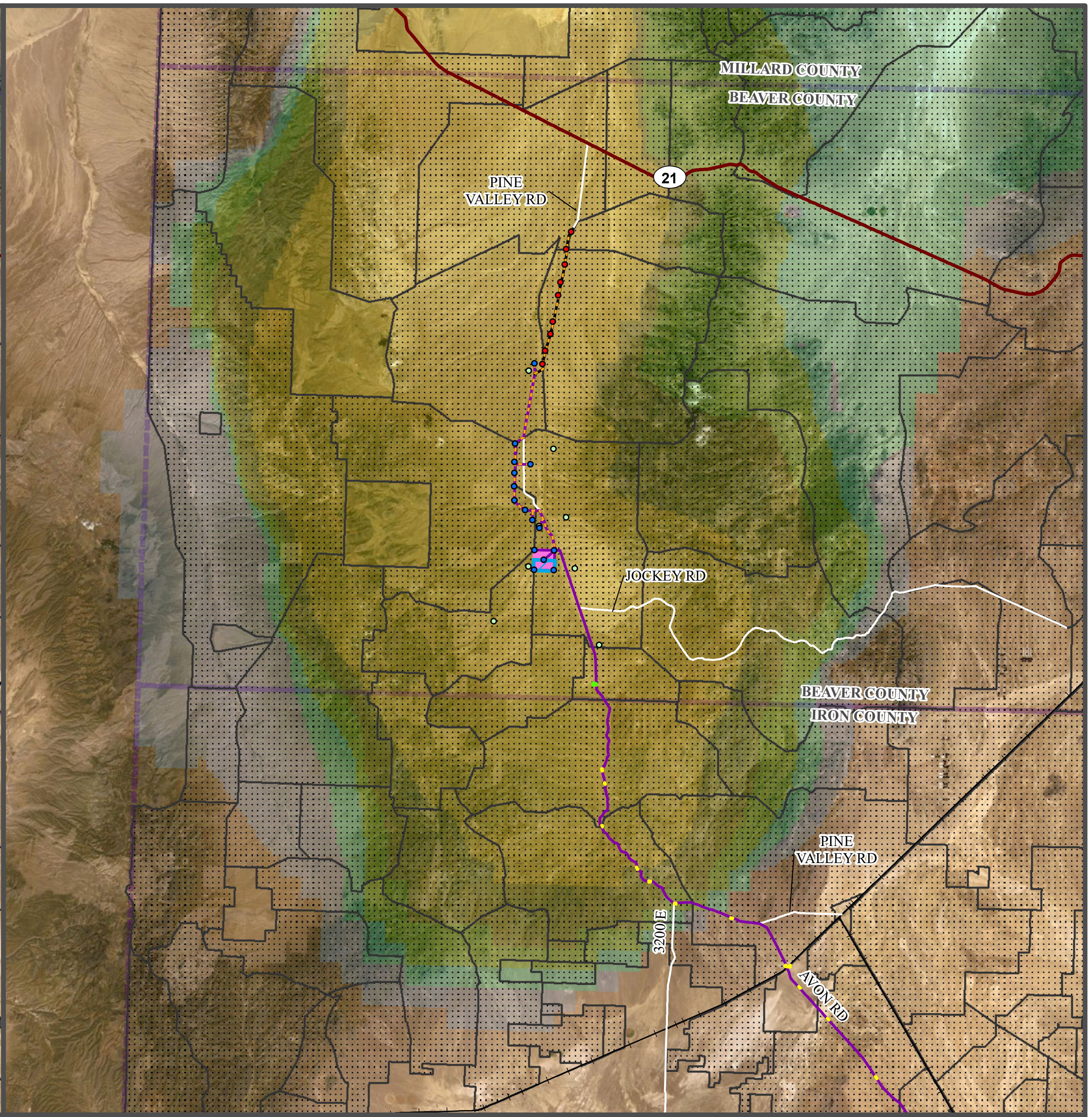
CICWCD
Pine Valley Water
Supply Project

Figure 8

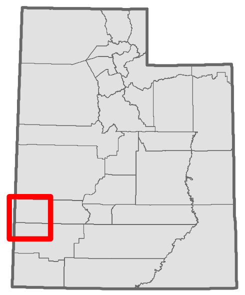
Transcon environmental
Planners & Scientists



Proposed Action Alternative



Adaptive Northern Well Sites Alternative



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Legend

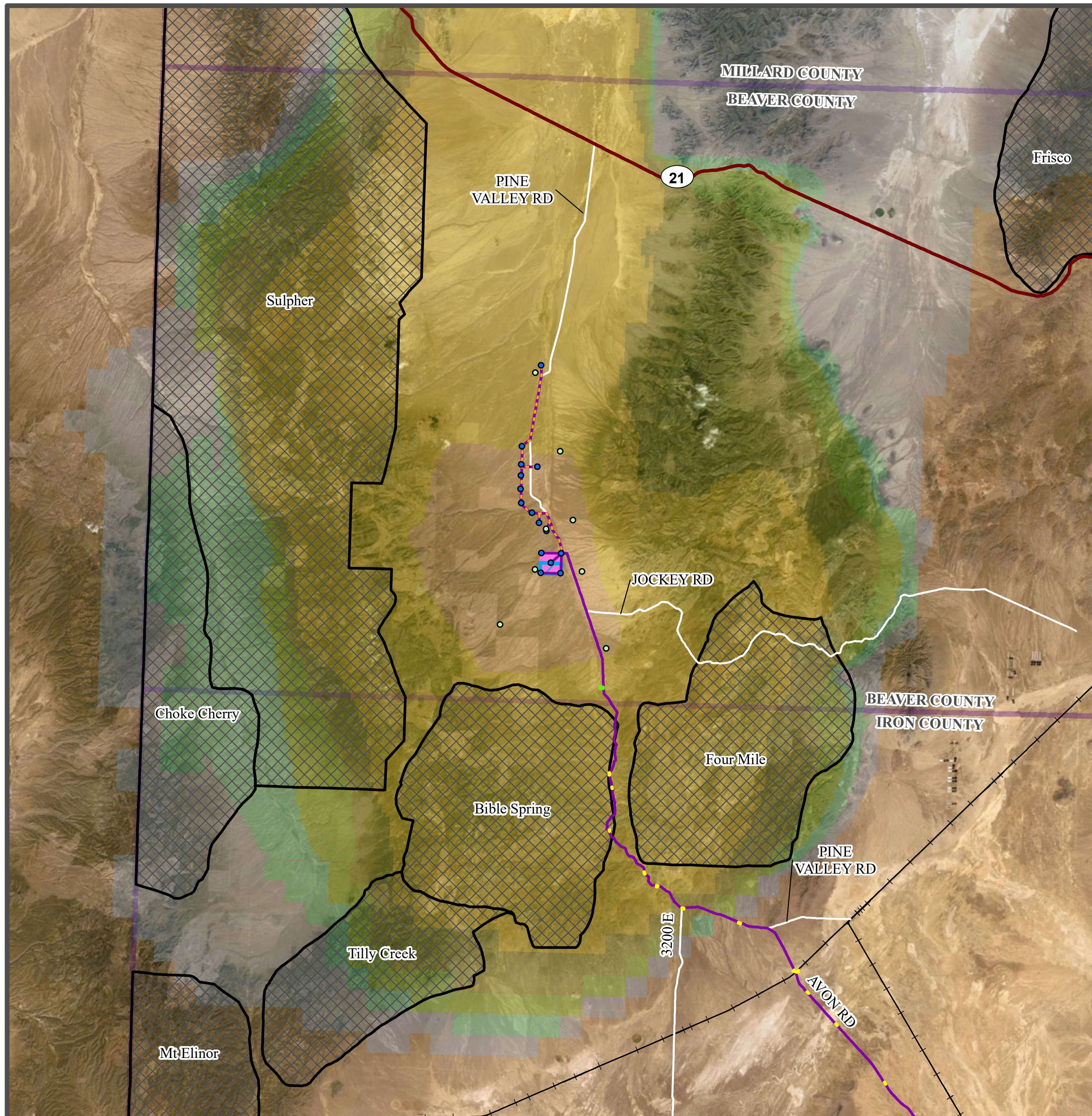
- Well Parcels
- Monitoring Wells
- Proposed ANWS Well Locations
- Proposed Alignment
- Proposed ANWS Alignment
- Electrical Transmission Line
- Staging Area
- Tank Site
- Solar Power Generation Site
- CICWCD Parcel
- Union Pacific Railroad
- Grazing Allotments
- < 1' Drawdown
- 1' - 2' Drawdown
- 2' - 3' Drawdown
- 3' - 5' Drawdown
- 5' - 10' Drawdown
- 10' - 50' Drawdown
- 50' - 100' Drawdown
- 100' - 500' Drawdown
- > 500' Drawdown

Grazing Allotments

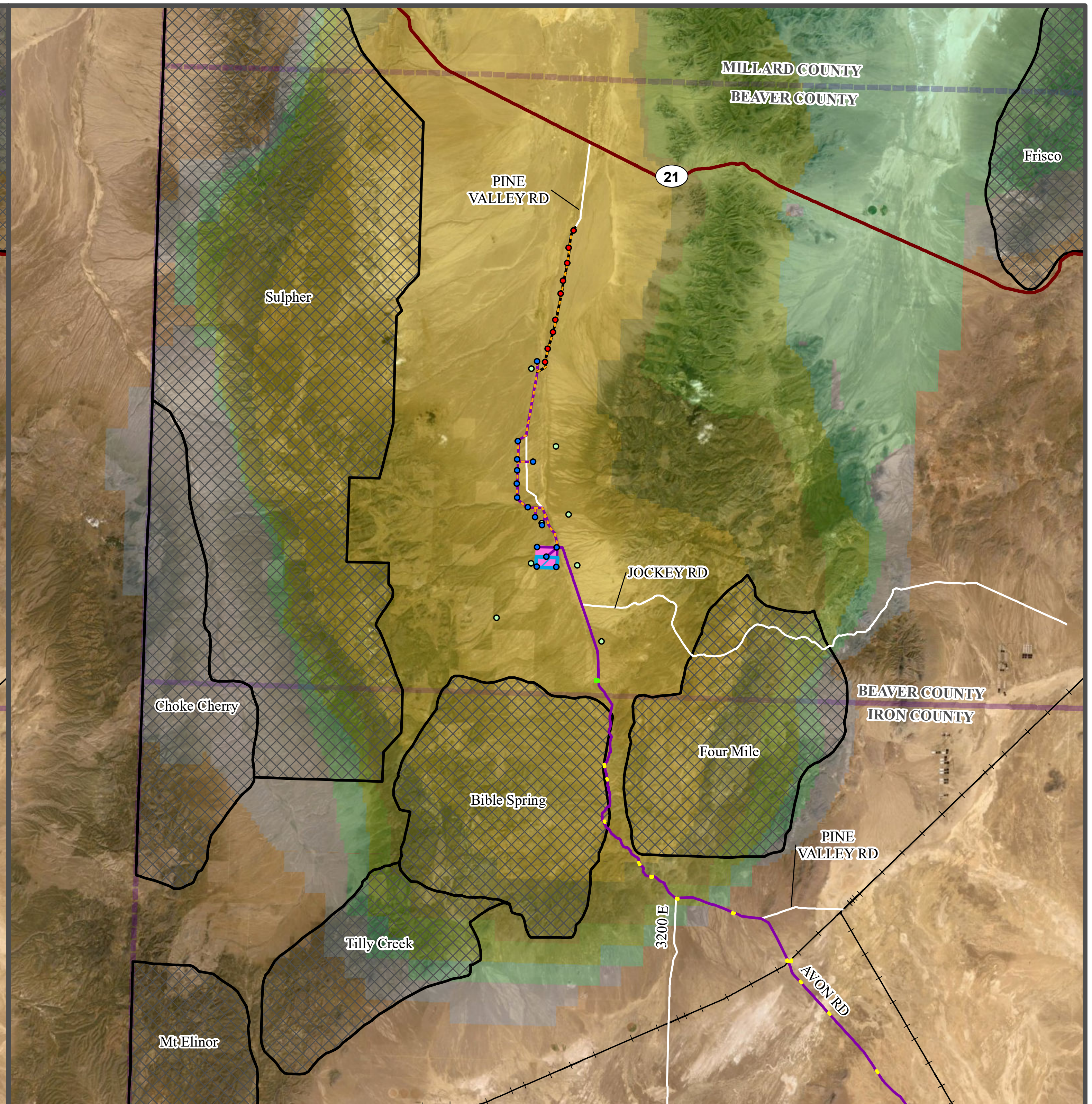
CICWCD
Pine Valley Water
Supply Project

Figure 9

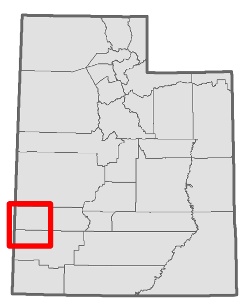
Transcon environmental | Planners & Scientists

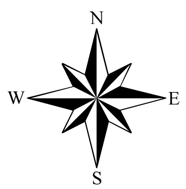


Proposed Action Alternative



Adaptive Northern Well Sites Alternative





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Legend

Well Parcels	Staging Area	< 1' Drawdown
Monitoring Wells	Tank Site	1' - 2' Drawdown
Proposed ANWS Well Locations	Solar Power Generation Site	2' - 3' Drawdown
Proposed Alignment	CICWCD Parcel	3' - 5' Drawdown
Proposed ANWS Alignment	Union Pacific Railroad	5' - 10' Drawdown
Electrical Transmission Line	Mangement Areas	10' - 50' Drawdown
50' - 100' Drawdown	100' - 500' Drawdown	> 500' Drawdown

Wild Horse and Burro Herd Management Areas

CICWCD
Pine Valley Water
Supply Project

Figure 10

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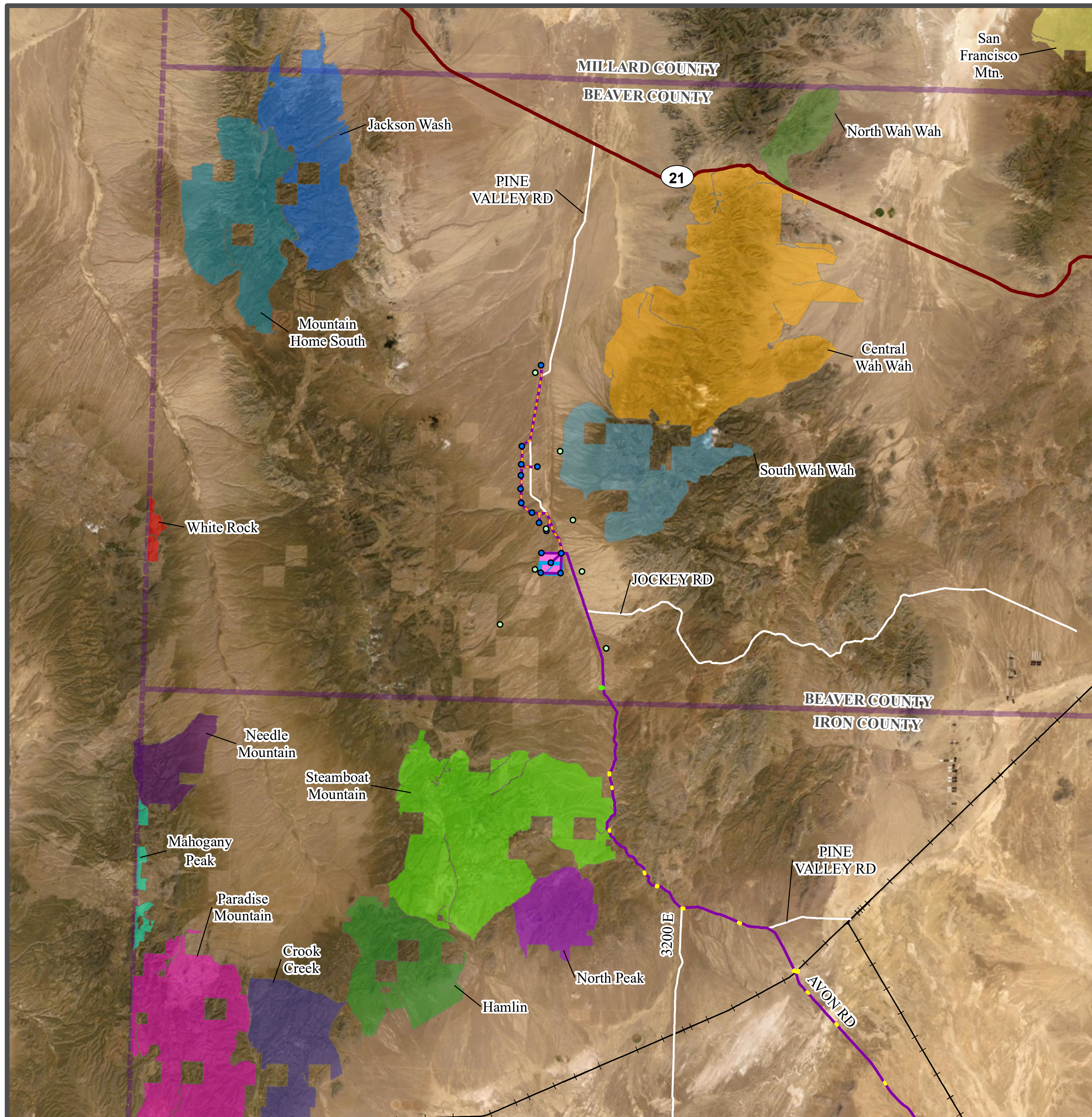

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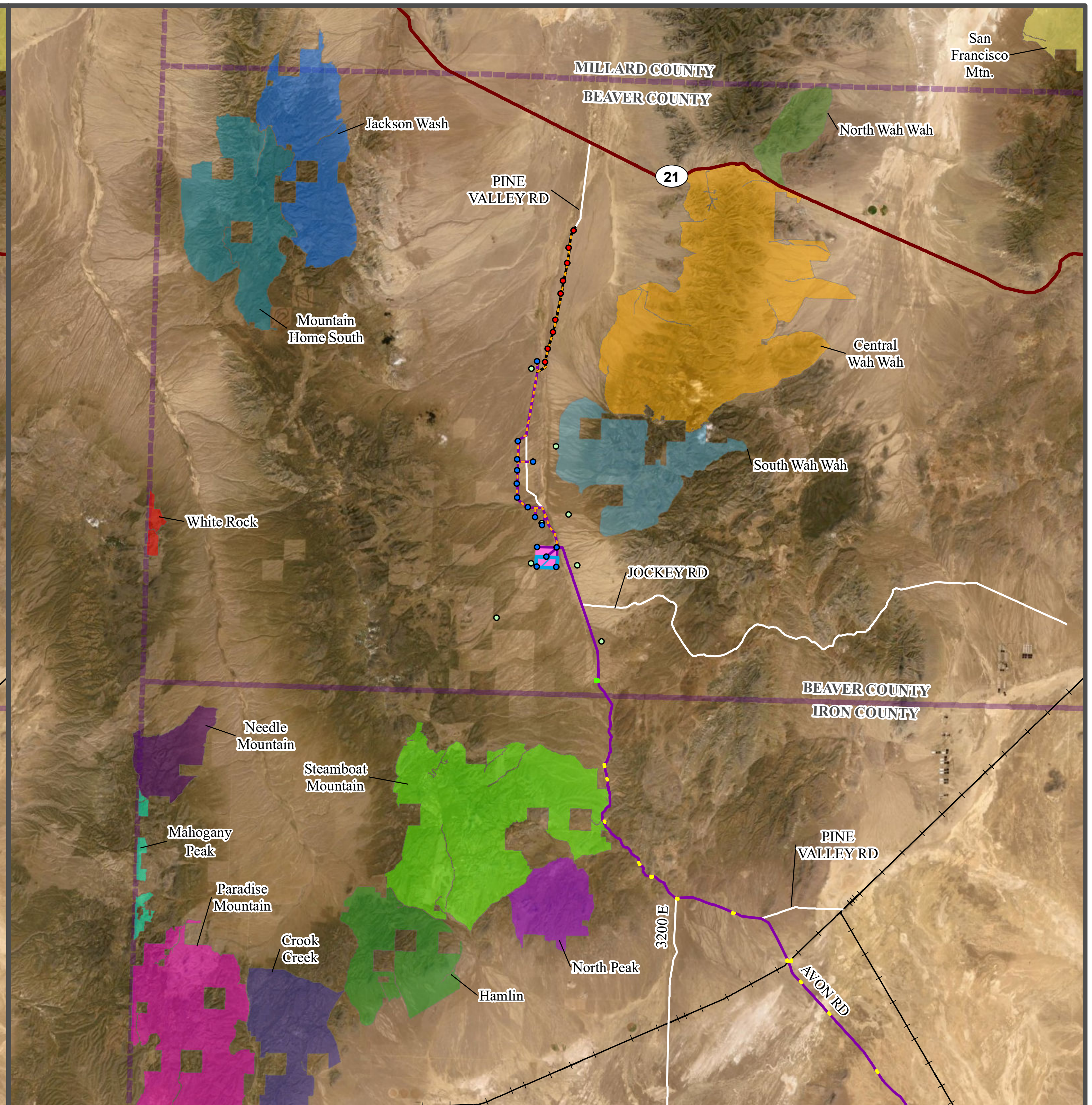
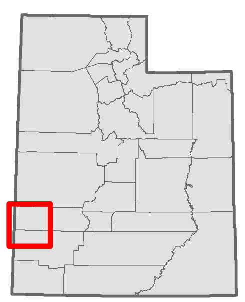


Adaptive Northern Well Sites Alternative



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Legend

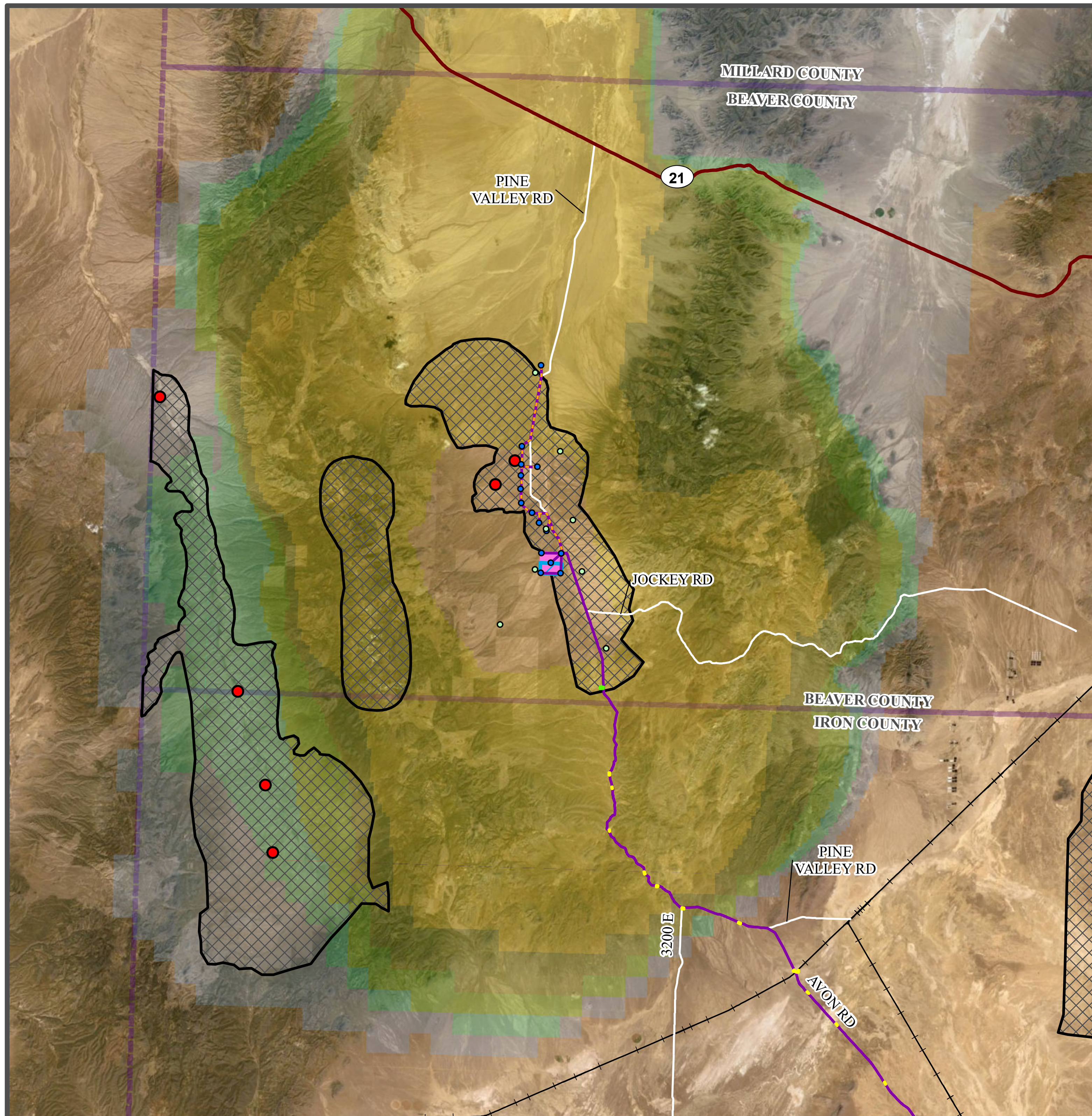
- Well Parcels
- Monitoring Wells
- Proposed ANWS Well Locations
- Proposed Alignment
- Proposed ANWS Alignment
- Electrical Transmission Line
- Staging Area
- Tank Site
- Solar Power Generation Site
- CICWCD Parcel
- Union Pacific Railroad
- Central Wah Wah
- Crook Creek
- Hamlin
- Jackson Wash
- Mahogany Peak
- Mountain Home South
- Needle Mountain
- North Peak
- North Wah Wah
- Paradise Mountain
- San Francisco Mtn.
- South Wah Wah
- Steamboat Mountain
- White Rock

Lands with Wilderness Characteristics

CICWCD
Pine Valley Water
Supply Project

Figure 11

Transcon environmental | Planners & Scientists



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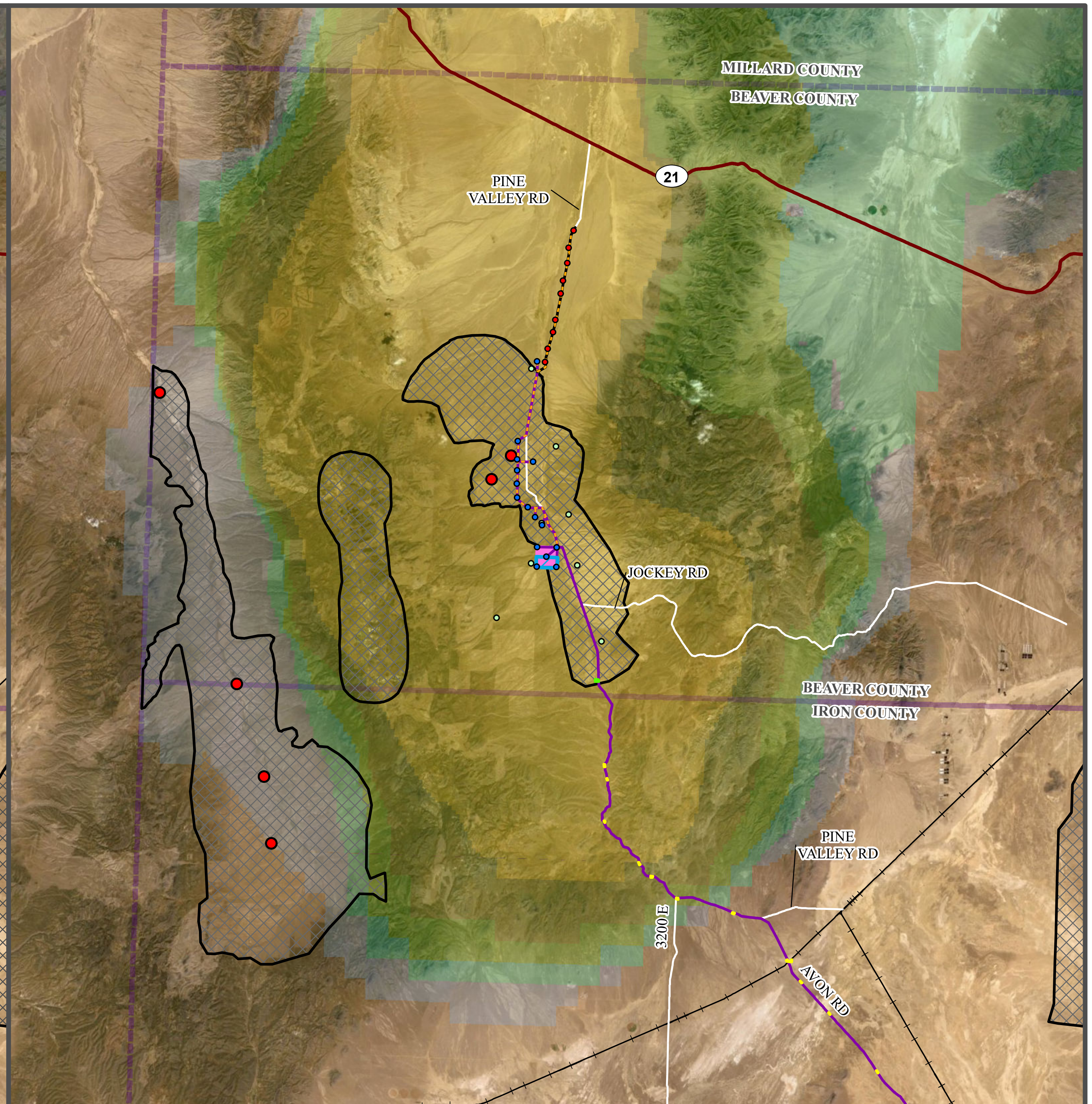
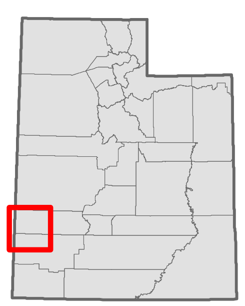
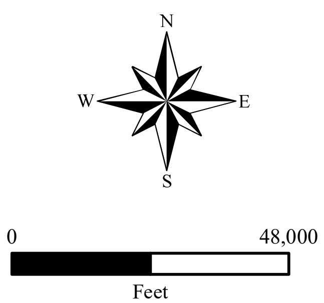


Adaptive Northern Well Sites Alternative





Legend

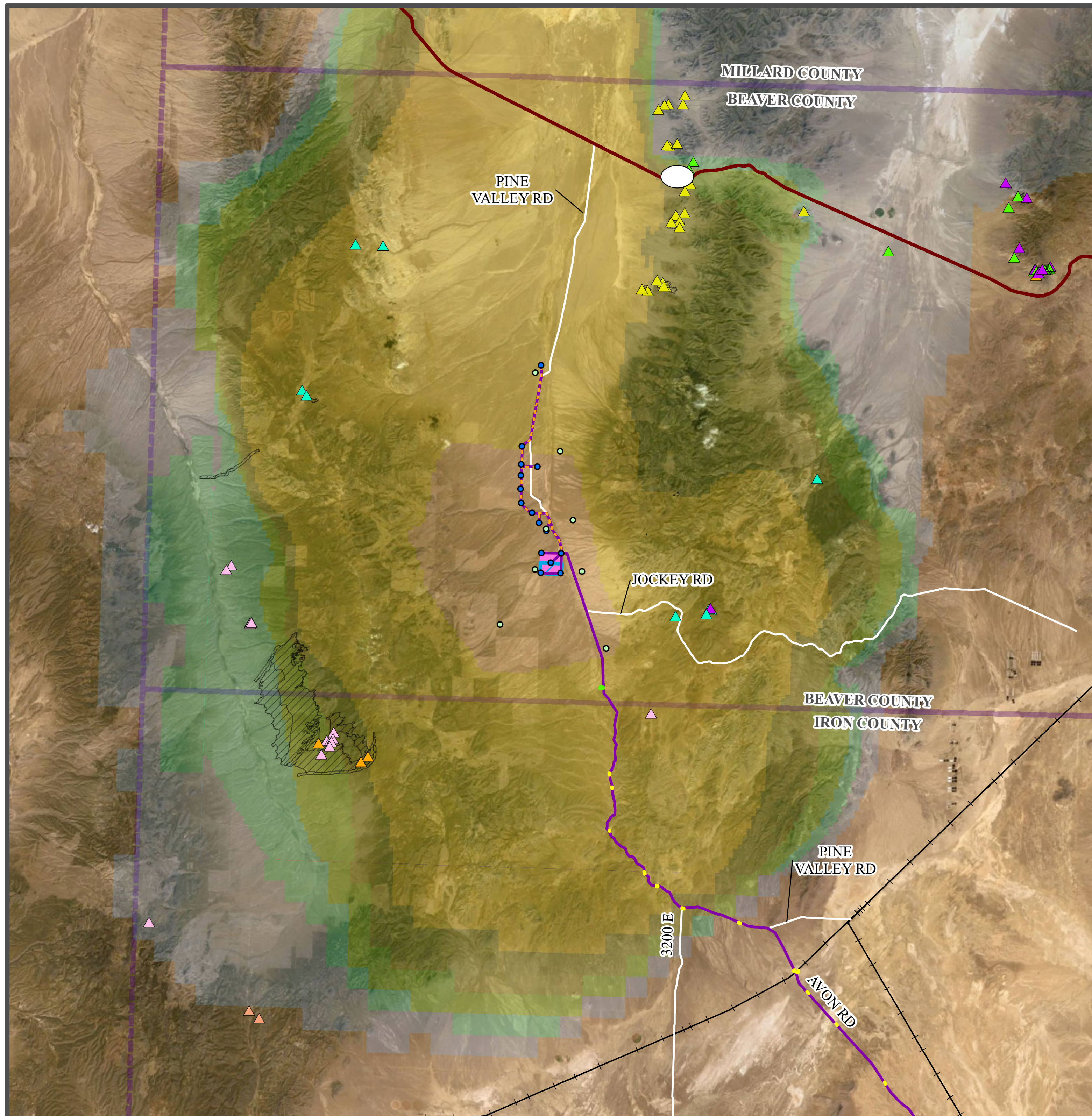
- Well Parcels
- Monitoring Wells
- Proposed ANWS Well Locations
- Proposed Alignment
- Proposed ANWS Alignment
- Electrical Transmission Line
- Staging Area
- Tank Site
- Solar Power Generation Site
- CICWCD Parcel
- Union Pacific Railroad
- Sage-Grouse Leks
- PHMA
- < 1' Drawdown
- 1' - 2' Drawdown
- 2' - 3' Drawdown
- 3' - 5' Drawdown
- 5' - 10' Drawdown
- 10' - 50' Drawdown
- 50' - 100' Drawdown
- 100' - 500' Drawdown
- > 500' Drawdown

Sage-Grouse

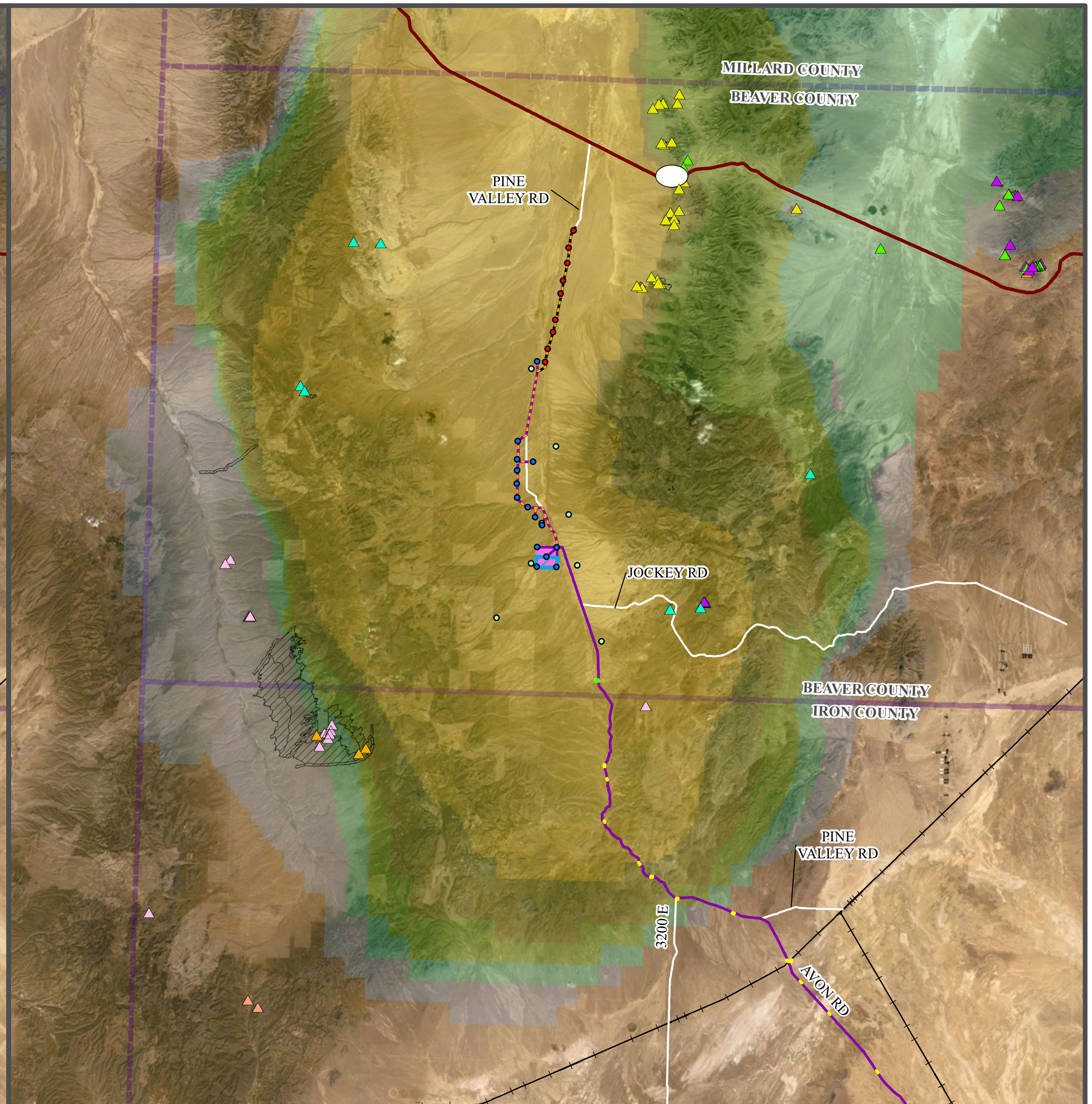
CICWCD
Pine Valley Water
Supply Project

Figure 12

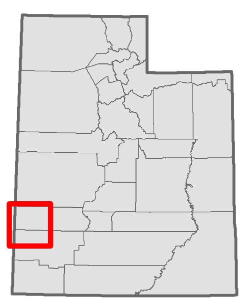
Transcon environmental | Planners & Scientists

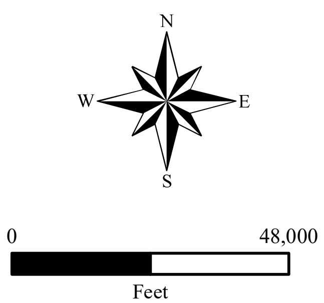


Proposed Action Alternative



Adaptive Northern Well Sites Alternative





Legend

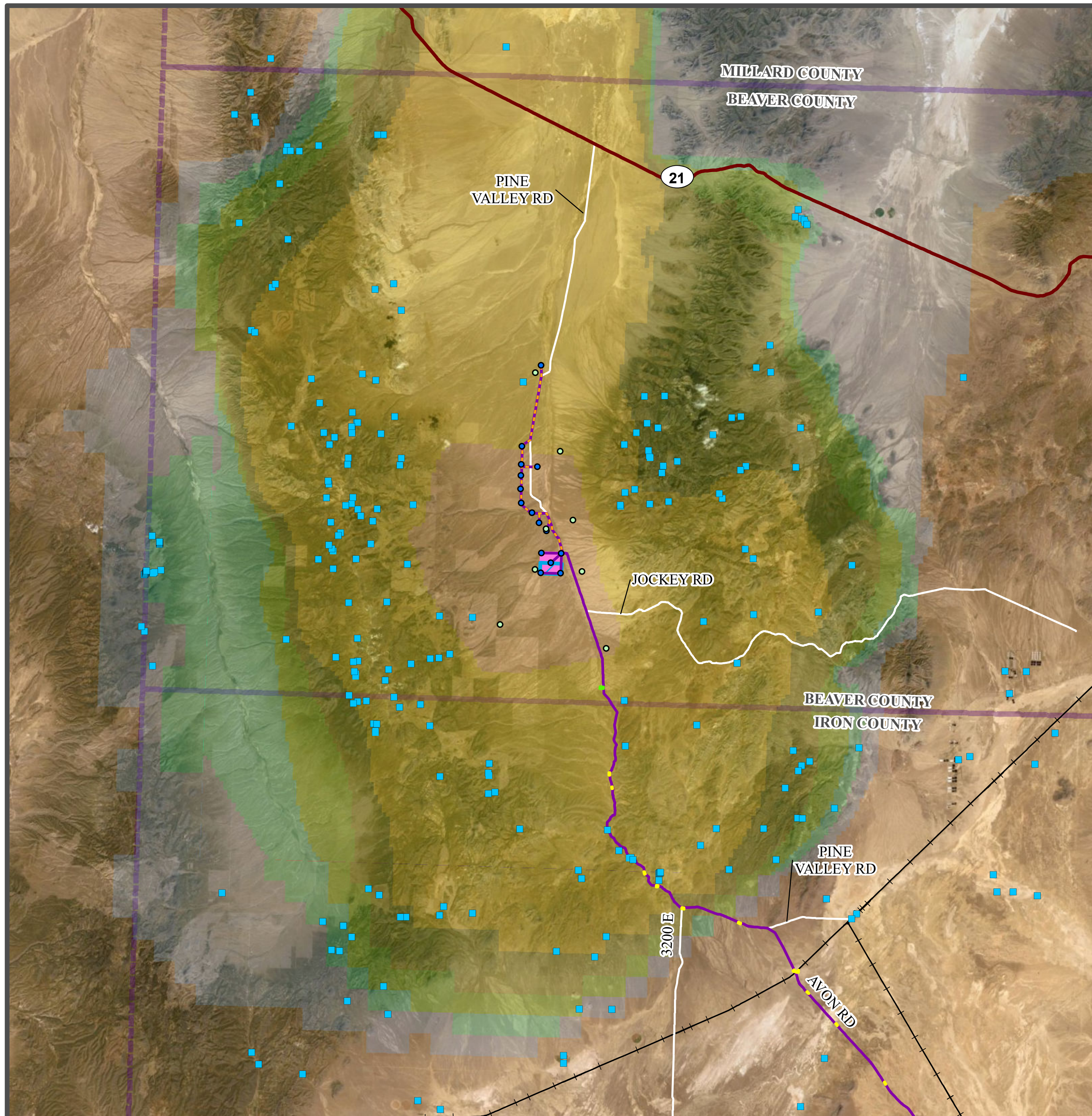
- Well Parcels
- Monitoring Wells
- Proposed ANWS Well Locations
- Proposed Alignment
- Proposed ANWS Alignment
- Electrical Transmission Line
- Staging Area
- Tank Site
- Solar Power Generation Site
- CICWCD Parcel
- Union Pacific Railroad
- < 1' Drawdown
- 1' - 2' Drawdown
- 2' - 3' Drawdown
- 3' - 5' Drawdown
- 5' - 10' Drawdown
- 10' - 50' Drawdown
- 50' - 100' Drawdown
- 100' - 500' Drawdown
- > 500' Drawdown
- Sensitive Plants
- Frisco buckwheat
- Frisco clover
- Ostler's Mousetail
- Ostler's pepperweed
- Pink egg milkvetch
- Tufted (Jones) globemallow
- Wirestem buckwheat

Sensitive Plants

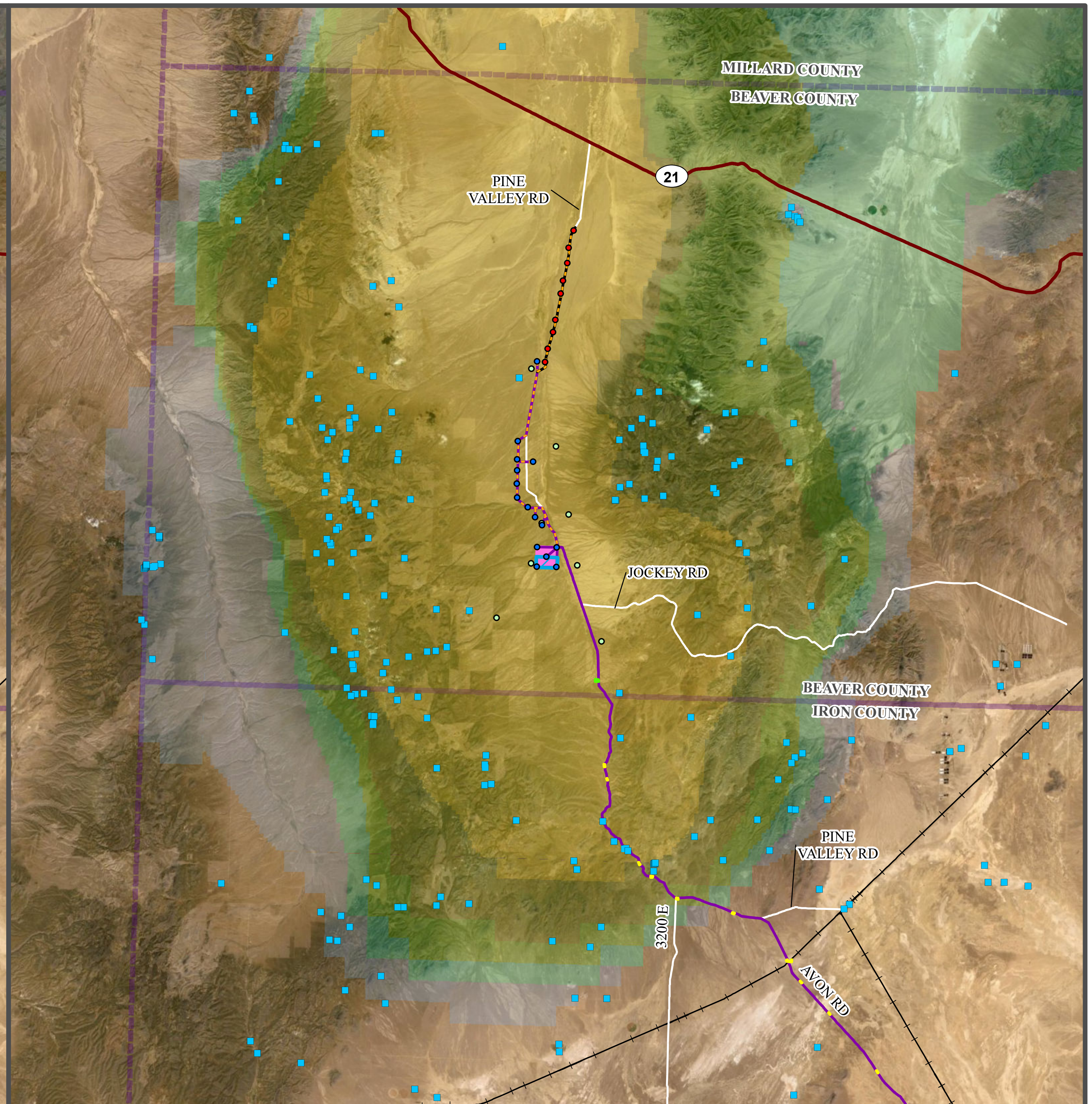
CICWCD
Pine Valley Water
Supply Project

Figure 13

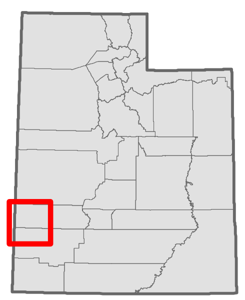
Transcon environmental | Planners & Scientists

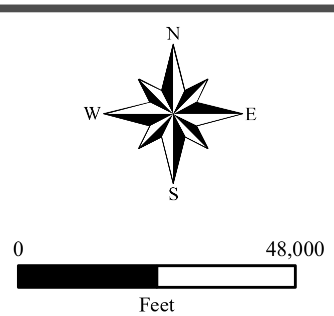


Proposed Action Alternative



Adaptive Northern Well Sites Alternative





Legend

- NHD Springs
- Well Parcels
- Monitoring Wells
- Proposed ANWS Well Locations
- Proposed Alignment
- Proposed ANWS Alignment
- Electrical Transmission Line
- Staging Area
- Tank Site
- Solar Power Generation Site
- CICWCD Parcel
- Union Pacific Railroad
- < 1' Drawdown
- 1' - 2' Drawdown
- 2' - 3' Drawdown
- 3' - 5' Drawdown
- 5' - 10' Drawdown
- 10' - 50' Drawdown
- 50' - 100' Drawdown
- 100' - 500' Drawdown
- > 500' Drawdown

National Hydrography Dataset Springs

CICWCD
Pine Valley Water
Supply Project

Figure 14

Transcon environmental | Planners & Scientists

APPENDIX B

INTERDISCIPLINARY TEAM NEPA CHECKLIST

INTERDISCIPLINARY TEAM NEPA CHECKLIST

Project Title: Pine Valley Water Supply Project
NEPA Log Number: DOI-BLM-UT-C010-2020-0012-EIS
File/Serial Number: UTU-92733
Project Leader: Michelle Campeau, Realty Specialist, (435) 865-3047 or mcampeau@blm.gov

DETERMINATION OF STAFF: ***(Choose one of the following abbreviated options for the left column)***

NP = not present in the area impacted by the proposed or alternative actions.
NI = present, but not affected to a degree that detailed analysis is required.
PI = present with potential for relevant impacts that need to be analyzed in detail in the EIS. The BLM NEPA Handbook (H-1790-1) states that issues need to be analyzed in detail if: 1) Analysis of the issue is necessary to make a reasoned choice between alternatives; 2) The issue is significant...or where analysis is necessary to determine the significance of impacts.

RESOURCES AND ISSUES CONSIDERED:

Determi-nation	Resource	Rationale for Determination	Signature	Date
NI	Air Quality	Ambient air quality within Iron, Beaver, and Millard counties is currently in attainment for all six criteria pollutants. Sources of criteria air pollutants in Iron and Beaver counties include on-road mobile sources, agricultural and other off-road operations, construction operations, and industrial sources of volatile organic compounds and other pollutants. Given the rural character of the Project area and intermittent vehicular travel, existing ambient sources of air pollutants are dispersed both spatially and temporally. Emissions resulting from construction would be temporary and would not affect the long-term air quality attainment goals in the region. With design features listed in Appendix C, fugitive dust would be controlled. Also, State Administrative Code R307-205 also has requirements for limiting fugitive dust from roads, construction sites, and material storage areas. Design features in Appendix C will require air quality permits, if necessary. This would ensure there is not undue degradation to air quality. Based on the gradual onset of evapotranspiration depletion, the ability of plants to adapt to gradual groundwater level changes, and the likely presence of local groundwater flow systems that provide at least some of the vegetative groundwater supply, the probability is low that drawdown associated with the PVWS Project would result in a widespread measurable decline in groundwater-dependent vegetation. Correspondingly, increased erosion and air quality degradation impacts are also unlikely. As described in **Appendix F**, if impacts should occur, adaptive management and mitigation measures would be implemented to decrease any negative effects to air quality.	E. Shotwell	01/12/2021
NP	Areas of Critical Environmental Concern	There are no ACECs within the CCFO.	Dave Jacobson	12/2/2020
NI	Cultural Resources	A Class III cultural inventory was completed for the proposed pipeline and other facilities. See design features listed in **Appendix C**. Adverse effects to cultural sites are being avoided by complete avoidance of the site, requiring a cultural monitor be present, or by employing fencing during Project development. The *Old Spanish National Historic Trail* is avoided by a reroute of the pipeline that became part of the Proposed Action and ANWS Alternative. No historic buildings located in adjacent communities would be affected by Project development.	Roy Plank	12/14/2020

Determi-nation	Resource	Rationale for Determination	Signature	Date
		Additional information about these sites and how they will be protected is contained in the administrative record. Construction personnel would be trained on identification of cultural resources and the procedures to follow in the event of an unanticipated discovery and would be instructed to watch for cultural artifacts while working on the Project. If cultural, historical, or prehistoric resources (including human remains) are inadvertently discovered during Project activities, the BLM authorized officer would be notified, and all work in the area would cease. If the CICWCD revises the location of ground-disturbing activities that affect areas beyond those surveyed for this EIS, those areas would be subjected to a cultural resources literature review and survey to ensure that any newly identified sites are not subject to ground-disturbing activities.		
PI	Environmental Justice	See Chapter 3 for analysis.	G. Ginouves	1/21/2021
NI	Farmlands (Prime or Unique)	The Project was considered for compliance with the Farmland Protection Policy Act (FPPA). Projects are subject to FPPA requirements if they may irreversibly convert farmland, (directly or indirectly) to nonagricultural use and are completed by a Federal agency or with assistance from a federal agency. Although the proposed Project does cross prime and unique farmlands on both BLM-administered and private lands, any potential impacts from the Project is not expected to cause irreversible conversion of prime or unique farmlands. About 87 acres of Prime farmland and 127 acres of Unique farmland would be temporarily impacted. All these areas would be reclaimed after initial construction activities. As explained in the *Groundwater Resources Impact Assessment* and **Appendix F**, groundwater drawdown is not expected to affect surface vegetation and loss of irrigation waters would be prevented or mitigated.	E. Shotwell	1/27/2021
NI	Floodplains	There are floodplains within and near the Project area, but the types of floodplain impacts described by statute are not expected. Executive Order 11988 specifies that special consideration should be given to projects that could impair floodplain function resulting in increased risk within the watershed. This Project would not result in any increased risk, and therefore, additional analysis is not necessary.	E. Shotwell	1/21/2021
NI	Fuels/Fire Management	Due to the design features included in the POD and **Appendix C**, there would be no impact to fire/fuels. All disturbed areas would be seeded to prevent cheatgrass and other highly flammable invasive plants from growing on the ROW. If construction occurs during the summer months, precautions would be taken to prevent the possibility of fire ignitions.	J. Cox	1/26/21
NI	Geology / Mineral Resources/Energy Production	The only known mineral resources coincident with the proposed Project disturbances are common variety deposits of sand and gravel. The entire Project footprint falls on land considered prospectively valuable for oil and gas resources, but none is currently under federal lease. There are currently no unpatented mining claims on any of the proposed Project lands. Depending on the exact alignment of the pipeline, it may cross two previously authorized free-use permits. One of these is west of Lund on the south side of the Pine Valley Road (UTU-91086), and the other is in the middle of Pine Valley on the east side of the Pine Valley County Road (UTU-90429). The size of each free use permit (5 acres) would allow sufficient room for the pipeline to cross without significantly reducing the extractable resource in either pit.	E. Ginouves	11-20-20

Determi-nation	Resource	Rationale for Determination	Signature	Date
NI	Greenhouse Gas Emissions	The well pumps would be powered by the solar field and would not result in emissions from the burning of fossil fuels. The Project proposal involves burning fossil carbon-based fuels for construction, which would temporarily produce byproducts such as CO_2, water vapor, etc. Ongoing research has identified the potential effects of so-called "greenhouse gas" (GHG) emissions (including CO_2, methane, nitrous oxide, water vapor and several trace gasses) on global climate. The release of these gasses during construction activities is cumulative with other local GHG releases (such as traffic on Interstates 15 and 70; the Union Pacific Railroad; state, county, and local roads, etc.), regional and global releases. The construction-related emissions would likely be below the 25,000 tons per year EPA reporting requirement for major sources, and as such, the construction would be considered to have a minor contribution to overall GHG emissions. Loss of carbon sequestration ability would likely be short-term due to reclamation requirements and be small in comparison to the construction emissions. Since climate change is a result of the global cumulative GHG emissions, it is not possible to provide a meaningful assessment of a single project's climate effect in isolation of other sources.	E. Shotwell	01/12/2021
NI	Invasive Species/ Noxious Weeds	The BLM coordinates with county and local governments to conduct an active program for control of invasive species. Project vehicles would be power washed prior to arrival in the Project area to guard against the introduction of noxious weed species. NI with design features.	E. Shotwell	1/12/2021
NI	Lands/Access	All ROW, lease, or permit holders' valid and existing rights would be honored. Construction and maintenance access have been identified in the Project POD.	M. Campeau	12/15/2020
NI	Lands with Wilderness Characteristics	There are no lands managed for wilderness characteristics in the field office under the current land use plans. While lands have been identified as having wilderness characteristics, there is no requirement to manage them for these characteristics at this time. Section 201 of FLPMA requires the BLM to maintain on a continuing basis an inventory of all public lands and their resources and other values, which includes wilderness characteristics. It also provides that the preparation and maintenance of the inventory shall not, of itself, change or prevent change of the management or use of public lands. A portion of the ROW for the pipeline would run adjacent to inventory unit UT-C010-103 (Steamboat Mountain). The pipeline itself would not affect this unit but would be placed in the existing Pine Valley Road. However, a temporary construction area would likely occur in the inventory unit. This disturbance would be short term, less than 5 acres, and would not be expected to preclude the area from being managed for its wilderness characteristics in the long-term.	Dave Jacobson	12/2/2020
PI	Livestock Grazing	See Chapter 3 for analysis.	E. Shotwell	12/15/2020
NI	National Historic Trails	The *Old Spanish National Historic Trail* will be crossed by the pipeline. The route has been revised to locate the crossing at a point where there are no trail traces and which minimizes disturbance to the trail (see cultural resources). After the pipeline is recontoured and revegetated, there should be no evidence of the pipeline crossing the assumed trail route. Less than one acre of the trail area would be temporarily disturbed.	R. Plank	1/25/2021

Determi-nation	Resource	Rationale for Determination	Signature	Date
PI	Native American Religious Concerns	See EIS Chapter 3 and Section 4.3.	R. Plank	1/19/2021
NI	Paleontology	The surficial geology of the proposed Project disturbances is Quaternary-age alluvium and colluvium. Using the BLM's Potential Fossil Yield Classification System, the sediments would typically fall within Class 1, low potential for scientifically significant invertebrate or vertebrate fossil resources. The pipeline footprint does cut across the shoreline of ancestral Lake Bonneville, a Pleistocene-aged lake which has known localities for vertebrate fossils of mega-fauna. Both crossing points (SE4 sec. 5, T. 34 S., R. 13 W and NW4 sec. 19, T. 32 S., R. 14 W.) occur on privately held land. The known fossil localities are very widely scattered and unpredictable, and the probability of the Project disturbances coinciding with an intact undiscovered locality is fairly low. No fossil-specific mitigation measures or pre-construction surveys are necessary for any of the federal land portions of the Project.	E. Ginouves	12/15/2020
NI	Rangeland Health Standards	The proposed action would cross numerous grazing allotments, ecological sites, etc. Rangeland Health Standards are directly related to grazing decisions and therefore, do not need to be analyzed in this EIS. Impacts associated with the RLH standards are discussed in detail in Chapter 3 under the livestock grazing, vegetation, water resources, wetland/riparian, and soils sections.	E. Shotwell	01/12/2021
NI	Recreation	The majority of the recreation in the Project area is seasonal and related to hunting and dispersed camping during late summer and fall. Short-term impacts may include a limit on off-highway vehicle accessibility during construction. Red Cliffs Accent has operated within the Project area for over 10 years under a Special Recreation Permit. The proposed Project may affect their operations for short periods by impairing their ease of access in and out of their main operating center along Bible Spring Road. None of these temporary impacts would be more than a short-term inconvenience to recreation users in the area.	Dave Jacobson	12/2/2020
PI	Socioeconomics	See Chapter 3 for analysis.	Gina Ginouves	11/24/2020
PI	Soils	See Chapter 3 for analysis. The Project is not within an area that has a substantial component of biological crusts. It is expected that biological crusts may be present in areas that are adjacent to the Project that are currently dominated by pinyon pine and juniper; however, these areas are not within the proposed ROW/disturbance area. The majority of the Project area is dominated by perennial grass, forbs, and shrubs, and biological crusts are uncommon within these areas throughout the field office. A survey for biological crusts in the area would be considered prior to Project construction if there are areas that are identified that may have high potential.	E. Shotwell	01/12/2021
NI	Special Status Plant Species	One federally threatened plant species, Jones cycladenia (*Cycladenia humilis* var. *jonesii*), was identified via iPaC as having the potential to occur within the Project area; however, this species is not known to occur in either Iron or Beaver counties and is primarily restricted to the canyonlands of the Colorado Plateau (UNHP 2019). Therefore, it has been determined that Jones cycladenia and any suitable habitat for the species are not present within or adjacent to the Project area. Five BLM-sensitive plant species have the potential to occur within or adjacent to the Project area. These include Franklin's penstemon (*Penstemon franklinii*), Jones globemallow (*Sphaeralcea*	M. Bayles	12/1/2020

Determi-nation	Resource	Rationale for Determination	Signature	Date
		caespitosa var. *caespitosa*), pink-egg milkvetch (*Astragalus oophorus* var. *lonchocalyx*), pinyon penstemon (*Penstemon pinorum*), and Wah Wah ivesia (*Ivesia shockleyi* var. *ostleri*). The analysis for special-status plants was conducted solely based on the presumed loss of acres of modeled suitable habitat from the footprint for the Proposed Action or the ANWS Alternative. Based on the mapped known occurrences of special status plant species, there are no know occurrences of special status plants within the area impacted by either action alternative. Pre-construction surveys for special status plant species would be required within one year prior to construction. Neither the Proposed Action nor the ANWS Alternative would result in any impacts to any known populations of special status plants. Impacts to potentially suitable habitat for special status plants may occur with the removal of vegetation due to Project construction and the permanent installation of Project infrastructure. Impacts to special status plants may also occur due to dust deposition and the potential introduction of exotic invasive species to nearby special status plant population areas and suitable habitat; however, such impacts are unlikely and will be minimized by design features (see **Appendix C**).		
PI	Vegetation	See Chapter 3 for analysis.	E. Shotwell	01/12/2021
NI	Visual Resources	The proposed pipeline corridor is within VRI Class III and IV and is completely with VRM Class IV. The proposed Project will meet the objectives of VRM Class IV with the implementation of the design features included in Appendix C, which are intended to reduce visual contrast through screening, painting structures appropriate colors and locating structures in low visually sensitive areas when possible.	Dave Jacobson	12/15/2020
NI	Wastes (hazardous or solid)	The construction process would introduce the possibility of waste associated with equipment operation throughout the construction process. Adherence to all applicable laws and regulations would minimize the amounts and likelihood of any issues and would not impact the area to any degree of concern. Solid waste would not be an issue since all demolition is proposed to be hauled and properly disposed outside the Project area. See **Appendix C** for design features to reduce impacts.	T. Carlson	10/23/2020
PI	Water Resources/Quality (drinking/surface/ground)	See Chapter 3 for analysis.	E. Shotwell	01/12/2021
PI	Wetlands/Riparian Zones	See Chapter 3 for analysis.	E. Shotwell	01/12/2021
NP	Wild and Scenic Rivers	There are no wild or scenic rivers within the CCFO.	Dave Jacobson	12/2/2020
NP	Wilderness/WSA	The proposed Project is not within or near a wilderness or WSA.	Dave Jacobson	12/2/2020
PI	Wildlife-Aquatic	There are no fish species that occur within the springs, streams, or wetlands associated with the CICWCD proposed pipelines and wells. The BLM Utah State Office entered into a Conservation Agreement for springsnails in Nevada and Utah on 11/27/2017. The overarching goal of the CA is to inventory and monitor aquatic areas for springsnails of conservation significance and mitigate against impacts where necessary to avoid a federal listing under the Endangered Species Act.	Meghan Krott	1/21/2021

Determi-nation	Resource	Rationale for Determination	Signature	Date
		One BLM sensitive springsnail, the Hamlin Valley pyrg, was identified as having the potential to occur within springs that may be impacted by Project-related groundwater drawdown. This species is only known to occur in one small complex of springs less than 0.5 mile east of White Rock Cabin Springs in Hamlin Valley, Beaver County, west of the Project area (Hershler 1995). A survey for springsnails occurred at a subset of the springs that may be impacted from potential groundwater drawdown (Transcon 2020b). Surveys identified one unknown species of springsnail at an unnamed spring (79032388) southeast of Hamlin Valley. While no special status springsnails were definitively identified during these surveys, suitable habitat is present within the study area. This spring is located near the top of a drainage saddle in the Needle Range between Hamlin Valley and Escalante Valley at an elevation of 6,595 feet and is underlain by volcanic rocks. Based on the geologic setting of the spring in the volcanic rocks of the Needle Range and geochemical data gathered by USGS (Gardner et al. 2020), this spring is believed to discharge water from a local perched aquifer and would not be affected by pumping in the regional aquifer. A single bleached snail shell was also observed at Meadow Spring in the Pine Valley HA (81421743) on the eastern flank of the Needle Range, closer to the bedrock-alluvium contact. The two springs discovered in 2020 to have living or dead springsnails would be monitored as part of the springsnail monitoring plan as described in the EIS. The adaptive management plan would be used to identify and implement appropriate mitigation if impacts to these springs are observed during monitoring.		
NI	Wildlife - General	Year-long habitat exists within the Project area for mule deer, elk, and pronghorn. Temporary impacts would occur due to noise, human presence, and collisions with vehicles during construction. These big game species are limited by water availability; however, the proponent would allocate water for wildlife use from the pipeline. Current water needs have been identified in the higher elevation areas and not within the valley; therefore, the sage-grouse mitigation is not anticipated to be a big game specific mitigation. Additional water through wildlife guzzlers would be evaluated in future NEPA documents. Long-term wildlife habitat loss of up to 224 acres under the Proposed Action Alternative or up to 233 acres under the ANWS Alternative would occur with planned permanent infrastructure (e.g., well houses, solar power generation sites, power poles). This would not substantially reduce available wildlife forage in the Project area. Short-term disturbance of wildlife habitat of up to 1,458 acres would occur under the Proposed Action due to Project construction activities (i.e., pipeline ROWs). Short-term disturbance of wildlife habitat under the ANWS Alternative would be slightly more at 1,564 acres. With the design features listed in **Appendix C**, no significant impacts are anticipated nor is additional analysis of the issue necessary to make a reasoned choice between alternatives. As shown in the groundwater report, the Fish Springs National Wildlife Refuge and the Clear Lake, Topaz Slough, and Topaz Marsh Waterfowl management areas will not be affected by the Project.	D. Schaible	1/19/2021
PI	Wildlife - Migratory Birds	See Chapter 3 for analysis.	Derek Christensen	12/17/2020

Determi-nation	Resource	Rationale for Determination	Signature	Date
PI	Wildlife-Sensitive/ Greater Sage-grouse	See Chapter 3 for analysis.	D. Schaible	1/7/21
PI	Wildlife – TEC Species	See Chapter 3 for analysis of Utah prairie dogs. There is no designated critical habitat found within or reasonably near the proposed Project for southwestern willow flycatcher, yellow-billed cuckoo, Mexican spotted owl, and California condor. The California condor may occur in the Project area during foraging flights and is considered endangered there. However, the likelihood of condor occurring in the Project area is low since the nearest known roosts are located approximately 20 miles southeast in Kolob Canyon and most foraging occurs along the front. There would be no impacts to the California condor.	Derek Christensen	12/17/2020
NI	Wild Horses	Four Herd Management Areas are located within the vicinity of the Project area: Blawn Wash, Four Mile, Bible Springs, and Sulphur. These HMAs total 462,130 total acres and support about 1,436 wild horse individuals. The Proposed Action has the potential to temporarily reduce forage and habitat within the 5 Herd Management Areas. Of the total disturbed area, only 2.33 miles of pipeline passes through the Bible Springs Herd Management Area, resulting in approximately 33.9 acres of disturbance. However, horses in the other HMAs would be disturbed because of the proximity to the Project. The Herd Management Areas have sufficient forage throughout the range, and forage reduction due to pipeline construction would not noticeably reduce wild horse habitat. Some of the wildlife watering areas and troughs being developed as part of the Proposed Action would be made available to wild horses. Construction has the potential to temporarily displace individual horses; however, any impacts are considered less than significant because most of the Project occurs along an already-established permanent road (i.e., Pine Valley Road and Mountain Springs Road). Sporadic maintenance would cause intermittent and short-term disturbance to wild horses. Wild horses are likely already accustomed to use of these roads. Impacts to wild horses are not expected to be significant as a result of implementing the design features listed in **Appendix C**, nor is additional analysis necessary to make a reasoned choice between alternatives.	C.Hunter	12/15/2020
NI	Woodland / Forestry	The majority of the proposed treatment area is non-woodland/ forest. A few trees may be present and need to be removed. Impacts would be minimal.	C. Peterson	11/24/2020

FINAL REVIEW:

Reviewer Title	Signature	Date	Comments
Environmental Coordinator			
Authorized Officer			

APPENDIX C
DESIGN FEATURES TO REDUCE IMPACTS

INTRODUCTION

The following design features have been identified during the planning process for the purpose of avoiding or minimizing resource impacts. Some are included as part of the preliminary Project POD as submitted by the CICWCD while others have been included from Project resource reports or have been provided by agency staff. The CICWCD would be required to implement all these measures as part of their final Project POD for construction which must be approved by the BLM. The design features included here would be applied to either action alternative.

Resource	Resource Protection Measure
Air Quality	AQ-1. Water application or other measures consistent with Utah Administrative Code Rule 307-205-5 will be used to control fugitive dust levels on access roads, material storage piles, and construction sites during construction. AQ-2. Required air quality permits would be obtained, if needed, from the State of Utah.
Cultural Resources	CR-1. Eligible resources will be avoided by at least 10 meters, if possible. If the eligible site cannot be avoided by at least 10 meters, a cultural resource monitor must be present for all ground disturbing construction activities within the vicinity of the site. CR-2. A cultural monitor will be present at two additional locations along the Project. *Water Tanks:* a cultural resource monitor will be present during all ground-disturbing construction activities and excavation associated with the development of the two water tanks (excluding concrete pouring and backfilling) located within Township 30 South, Range 16 West, Section 33 (NW) along the west side of Pine Valley Road in Beaver County *Mountain Spring Wash*: a cultural resource monitor will be present during all ground-disturbing activities within the vicinity of Mountain Spring Wash along Pine Valley Road in Iron County. These areas are defined as Township 31 South, Range 16 West, Sections 4 (entire SW 1/4) and 33 (S 1/2; overlapping site 42IN4674 [mislabeled on draft as site 42BE4989]); Township 32 South, Range 16 West, Sections 3 (3/4 of section starting from NW), 4 (NE corner), 13 (SE corner); and Township 32 South, Rane 15 West, Sections 18 (SW corner) and 19 (NW 1/4) CR-3. Construction personnel would be trained on identification of cultural resources and the procedures to follow in the event of an unanticipated discovery and would be instructed to watch for cultural artifacts while working on the Project. If cultural, historical, or prehistoric resources (including human remains) are inadvertently discovered during Project activities, the BLM authorized officer would be notified, and all work in the area would cease. Treatment of human remains and/or cultural items will be in compliance with federal laws, including the Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001-3013 for resources discovered on federal lands, and Utah Code Annotated 9-8-309 and Rule 455-4 for resources discovered on private and state lands. If the CICWCD revises the location of ground-disturbing activities that affect areas beyond those surveyed for this EIS, those areas would be subjected to a cultural resources literature review and survey to ensure that any newly identified sites are not subject to ground-disturbing activities.
Fire Protection and Prevention	FP-1. All construction personnel will always have fire tools and fire extinguishers available for use if the occasion arises. Construction staff will adhere to any BLM fire prevention and suppression requirements. During extreme fire conditions, operations may be suspended or limited in certain locations.
Fish and Wildlife	FW-1. To prevent entrapment of wildlife during construction, all open holes will be monitored throughout the construction day. All open holes would be covered at the close

	of each day, or one or more escape ramps would be provided for each open hole. Alternatively, fencing may be erected around open pits or trenches. At the beginning of the construction day and before pits or trenches are filled, they will be inspected for trapped animals. If any animals are found, they will be moved out of harm's way, and coordination with the BLM biologist would be required. FW-2. No pets, firearms, air guns, or archery equipment would be allowed on the Project site during construction, operation, and maintenance by Project contractors and personnel. No rodenticides will be used on the Project site during Project construction, operation, and maintenance. FW-3. All construction and maintenance personnel will be required to attend BLM environmental training. The training will address environmental concerns, applicable environmental laws, and requirements for compliance. The training will highlight the Utah prairie dog so that personnel are aware of the species and measures implemented to reduce potential impacts. Encounters with a protected species (e.g., raptors, migratory birds, or listed or sensitive species) will be reported to the BLM and/or the appropriate oversight agency (e.g., UDWR). Any Project-related inadvertent death or injury of a protected species would immediately be reported to the BLM, USFWS, and UDWR.
Hazardous Materials and Wastes	HM-1. Construction sites, staging areas, and access roads will be kept in an orderly condition throughout construction. Refuse and trash, including stakes and flags, will be removed and disposed of. Covered dumpsters located in the Project area will contain all refuse. Refuse will be removed on a regular basis to an approved disposal facility. No open burning of construction trash will occur. Portable toilets will be used on-site and will be maintained on a regular schedule. HM-2. Local, state, and federal regulations related to the use, handling, storage, transportation, and disposal of hazardous materials would be followed. No equipment oil or fuel would be drained on the ground. Oils or chemicals would be hauled to an approved site for disposal. A hazardous materials spill kit appropriate for the solvents involved in operation and maintenance of vehicles and machinery used during the Project would be kept on-site during construction. BLM and other regulatory agencies would be contacted as soon as possible in the event of a fuel/oil or hazardous material spill. Actions would be taken to minimize the amount and spread of the spill material, including use of straw bale plugs, earthen berms, and absorbent materials. If necessary, soil remediation would be conducted, including the removal of contaminated soils to an approved facility and soil sampling to verify successful site remediation.
Human Health and Safety	HS-1. Construction sites will be managed to prevent harm to any person and property. During construction, all employees, Project managers, supervisors, inspectors, contractors, and subcontractors will be required to conform to contractor safety procedures. All personnel will be adequately trained to perform their tasks. Heavy equipment will be outfitted with Occupational Safety and Health Administration-required safety devices such as backup warnings and seat belts. Hard hats, safety boots, ear and eye protection, and other personal safety equipment will also be available to any personnel requesting it. All accidents and injuries will be reported to the appropriate contractor safety officer. HS-2. Signs will be placed appropriately where needed to provide sufficient warning to recreational riders of travel hazards associated with the Project.
Livestock Grazing and Rangeland Management	LM-1. Livestock permittees will be notified prior to beginning construction activities. Notification will include estimates of construction schedule and duration. LM-2. The CICWCD will ensure that any livestock grazing facility improvements and pipelines will remain in a serviceable condition and avoided to the extent possible. If impacts or damage occur to any pipelines, fences, troughs, or other rangeland improvements, the CICWCD will be responsible for any needed repair/replacements. LM-3. A ¼-mile buffer will be established between livestock water sources and Project activities to alleviate livestock distribution issues that that could occur due to Project noise and traffic.
Migratory Birds	MB-1. Where possible, construction activities (including habitat alteration and noise) will occur outside of Utah's migratory bird primary nesting season (April 1 to July 30). In

	Utah, the migratory bird nesting season can extend from January 1 to August 31 (especially for raptors); therefore, a pre-construction survey by a qualified biologist (fewer than 7 to 10 days prior to when ground-disturbing work begins on the Project site) will be conducted for nesting birds. After such surveys are performed, the applicant will not conduct any additional disturbance during the avian breeding season without first conducting another avian survey. MB-2. If an active nest is identified, the BLM authorized officer will be notified and, in consultation with the BLM biologist, a no-activity buffer (ranging from 100 feet to 1 mile, depending on species) will be established around the nest site and remain in place until the young have fledged and/or the nest becomes inactive (Romin and Muck 2002; USFWS 2014). After August 31, no further avian surveys will be required until the next year. MB-3. Poles and power lines needed to operate the production wells will be designed and constructed to meet or exceed those guidelines in “Reducing Avian Collisions with Power Lines: The State of the Art in 2012” (APLIC 2012). To avoid or reduce impacts on nesting success of raptors, activities will not occur within recommended spatial and seasonal buffers and will follow Utah BLM BMPs for Raptors and Their Associated Habitats in Utah. If existing topography limits actual line-of-sight between an active nest (i.e., the nest has eggs or young) and construction activities, the spatial and seasonal buffer may be reduced.
Special Status Plants	SSP-1. A pre-construction survey for special-status plant species would be completed by a qualified biologist within 1 year prior to construction during the appropriate season. Surveys would be coordinated with appropriate BLM staff. SSP-2. If a sensitive plant is discovered during Project construction, operation, maintenance, or decommissioning, the BLM would be immediately notified. All ground disturbing activities that may affect the resource would immediately cease until the BLM issues written authorization to proceed. The BLM would develop and implement appropriate mitigation measures.
Special Status Wildlife	SSW-1. A pre-construction survey (April 1 to August 31) would be completed by a USFWS-certified Utah prairie dog biologist within 1 year prior to construction, following the USFWS Utah prairie dog habitat and occupancy survey protocol used during 2019 biological surveys. If construction activities are approved by the BLM within 350 feet of an occupied prairie dog colony, the following mitigation measures will be implemented: • All vehicle maintenance activities shall be conducted in maintenance facilities or, in the event of emergency vehicle maintenance, at least 350 feet from mapped Utah prairie dog habitat in previously disturbed areas • A USFWS-certified Utah prairie dog biological monitor would be on-site during all ground-disturbing activities within 350 feet of a Utah prairie dog colony. The monitor would be accountable for overseeing compliance with the conservation measures and ensure personnel or equipment avoid Utah prairie dog burrows/mounds by 15 feet. The biological monitor would have authority to halt all activities if “take” occurs or if non-compliance with these conservation measures occurs • Once ground-disturbing activities occur in occupied Utah prairie dog habitat, they will continue without interruption. All unattended construction holes dug in or within 730 feet (foraging distance) of occupied habitat will be covered. At the beginning of each construction day or after any period of being unattended, construction holes will be inspected prior to filling • If construction is occurring within a designated Utah prairie dog buffer, the biological monitor will ensure that all conservation measures are followed and provide a daily compliance report to the BLM biologist. If the monitor documents any activities that are not in compliance, then all construction activities within Utah prairie dog habitat must be halted and the BLM and USFWS notified immediately. The monitoring report will include construction

	activities each day, how many Utah prairie dogs were subject to temporary harassment, and any take with date and times. Harassment will include construction noise levels, ground vibration, increased human activity, and length of construction • All staging areas (e.g., vehicles, trailers, and materials) would be located outside of 350-foot buffer areas identified as mapped Utah prairie dog habitat • Project-related vehicles would not exceed a speed of 15 miles per hour within mapped Utah prairie dog habitat • There would be no parking of vehicles or equipment within 350 feet of Utah prairie dog burrows/mounds. Upon locating a dead or injured Utah prairie dog, initial notification by telephone must be made within one business day to the USFWS Division of Law Enforcement in St. George, Utah (435-673-3420), the USFWS Ecological Services Office (801-975-3330 and 435-865-3763), and the UDWR's Cedar City office (435-865-6120). The reporting requirement will allow the USFWS Division of Law Enforcement or the UDWR to collect and process dead prairie dogs, if necessary, to determine cause of death. Instructions for proper handling and disposition of such specimens will be issued by USFWS's Division of Law Enforcement • Reclamation and restoration efforts in Utah prairie dog habitat would be conducted from October 15 to December 15 after Project implementation. The seed mix designed according to the *Interim Vegetation Composition Recommendation for Utah Prairie Dog Habitat* developed by the USFWS would be used. SSW-2. Ground-disturbing activities within previously mapped colonies would be conducted during the Utah prairie dog active season (April 1 to August 31). SSW-3. In addition to the pre-construction survey of the entire ROW within 1 year prior to construction, a pre-construction Utah prairie dog clearance survey would occur within 2 weeks prior to construction within previously mapped colonies and areas within 1,000 feet of previously mapped colonies to ensure there is no Utah prairie dog occupancy within the Project area. If the survey confirms Utah prairie dog colony occupancy and activities are approved by the BLM within 350 feet of an occupied prairie dog colony, the mitigation measure described under measure SSW-1 will apply. SSW-4. If Utah prairie dog are observed within 1,000 feet of the Project ROW, then a certified Utah prairie dog biological monitor would be assigned to be on-site during all Project activities in these areas. SSW-5. If Utah prairie dog are observed within the ROW, all Project work would be halted until additional consultation with USFWS has been completed. SSW-6. Power pole design must consist of a monopole without a crossarm and with perch deterrents. The final design must be approved by BLM biologists and must not create any additional predator perching opportunity within GRSG PHMA. SSW-7. There will be seasonal restrictions applied to Project construction within GRSG PHMA. Anthropogenic disturbance will be limited based on the various habitat areas as follows: • In breeding (leks), nesting and early brood-rearing habitat from February 15 through June 15 • In brood rearing habitat from April 15 through August 15 • In winter habitat from November 15 through March 15 SSW-8. All new fences within the GRSG PHMA will have markers and/or diverters installed. SSW-9. Noise from discrete anthropogenic disturbances, whether during construction, operation, or maintenance, must not exceed 10 decibels above ambient sound levels (as available at the signing of the GRSG ARMPA Record of Decision or as first measured thereafter) at occupied leks from 2 hours before to 2 hours after official sunrise and

	sunset during breeding season (e.g., while males are strutting). Limit Project-related noise in other PHMA habitats and seasons where it will be expected to reduce functionality of habitats that support associated GRSG populations. SSW-10. The CICWCD will install tap lines and water meters to each of the mesic meadow/wildlife watering locations as shown on the final map. The CICWCD will install water meters on each of these pipelines. SSW-11. The CICWCD will commit a minimum of 300 acre-feet annually for the life of the Project for the benefit of greater sage-grouse and other wildlife species. This would be used by the BLM to develop the mesic meadows or in other ways to benefit greater sage-grouse. SSW-12. Water sources created to improve greater sage-grouse habitat to meet the net benefit requirement will be fenced to prevent usage by livestock and wild horses. The fence placement and design must be approved by BLM staff. Mesic meadow and water source creation and maintenance would be the responsibility of the BLM. SSW-13. Encounters with a protected species will be reported to the environmental inspector. An authorized biologist will maintain records of all these encounters during the Project, including the species condition, location found, and location released. SSW-14. Any contractor or employee who inadvertently kills or injures a protected species would immediately report the incident to the BLM and/or the appropriate oversight agencies. SSW-15. A 0.25-mile avoidance buffer will be established around any burrowing owl or kit fox dens. SSW-16. A 330-foot avoidance buffer will be established around any dens and burrows of special-status mammals (i.e., dark kangaroo mouse and pygmy rabbit) identified during work activities. SSW-17. A 330-foot avoidance buffer will be established around any roosts of special-status bats identified during work activities.
Vegetation Communities, Noxious Weeds, and Invasive Species	VC-1. All equipment would be cleaned of soils, seeds, vegetative matter, and other debris prior to entering or re-entering the Project area to guard against the introduction of noxious weed species. Vegetation would be monitored periodically for the establishment of noxious weeds or undesirable plant species. If needed as a result of the implementation of this Project, the CICWCD would be responsible for weed control in disturbed areas within the ROW and for consultation with the authorized officer and/or local authorities in determining acceptable control methods for invasive species. VC-2. All construction and maintenance activities would be conducted in a manner that would minimize disturbance to vegetation, drainage channels, and intermittent and perennial stream banks. Temporary ground disturbance will be restored to approximate original contours to the extent determined by the BLM. Soil removed during construction will be salvaged and used for restoration. Vegetation removal will be kept to the minimum needed to carry out construction activities. Any trees felled will either be left on-site as down woody debris or removed if preferred by the BLM. Brush removed during construction may be cut and scattered or used as mulch after reclamation activities. VC-3. A BLM-approved, certified weed-free seed mix containing native species found in the area would be used during reclamation activities.
Visual Resources	VR-1. Color for tanks, well houses, and any other structures will be coordinated with and approved by the BLM.
Water Resources	WR-1. To control stormwater discharges, BMPs will be used as needed, including material handling and temporary storage procedures that minimize exposure of potential pollutants to stormwater, spill prevention and response, sediment and erosion control, and physical stormwater controls. A Stormwater Pollution Prevention Plan would be prepared and implemented during construction. WR-2. Meters will be installed at each production well constructed for the PVWS Project and CICWCD will report groundwater extraction form the wells annually and maintain a permanent record of diversions.

	WR-3. A Wellfield Construction Monitoring and Adaptive Management Program will be implemented as described in Appendix F and the Groundwater Resources Impact Assessment for the Pine Valley Water Supply Project prepared by Formation Environmental and dated February 2021 (hereinafter the GRIA Report) to collect data during construction and initial operation of the first six wells. The aquifer and drawdown data collected during this time will be used to adjust the wellfield configuration as needed so drawdown and water budget impacts to the Beryl-Enterprise Area Hydrographic Area (HA) do not impair prior water rights as required in the DWRi 2014 Order. This would be accomplished by moving some or all the remaining supply wells to locations that are further to the north along Pine Valley Road. WR-4. A Wellfield Operation Monitoring and Adaptive Management Program will be implemented as described Appendix F and in the GRIA Report to collect data during long-term operation of the wellfield. The drawdown and water quality data will be used to help ensure that exceedances of the safe yield are pre-emptively identified and avoided as required in the DWRi 2014 Order. This would be accomplished by adjusting the temporal or spatial configuration of pumping within the well field, constructing new wells at available alternate locations, and/or limiting pumping rates as needed.
Wild Horses	WH-1. Some of the wildlife watering areas will be developed such that water will be made available for use by wild horses.
	WH-2. Construction and non-emergency maintenance will be limited to times outside wild horse foaling season (March 1 through May 31) from the intersection of Pine Valley Road and Jockey Road to the intersection of Mountain Spring Road and Road 3200E. The road may still be used for vehicular travel to and from Pine Valley for other Project construction activities.

APPENDIX D

PROPOSED ACTION AND ADAPTIVE NORTHERN WELL SITES
ALTERNATIVE DISTURBANCE ESTIMATES

TABLE D-1
PROPOSED ALTERNATIVE DISTURBANCE ESTIMATES

Facility	Disturbance Type		BLM Lands			Non-BLM Lands			TOTAL		
	Long-term	*Short-term*	*Qnty*	*Long-term*	*Short-term*	*Qnty*	*Long-term*	*Short-term*	*Qnty*	*Long-term*	*Short-term*
Pine Valley – Main Line	None	120-ft construction corridor	31.1 miles	–	452.4 acres	2.7 miles	–	39.3 acres	33.8 miles	–	491.7 acres
Pine Valley – Lateral Lines	None	120-ft construction corridor	1.61 miles	–	23.5 acres	3.72 miles	–	54.1 acres	5.3 miles	–	77.6 acres
Avon Route Corridor Transmission Pipeline	None	120-ft construction corridor	9.9 miles	–	144 acres	21 miles	–	305.5 acres	30.9 miles	–	449.5 acres
Manholes (to access isolation valves)	13 ft^2	–	50	650 ft^2	–	25	325 ft^2	–	75	975 ft^2	–
Production Wells	1 acre	-	10	10 acres	–	5	5 acres	–	15	15 acres	–
Monitoring Wells	50 ft^2	–	8	400 ft^2	–	–	–	–	8	400 ft^2	–
Solar Power Generation Site	200 acres	–	–	–	–	1	200 acres	435.5 acres	1	200 acres	435.5 acres
Power Lines	6 ft^2 per pole (16 miles of line)	–	282	0.23 acres	–	–	–	–	282	0.23 acres	–
Mountain Springs Water Storage Tank Site	1 acre	9 acres	–	–	7.6 acres	1	1 acre	1.4 acres	1	1 acre	9 acres
Staging Areas	none	1.5 – 4.5 acres	14	–	35 acres	4	–	13.6 acres	18	–	48.6 acres
Pressure Reducing Station	160 ft^2	1 acre	–	–	–	1	160 ft^2	1 acre	1	160 ft^2	1 acre
Access Roads	7-foot-wide roadway	–	3.9 miles	3.3 acres	–	2.2 miles	1.8 acres	–	6.1 miles	5.1 acres	–
TOTALS			–	**11.62 acres**	**662.3 acres**	–	**209.17 acres**	**849.5 acres**	–	**220.79 acres**	**1,511.8 acres**

[a] These disturbance calculations represent best estimates of short-term and long-term ground disturbance based on available information. These estimates are subject to change pending final engineering of the proposed Project. We anticipate that final disturbance acreages will reasonably match these calculated estimates.

TABLE D-2 ADAPTIVE NORTHERN WELL SITES ALTERNATIVE DISTURBANCE ESTIMATES										
Facility	**Disturbance Type**		**BLM Lands**			**Non-BLM Lands**			**TOTAL**	
	Long-term	*Short-term*	*Qnty*	*Long-term*	*Short-term*	*Qnty*	*Long-term*	*Short-term*	*Qnty*	*Long-term*	*Short-term*
Pine Valley – Main Line	None	120-ft construction corridor	**37.4 miles**	**–**	**544 acres**	**3.7 miles**	**–**	**53.8 acres**	**41.1 miles**	–	**597.8 acres**
Pine Valley – Lateral Lines	None	120-ft construction corridor	1.61 miles	–	23.5 acres	3.72 miles	–	54.1 acres	5.3 miles	–	77.6 acres
Avon Route Corridor Transmission Pipeline	None	120-ft construction corridor	9.9 miles	–	144 acres	21 miles	–	305.5 acres	30.9 miles	–	449.5 acres
Manholes (to access isolation valves)	13 ft^2	–	**52**	**676 ft^2**	**–**	**26**	**338 ft^2**	**–**	**78**	**1,014 ft^2**	–
Production Wells	1 acre	-	**19**	**19 acres**	–	5	5 acres	–	**24**	**24 acres**	–
Monitoring Wells	50 ft^2	–	8	400 ft^2	–	–	–	–	8	400 ft^2	–
Solar Power Generation Site	200 acres	–	–	–	–	1	200 acres	435.5 acres	1	200 acres	435.5 acres
Power Lines	**6 ft^2 per pole (23.3 miles of line)**	**–**	**410**	**0.34 acres**	–	–	–	–	**410**	**0.34 acres**	–
Mountain Springs Water Storage Tank Site	1 acre	9 acres	–	–	7.6 acres	1	1 acre	1.4 acres	1	1 acre	9 acres
Staging Areas	none	1.5 – 4.5 acres	14	–	35 acres	4	–	13.6 acres	18	–	48.6 acres
Pressure Reducing Station	160 ft^2	1 acre	–	–	–	1	160 ft^2	1 acre	1	160 ft^2	1 acre
Access Roads	7-foot-wide roadway	–	3.9 miles	3.3 acres	–	2.2 miles	1.8 acres	–	6.1 miles	5.1 acres	–
TOTALS			–	**20.73 acres**	**753.9 acres**	–	**209.17 acres**	**864 acres**	–	**229.9 acres**	**1,617.9 acres**

[a] These disturbance calculations represent best estimates of short-term and long-term ground disturbance based on available information. These estimates are subject to change pending final engineering of the proposed Project. We anticipate that final disturbance acreages will reasonably match these calculated estimates.

APPENDIX E

STANDARD RIGHT-OF-WAY STIPULATIONS

STANDARD RIGHT-OF-WAY STIPULATIONS

Temporary Right-of-Way

UTU-92733-01

General

1. The holder shall construct, operate, and maintain the facilities, improvements, and structures within this right-of-way in strict conformity with the plan(s) of development which was (were) approved and made part of the authorized grant. Any relocation, additional construction, or use that is not in accord with the approved plan(s) of development, shall not be initiated without the prior written approval of the authorized officer. A copy of the complete right-of-way grant, including all stipulations and approved construction, operation, and termination to the authorized officer. Noncompliance with the above will be grounds for an immediate temporary suspension of activities if it constitutes a threat to public health and safety or the environment.

2. The holder shall designate a representative(s) who shall have the authority to act upon and to implement instructions form the authorized officer. The holder's representative shall be available for communication with the authorized officer within a reasonable time when construction or other surface disturbing activities are underway.

3. The authorized officer may suspend or terminate in whole or in part, any notice to proceed which has been issued when, in his judgment, unforeseen conditions arise which result in the approved terms and conditions being inadequate to protect the public health and safety or to protect the environment.

4. The holder shall be liable for damage or injury to the United States to the extent provided by 43 CFR Sec. 2803.1-4. The holder shall be held to a standard of strict liability for damage or injury to the United States resulting from fire or soil movement (including landslides and slumps as well as wind and water-caused movement of particles) caused or substantially aggravated by any of the following within the right-of-way or permit area:

    a. Activities of the holder, including but not limited to construction, operation, maintenance, and termination of the facility.
    b. Activities of other parties including, but not limited to:
    - Land clearing and logging;
    - Earth-disturbing and earth-moving work;
    - Blasting; and
    - Vandalism and sabotage.

5. The maximum limitation for such strict liability damages shall not exceed $2 million (or as determined in 43 CFR Sec. 2807.12(b)(4)) for any one event, and any liability in excess of such amount shall be determined by the ordinary rules of negligence of the jurisdiction in which the damage or injury occurred.

6. This section shall not impose strict liability for damage or injury resulting primarily from the negligent acts or omissions of the United States.

Pre-Construction

1. The holder shall submit a plan of development that describes in detail the construction, operation, maintenance, and termination of the right-of-way and its associated improvements and/or facilities. The plan shall include drawings in sufficient detail in enable a complete evaluation of all proposed structures,

facilities, and landscaping to ensure compliance with the requirements of the grant and to ensure visual compatibility with the site. These drawings shall be the construction documents and must show dimensions, materials, finishes, etc. to demonstrate compliance with the requirements. The plans will be reviewed and, if appropriate, modified and approved by the authorized officer. An approved plan of development shall be made a part of the right-of-way grant.

2. The holder shall contact the authorized officer at least 45 days prior to the anticipated start of construction and/or any surface disturbing activities. The authorized officer may require and schedule a preconstruction conference with the holder prior to the holder's commencing construction and/or surface disturbing activities on the right-of-way. The holder and/or his representative shall attend this conference. The holder's contractor, or agents involved with construction and/or any surface disturbing activities associated with the right-of-way, shall also attend this conference to review the stipulations of the grant including the plan(s) of development.

3. The holder shall not initiate any construction or other surface disturbing activities on the right-of-way without the prior written authorization of the authorized officer. Such authorization shall be a written notice to proceed issued by the authorized officer. Any notice to proceed shall authorize construction or use only as therein expressly stated and only for the particular location or use therein described.

4. The holder shall perform the necessary transportation studies and recommend a road standard to meet the purpose of the road. This standard and the topography, soils, and geologic hazards of the lands crossed will define the level of survey and design necessary. Accepted standards for road design, including the BLM Manual Section may be used.

5. The holder shall obtain the services of a licensed professional engineer to locate, survey, design, and construct the proposed road as directed by the authorized officer. The road design shall be based on the (1) width, (2) maximum grade, and (3) design speed of the road.

6. The holder shall submit standard or typical cross sections of the road to be constructed, maintained, or reconstructed as directed by the authorized officer. The cross sections should include, but are not limited to, the proposed road width, ditch dimensions, cut and fill slopes, and typical culvert installation.

7. As directed by the authorized officer, the completed subgrade shall be submitted to the Bureau for approval prior to the placement of any surfacing.

8. As directed by the authorized officer, surfacing shall be designed to accommodate anticipated loading and traffic volumes and shall provide for future maintenance.

9. The design and location of all facilities shall be approved by the authorized officer prior to construction.

10. The site plan, building design, floor plan, tower design, and electrical drawings submitted with the original proposal shall be made a part of this right-of-way grant. All construction must conform to these drawings.

11. Specific sites as identified by the authorized officer (e.g., archaeological sites, areas with threatened and endangered species, or fragile watersheds) where construction equipment and vehicles shall not be allowed, shall be clearly marked onsite by the holder before any construction or surface disturbing activities begin. The holder shall be responsible for assuring that construction personnel are well trained to recognize these markers and understand the equipment movement restrictions involved.

12. Where slope stabilization requires significant terrace or bench construction, the holder shall include

engineering drawings for this work to be reviewed and, where appropriate, modified and approved by the authorized officer.

13. The holder shall place slope stakes, culvert location and grade stakes, and other construction control stakes as deemed necessary by the authorized officer to ensure construction in accordance with the plan of development. If stakes are disturbed, they shall be replaced before proceeding with construction.

14. The holder shall mark the exterior boundaries of the right-of-way with a stake and/or lath at 200-foot intervals. The intervals may be varied at the time of staking at the discretion of the authorized officer. The tops of the stakes and/or laths will be painted, and the laths flagged in a distinctive color as determined by the holder. The survey station numbers will be marked on the boundary stakes and/or laths at the entrance to and the exit from public land. Holder shall maintain all boundary stakes and/or laths in place until final cleanup and restoration is completed and approved by the authorized officer. The stakes and/or laths will then be removed at the direction of the authorized officer.

15. The holder shall survey and clearly mark the centerline and/or exterior limits of the right-of-way, as determined by the authorized officer.

16. The holder shall set center line stakes to identify the location of the proposed road as directed by the authorized officer.

17. Cut and fill slope stakes shall be set as directed by the authorized officer.

18. The holder shall prepare a fire prevention and suppression plan, that shall be reviewed, modified, and approved, as appropriate, by the authorized officer. The holder shall take into account such measures for prevention and suppression of fire on the right-of-way and other public land used or traversed by the holder in connection with operations of the right-of-way. Project personnel shall be instructed as to individual responsibility in implementation of the plan.

19. The holder must take all precautionary measures to reduce the risk of wildfires when operating and maintaining electrical utilities ROW. See BLM Instruction memorandum UT IM-2021-004 for more information (https://www.blm.gov/policy/ut-im-2021-004).

Construction

1. No signs or advertising devices shall be placed on the premises or on adjacent public lands, except those posted by or at the direction of the authorized officer.

2. Use of pesticides shall comply with the applicable Federal and state laws. Pesticides shall be used only in accordance with their registered uses and within limitations imposed by the Secretary of the Interior. Prior to the use of pesticides, the holder shall obtain from the authorized officer written approval of a plan showing the type and quantity of material to be used, pest(s) to be controlled, method of application, location of storage and disposal of containers, and any other information deemed necessary by the authorized officer. Emergency use of pesticides shall be approved in writing by the authorized officer prior to such use.

3. The holder shall protect all survey monuments found within the right-of-way. Survey monuments include, but are not limited to, General Land Office and Bureau of Land Management Cadastral Survey Corners, reference corners, witness points, U.S. Coastal and Geodetic benchmarks and triangulation stations, military control monuments, and recognizable civil (both public and private) survey monuments. In the event of obliteration or disturbance of any of the above, the holder shall immediately

report the incident, in writing, to the authorized officer and the respective installing authority if known. Where General Land Office or Bureau of Land Management right-of-way monuments or references are obliterated during operations, the holder shall secure the services of a registered land surveyor or a Bureau cadastral surveyor to restore the disturbed monuments and references using surveying procedures found in the Manual of Surveying Instructions for the Survey of the Public Lands in the United States, latest edition. The holder shall record such survey in the appropriate county and send a copy to the authorized officer. If the Bureau cadastral surveyors or other Federal surveyors are used to restore the disturbed survey monument, the holder shall be responsible for the survey cost.

4. Excavation and embankment quantities shall be balanced as nearly as design and construction considerations allow. Any waste and/or borrow needs shall be specifically identified by the holder.

5. Material encountered on the project and needed for select borrow, surfacing, riprap, or other special needs shall be conserved.

6. Excess excavated, unsuitable, or slide materials shall be disposed of as directed by the authorized officer.

7. All design, material, and construction, operation, maintenance, and termination practices shall be in accordance with safe and proven engineering practices.

8. Holder shall limit excavation to the areas of construction. All off-site borrow areas must be approved in writing by the authorized officer in advance of excavation. All waste material resulting from construction or use of the site by holder shall be removed from the site. All waste disposal sites on public land must be approved in writing by the authorized officer in advance of use.

9. Construction-related traffic shall be restricted to routes approved by the authorized officer. Authorized roads used by the holder shall be rehabilitated or maintained when construction activities are complete as approved by the authorized officer.

10. During conditions of extreme fire danger, operations shall be limited or suspended in specific areas, or additional measures may be required by the authorized officer.

11. The holder and its contractors would notify the BLM of any fires and comply with all rules and regulations administered by the BLM concerning the use, prevention, and suppression of fires on federal lands, including any fire prevention orders that may be in effect at the time of the permitted activity.

12. The holder and its contractors would maintain and clean all equipment regularly to remove flammable debris buildup and prevent fluid leaks that can lead to ignitions.

13. The holder and its contractors would operate all internal and external combustion engines (for example, off-highway vehicles, chainsaws, generators, and heavy equipment) with a qualified spark arrester. Qualified spark arresters would be maintained, would not be modified, and meet the Society of Automotive Engineers Recommended Practices J335 or J350. Refer to 43 CFR §8343.1.

14. The holder and its contractors would carry at least one shovel, water, and a fire extinguisher rated at a minimum of ABC - 10 pound on each piece of equipment and each vehicle.

15. When welding, grinding, cutting, or conducting other similar, spark-producing work, choose an area large enough to contain the sparks that is naturally free of all flammable vegetation or remove the flammable vegetation in a manner compliant with the permitted activity.

16. The holder and its contractors would initiate fire suppression actions in the work area to prevent fire spread to or on BLM-administered lands. If a fire spreads beyond the capability of workers with the stipulated tools, all would cease fire suppression action and leave the area immediately via pre-identified escape routes.

17. The Holder and its contractors would call 911 or the Color Country Interagency Fire Center at 435-586-4484 immediately with the location and status of any fire AND notify the Cedar City Field Office at 435-865-3000 immediately to report the incident.

18. The holder and its contractors would keep apprised of current and forecasted weather and fire conditions at http://www.wrh.noaa.gov/firewx/?wfo=slc and take additional fire precautions when fire danger is rated High or greater. Red Flag Warnings for high winds and low humidity are issued by the National Weather Service when fire conditions are most dangerous, and ignitions escape control quickly. Extra precautions would be required during these warnings such as additional water, patrols, and tools. When fire danger is rated Extreme and a Red Flag Warning is forecasted, all construction activities would be shut down. Any exceptions must be approved in advance by the BLM.

Bonding

1. The Holder is required to submit a Reclamation Cost Estimate (RCE) for a reclamation and performance bond. The RCE means estimating the cost to restore the land to a condition that would support pre-disturbance land uses. This includes the cost to remove all improvements that would be made under the ROW authorization, return the land to approximate original contour, and establish a sustainable vegetation community, as required by the Bureau of Land Management (BLM). The RCE shall be furnished within 90 days, estimating all costs for the BLM to fulfill the term and conditions of the grant in the event that the Holder would not be able to do so. All costs of preparing and submitting the RCE shall be borne solely by the holder. The bond would be subject to current regulations and policies. Bond components that must be addressed when determining the RCE amount include, but are not limited to:
    - Environmental liabilities such as use of hazardous materials waste and hazardous substances, herbicide use, the use of petroleum-based fluids, and dust control or soil stabilization materials;
    - The decommissioning, removal, and proper disposal, as appropriate, of any improvements and facilities; and
    - Interim and final reclamation, re-vegetation, recontouring, and soil stabilization. This component must address the potential for flood events and downstream sedimentation from the site that may result in offsite impacts.

2. Acceptable bond instruments: The BLM will accept cash, cashier's or certified check, certificate or book entry deposits, negotiable U.S. Treasury securities, and surety bonds from the approved list of sureties (U.S. Treasury Circular 570) payable to the BLM. Irrevocable letters of credit payable to the BLM and issued by banks or financial institutions organized or authorized to transact business in the United States are also acceptable bond instruments. An insurance policy can also qualify as an acceptable bond instrument, provided that the BLM is a named beneficiary of the policy, and the BLM determines that the insurance policy will guarantee performance of financial obligations and was issued by an insurance carrier that has the authority to issue policies in the applicable jurisdiction and whose insurance operations are organized or authorized to transact business in the United States.
3. The bond must be reviewed, received, and approved, prior to issuance of a Notice to Proceed. The bond may be periodically reviewed to determine the adequacy and adjust bond as appropriate by the authorized officer. Surface disturbing activities shall not commence until the BLM authorized officer has accepted the bond. The ROW grant does not authorize the Holder to commence construction of any

project facilities or proceed with other ground-disturbing activities connected with the Project on Federal lands. Actual on-site construction or other surface disturbing activities will be authorized by issuing a written Notice to Proceed (NTP) by the BLM authorized officer. The Holder shall not commence construction of project facilities or proceed with any ground-disturbing activities related to the Project on federal lands until the Holder: (1) in accordance with 43 CFR Sec. 2807.10, receives a written Notice to Proceed from the BLM's authorized officer authorizing the Holder to commence construction of project facilities or proceed with other ground-disturbing activities in connection with the Project and (2) complies with all pre-construction requirements included in the NTP(s), ROW grant, POD, and any special stipulations. Should non-compliance issues, environmental issues, or other problems be encountered during authorized activities, the BLM authorized officer may amend or rescind any NTP previously issued.

Hazardous Wastes

1. The holder(s) shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder(s) shall comply with the Toxic Substances Control Act of 1976, as amended (15 U.S.C. 2601, et seq.) with regard to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

2. The Right-of-Way holder of agrees to indemnify the United States against any liability arising form the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601 et seq. or the Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901 et seq.) on the right-of-way (unless the release or threatened release is wholly unrelated to the right-of-way holder's activity on the right-of-way). This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

STANDARD RIGHT-OF-WAY STIPULATIONS

Permanent Right-of-Way

UTU-92733

General

1. A performance bond is required for this authorization. The amount of the bond shall be determined as follows: the holder shall furnish a report within 90 days estimating all costs for the BLM to fulfill the terms and conditions of the grant in the event that the holder was not able to do so. All costs of preparing and submitting this report shall be borne solely by the holder. This report along with inflationary estimates shall be the basis of the bond and shall remain in effect until such time that the authorized officer determines that conditions warrant a review of the bond. This bond may be periodically adjusted by the authorized officer in the method described above when, in his/her sole determination, conditions warrant a review of the bond. Surface disturbing activities shall not commence until the BLM authorized officer has accepted the bond.

2. The ROW grant does not authorize the Holder to commence construction of any project facilities or proceed with other ground-disturbing activities in connection with the Project on Federal lands. Actual on-site construction or other surface disturbing activities will be authorized by the issuance of a written Notice to Proceed (NTP) by the BLM authorized officer. The Holder shall not commence construction of project facilities or proceed with any ground-disturbing activities related to the Project on federal lands until the Holder: (1) in accordance with 43 CFR sec. 2807.10, receives a written Notice to Proceed from the BLM's authorized officer authorizing the Holder to commence construction of project facilities or proceed with other ground disturbing activities in connection with the Project and (2) complies with all pre-construction requirements included in the NTP(s), ROW grant, POD, and any special stipulations. Should non-compliance issues, environmental issues, or other problems be encountered during authorized activities, the BLM authorized officer may amend or rescind any NTP previously issued.

3. This right-of-way applies only to public lands. It is the grantee's responsibility to obtain appropriate authorization from the landowners of other affected lands.

4. There is reserved to the authorized officer, the right to grant additional rights-of-way or permits for compatible use on, over, under, or adjacent to the land involved in this grant.

5. Within 90 calendar days of completion of construction, the holder will submit to the Authorized Officer as-built drawings and a certification of construction verifying that the facility has been constructed in accordance with the design, plans, specifications, and applicable laws and regulations.

6. The holder will be responsible for controlling noxious weeds within the limits of the ROW area. Noxious weeds are defined as those which are listed by the Utah Commissioner of Agriculture under the Noxious Weed Act, and those declared noxious by Beaver and Iron counties.

7. In the event that the public land underlying the right-of-way (ROW) encompassed in this grant, or a portion thereof, is transferred out of Federal ownership and administration of the ROW or the land underlying the ROW is not reserved to the United States in the patent/deed and/or the United States waives any right it has to administer the right-of-way, or portion thereof, within the conveyed land under Federal laws, statutes, and regulations, including the regulations at 43 CFR Part 2800, including any rights to have the holder apply to BLM for amendments, modifications or assignments and for BLM to approve or recognize such amendments, modifications or assignments. At the time of conveyance, the patentee/grantee, and their successors and assigns, shall succeed to the interests of the United States in

all matters relating to the right-of-way, or portion thereof, within the conveyed land and shall be subject to applicable State and local government laws, statues, and ordinances. After conveyance, any disputes concerning compliance with the use and the terms and conditions of the ROW shall be considered a civil matter between the patentee/grantee and the ROW holder.

8. The holder shall protect all survey monuments found within the right-of-way. Survey monuments include, but are not limited to, General Land Office and Bureau of Land Management Cadastral Survey Corners, reference corners, witness points, U.S. Coastal and Geodetic benchmarks and triangulation stations, military control monuments, and recognizable civil (both public and private) survey monuments. In the event of obliteration or disturbance of any of the above, the holder shall immediately report the incident, in writing, to the authorized officer and the respective installing authority if known. Where General Land Office or Bureau of Land Management right-of-way monuments or references are obliterated during operations, the holder shall secure the services of a registered land surveyor or a Bureau cadastral surveyor to restore the disturbed monuments and references using surveying procedures found in the Manual of Surveying Instructions for the Survey of the Public Lands in the United States, latest edition. The holder shall record such survey in the appropriate county and send a copy to the authorized officer. If the Bureau cadastral surveyors or other Federal surveyors are used to restore the disturbed survey monument, the holder shall be responsible for the survey cost.

9. The holder shall comply with the provision of Title VI of the Civil Rights Act of 1964, and will not engage in any discriminatory actions prohibited by 43 CFR Part 17, to the end that no person in the United States shall, on the grounds of race, color, national origin, or gender, be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under the program for which the holder has received a Federal authorization.

10. No routine maintenance activities will be performed during periods when the soil is too wet to adequately support maintenance equipment. If such equipment creates ruts in excess of four inches deep, the soil shall be deemed too wet to adequately support construction equipment.

11. If an unanticipated discovery of human remains occurs during maintenance activities, the maintenance activities will cease in the area and the local law authorities and the BLM will be immediately notified.

12. This grant will be issued subject to all valid existing rights including other authorized rights-of-way that may be located adjacent to or which may be affected by the operation, maintenance, and termination of this described right-of-way. Any existing facilities which may be damaged during operation, maintenance, or termination of this right-of-way shall be repaired or restored to the same condition as existed prior to the damage.

13. Holder shall maintain the right-of-way in a safe, usable condition.

14. All trash, litter, etc. occurring as a direct result of maintenance activities will be removed from public land upon completion of the maintenance activity.

15. Excess excavated, unsuitable, or slide materials shall be disposed of as directed by the authorized officer.

16. All design, material, and construction, operation, maintenance, and termination practices shall be in accordance with safe and proven engineering practices.

17. The holder shall construct, operate, and maintain the facilities, improvements, and structures within this right-of-way in strict conformity with the plan(s) of development which was (were) approved and made

part of the ROW Grant. Any relocation, additional construction, or use that is not in accord with the approved plan(s) of development, shall not be initiated without the prior written approval of the authorized officer. A copy of the complete right-of-way grant, including all stipulations and approved construction, operation, and termination to the authorized officer. Noncompliance with the above will be grounds for an immediate temporary suspension of activities if it constitutes a threat to public health and safety or the environment.

18. The holder shall be liable for damage or injury to the United States to the extent provided by 43 CFR Sec. 2803.1-4. The holder shall be held to a standard of strict liability for damage or injury to the United States resulting from fire or soil movement (including landslides and slumps as well as wind and water-caused movement of particles) caused or substantially aggravated by any of the following within the right-of-way or permit area:

    a. Activities of the holder, including but not limited to construction, operation, maintenance, and termination of the facility.
    b. Activities of other parties including, but not limited to:
    - Land clearing and logging;
    - Earth-disturbing and earth-moving work;
    - Blasting; and
    - Vandalism and sabotage.

19. All design, material, and construction, operation, maintenance, and termination practices shall be in accordance with safe and proven engineering practices.

20. The maximum limitation for such strict liability damages shall not exceed $2 million (or as determined in 43 CFR Sec. 2807.12(b)(4)) for any one event, and any liability in excess of such amount shall be determined by the ordinary rules of negligence of the jurisdiction in which the damage or injury occurred.

21. This section shall not impose strict liability for damage or injury resulting primarily from the negligent acts or omissions of the United States.

Bonding

1. The Holder is required to submit a Reclamation Cost Estimate (RCE) for a reclamation and performance bond. The RCE means estimating the cost to restore the land to a condition that would support pre-disturbance land uses. This includes the cost to remove all improvements that would be made under the ROW authorization, return the land to approximate original contour, and establish a sustainable vegetation community, as required by the Bureau of Land Management (BLM). The RCE shall be furnished within 90 days, estimating all costs for the BLM to fulfill the term and conditions of the grant in the event that the Holder would not be able to do so. All costs of preparing and submitting the RCE shall be borne solely by the holder. The bond would be subject to current regulations and policies. Bond components that must be addressed when determining the RCE amount include, but are not limited to:
    - Environmental liabilities such as use of hazardous materials waste and hazardous substances, herbicide use, the use of petroleum-based fluids, and dust control or soil stabilization materials;
    - The decommissioning, removal, and proper disposal, as appropriate, of any improvements and facilities; and
    - Interim and final reclamation, re-vegetation, recontouring, and soil stabilization. This component must address the potential for flood events and downstream sedimentation from the site that may result in offsite impacts.

2. Acceptable bond instruments: The BLM will accept cash, cashier's or certified check, certificate or book entry deposits, negotiable U.S. Treasury securities, and surety bonds from the approved list of sureties (U.S. Treasury Circular 570) payable to the BLM. Irrevocable letters of credit payable to the BLM and issued by banks or financial institutions organized or authorized to transact business in the United States are also acceptable bond instruments. An insurance policy can also qualify as an acceptable bond instrument, provided that the BLM is a named beneficiary of the policy, and the BLM determines that the insurance policy will guarantee performance of financial obligations and was issued by an insurance carrier that has the authority to issue policies in the applicable jurisdiction and whose insurance operations are organized or authorized to transact business in the United States.

3. The bond must be reviewed, received, and approved, prior to issuance of a Notice to Proceed. The bond may be periodically reviewed to determine the adequacy and adjust bond as appropriate by the authorized officer. Surface disturbing activities shall not commence until the BLM authorized officer has accepted the bond. The ROW grant does not authorize the Holder to commence construction of any project facilities or proceed with other ground-disturbing activities connected with the Project on Federal lands. Actual on-site construction or other surface disturbing activities will be authorized by issuing a written Notice to Proceed (NTP) by the BLM authorized officer. The Holder shall not commence construction of project facilities or proceed with any ground-disturbing activities related to the Project on federal lands until the Holder: (1) in accordance with 43 CFR Sec. 2807.10, receives a written Notice to Proceed from the BLM's authorized officer authorizing the Holder to commence construction of project facilities or proceed with other ground-disturbing activities in connection with the Project and (2) complies with all pre-construction requirements included in the NTP(s), ROW grant, POD, and any special stipulations. Should non-compliance issues, environmental issues, or other problems be encountered during authorized activities, the BLM authorized officer may amend or rescind any NTP previously issued.

Hazardous Wastes

1. The holder(s) shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder(s) shall comply with the Toxic Substances Control Act of 1976, as amended (15 U.S.C. 2601, et seq.) with regard to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

2. The Right-of-Way holder of agrees to indemnify the United States against any liability arising form the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601 et seq. or the Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901 et seq.) on the right-of-way (unless the release or threatened release is wholly unrelated to the right-of-way holder's activity on the right-of-way). This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

3. Prior to termination of the right-of-way, the holder shall contact the authorized officer to arrange a joint inspection of the right-of-way. This inspection will be held to agree to an acceptable termination and

rehabilitation plan. This plan shall include but is not limited to, removal of facilities, drainage structures, or surface material, recontouring, topsoiling, or seeding. The authorized officer must approve the plan in writing prior to the holder's commencement of any termination activity. The final reclamation seed mix will be determined by the Authorized Officer based on current knowledge of restoration techniques at the time.

APPENDIX F

ADAPTIVE MANAGEMENT, MONITORING, AND MITIGATION PROGRAM

PVWS PROJECT ADAPTIVE MANAGEMENT, MONITORING, MITIGATION MEASURES AND REPORTING

Introduction and Background

This appendix presents a description of measures to avoid, minimize or mitigate potential significant environmental impacts resulting from groundwater extraction for the Pine Valley Water Supply (PVWS) Project. If a right-of-way is granted, the Central Iron County Water Conservancy District (CICWCD) will be required to conform with the requirements of these measures.

The Utah Department of Natural Resources, Division of Water Rights (DWRi) 2014 order granting the water right under which the PVWS will operate states the following:

> *"There has been very little actual pumping of groundwater in Pine Valley to stress the groundwater system such that recharge estimates can be verified through a quantitative analysis. Although the state engineer believes there is water available for appropriation, estimates of the amount of water should be considered preliminary at this time. Applicant should understand that this decision is based on the information and data currently available. Should the groundwater resource prove to be over appropriated as diversions under this and other applications are made, a groundwater management plan could be formulated in the future to address that issue."*

As a result of this finding, the DWRi 2014 order requires the applicant to implement the following measures, which are described in more detail in the following sections:

- An accounting of all groundwater diversions from the PVWS Project wells;
- A monitoring program to be approved by DWRi that assures pumping for the project will not impair prior water rights or result in groundwater extraction in excess of the safe yield of the aquifer system; and
- Measures to mitigate impairment of prior water rights or compensate the holders of these water rights for the impairment.

Since these measures are a compliance requirement to exercise the water rights granted by the State of Utah to Central Iron County Water Conservancy District (CICWCD) and are administered under the authority of the DWRi, they are regarded herein as Applicant Provided Measures enforced by DWRi. Notwithstanding, the Bureau of Land Management (BLM) has responsibilities and authorities set forth in the National Environmental Policy Act (NEPA) and the Federal Land Policy and Management Act (FLPMA) for avoiding, minimizing, and mitigating environmental impacts. A key concept of the monitoring and mitigation program is therefore that BLM has a responsibility to avoid, minimize, and mitigate impacts to groundwater water-dependent values (environmental resources that can be affected by groundwater pumping for the PVWS Project), regardless of whether those values are or are not represented by a water right. For this reason, the monitoring and mitigation program assumes that BLM cannot exclusively rely upon enforcement of priorities within the water rights system to protect groundwater-dependent values and that other complementary measures may be required to fulfill BLM's responsibilities.

Approach

The adaptive management, monitoring, mitigation measures and reporting requirements described in this appendix are divided into two categories.

- **Applicant Provided Measures.** As required under the DWRi 2014 order granting the water rights under which the PVWS Project will operate, the CICWCD will implement a monitoring and adaptive management program to help assure that groundwater extraction by the PVWS Project will not impair prior (senior) water rights or exceed the safe yield of the aquifer system. These avoidance and minimization measures are provided by the applicant as part of the PVWS Project in order to comply with the DWRi's 2014 order, and are considered as part of the project description evaluated in the impact analysis presented in the Environmental Impact Statement (EIS) for the project. As such, these measures are project obligations under NEPA that will be implemented in consultation with BLM, and BLM will retain authority to assure they are properly implemented.

- **Required Monitoring and Mitigation Measures.** Based on the impact analysis presented in the EIS, a number of monitoring and mitigation measures are required by the BLM under its authority pursuant to the National Environmental Policy Act (NEPA) and the Federal Land Policy and Management Act (FLPMA). CICWCD will perform monitoring and mitigation that reduces potentially significant impacts to environmental values to levels that are less than significant. To the extent that these mitigation measures affect the exercise of state-granted water rights, they will be implemented in coordination with the DWRi.

These two categories of measures and the rationale and general approach for their implementation are summarized in the following sections. Detailed information regarding the implementation steps, reporting requirements, schedules, responsibilities, and enforcement authority are presented in Tables F1 and F2 for Applicant Committed Measures and Required Monitoring and Mitigation Measures, respectively. Additional background regarding these measures and the technical approach to their implementation is presented in Section 6 of the Groundwater Resources Impact Assessment.
]
The intent of the monitoring and mitigation is to provide early warning of potential adverse effects to groundwater-dependent resources and water rights and provide time and flexibility to implement management measures and gage their effectiveness. BLM's framework for implementing the PVWS Monitoring and Mitigation Plan will be to allow CICWCD flexibility in meeting its water production objectives, consistent with BLM's obligations under federal law to avoid and minimize impacts to water-dependent and environmental values. To optimize project operations within this framework, CICWCD has proposed a suite of monitoring and mitigation measures designed to address potential environmental impacts through adaptive management and escalating monitoring, investigation and mitigation triggers.

BLM's role during project implementation would be to ensure that monitoring data related to water-dependent values is collected and disseminated, and to ensure that operational and mitigation measures related to protecting water-dependent and environmental values are implemented and effective. DWRi is a key partner within this framework because project implementation is based upon the assumption that operations will comply with DWRi's 2014 Order. DWRi has authority to enforce operational and mitigation measures that ensure the project operates within the parameters of Utah water law. BLM's role will be to ensure that CICWCD collects data required by the Utah DWRi order and by the proposed monitoring and mitigation plan. BLM will then ensure that this data is transmitted to Utah DWRi so that Utah DWRi can make decisions as to how the operational and mitigation measures related to water rights should be enforced.

BLM recognizes that adjusting project operations to maximize water production while avoiding impacts to water-dependent values and water rights holders will require specialized expertise and collaboration among multiple agencies and stakeholders. For this reason, BLM will form a technical team to advise BLM on project operations and implementation of these monitoring and mitigation measures. It is anticipated this team will have a similar technical makeup as the technical advisory team assembled to prepare the groundwater resources impact assessment (GRIA) for the EIS, and will include representatives and subject matter experts from BLM, DWRi, USGS, CICWCD and Beaver County. The technical team will ensure that BLM is informed about issues related to project infrastructure, water rights compliance, scientific data collection, and the status of water-dependent values before BLM provides final approval for the adaptive management program. Final approval by the BLM will be required as a condition of the ROW grant.

Applicant-Provided Measures

This appendix presents a description of measures to avoid, minimize or mitigate potential significant environmental impacts resulting from groundwater extraction for the Pine Valley Water Supply (PVWS) Project. These measures may be divided into two categories.

APM-1: Groundwater Diversion Accounting

The 2014 DWRi Order requires the following:

> *"Each well under this application is to be individually metered and a permanent record of the water diverted from each well shall be maintained. The applicant shall make those records of the diversions made available for inspection by personnel of the Division of Water Rights upon reasonable request. An annual report of all water diversions under this approval shall be submitted to the Division of Water Rights."*

APM-1, outlined in Table F2, describes the measures that will be taken by CICWCD to comply with this requirement.

APM-2: Wellfield Construction Monitoring and Adaptive Management Program

The 2014 DWRi Order requires the following:

> *"All wells used as public water supply wells are regulated by the Utah Division of Drinking Water. Plans for the construction of new wells must be reviewed and approved by the Division of Drinking Water prior to any drilling or construction activity being commenced."*
>
> *"Along with this approval, the applicant shall develop a monitoring program to ensure that no prior rights are being impaired and that the aquifer system is not exceeding safe yield. Plans for this monitoring program must be submitted to and approved by the State Engineer prior to diversion of any water from the proposed sources."*

In partial fulfillment of these requirements, CICWCD will implement APM-2, the Wellfield Construction Monitoring and Adaptive Management Program. An overview of the program is provided in Section 6.1.2 of the GRIA and the detailed program requirements are outlined in Table F2. The program combines a phased wellfield development approach with the collection of monitoring data to allow adaptation of wellfield development to avoid or minimize potential drawdown and interbasin flow (IBF) impacts in southern Pine Valley and the northern Beryl-Enterprise Hydrologic Area (HA). The program includes:

- Submittal of a work plan for DWRi approval presenting the well completion, monitoring and adaptive management approach taken during wellfield construction;
- Implementation of a monitoring program to assess drawdown effects from operating the wells installed during during Phase 1 of wellfield construction for an initial period of 3 to 12 months; and
- Adaptive management to shift the locations of some or all of the wells installed during Phase 2 of wellfield construction so as to maintain drawdown and IBF impacts within those analyzed in the GRIA.

APM-3: Wellfield Operation Monitoring and Adaptive Management Program

To further fulfill the 2014 DWRi order requirement to develop and implement "… *a monitoring program to ensure that no prior rights are being impaired and that the aquifer system is not exceeding safe yield …"* during operation of the PVWS Project, CICWCD will implement APM-3.

An overview of the program is provided in Section 6.1.3 of the GRIA and the detailed program requirements are outlined in Table F2. The program collects groundwater level data during operation of the final PVWS Project wellfield and allows the wellfield configuration or operation to be adjusted to avoid or minimize potential drawdown or water rights impacts, or exceedance of the safe yield of the aquifer system. The program includes:

- Submittal of a work plan for DWRi approval presenting the well completion, monitoring and adaptive management approach taken during wellfield and monitoring well construction;
- Implementation of a monitoring program to assess long-term drawdown effects from operating the full PVWS Project wellfield on a series of nearfield and farfield monitoring wells located in all directions from the wellfield; and
- Adaptive management to develop a Revised Wellfield Operation Plan with the review and approval of the Utah DWRi if measured drawdowns exceed predicted drawdowns.

APM-4: Well Interference Monitoring and Mitigation Program

The 2014 DWRi Order requires the following:

> *"As noted, this approval is granted subject to prior rights. The applicant must, as necessary, mitigate or provide compensation for any impairment of prior rights such as may be stipulated among parties or decreed by a court of competent jurisdiction."*

In fulfillment of this requirement, APM-4 will be implemented to mitigate the potential adverse impacts of interference drawdown resulting from the PVWS Project on existing wells operated by prior (senior) water rights holders. This measure will consist of an interference drawdown monitoring and mitigation program. The program will reimburse senior water right holders for potential expenses associated well interference associated with drawdown induced by the PVWS Project. The program is outlined in Table F2 and will include the following components:

- The program would be administered by BLM or a designated third party.
- Senior water right holders in the area projected to be impacted by 15 feet or more of project-induced drawdown would be identified and notified regarding the program and the opportunity to participate (see GRIA Tables 4-3, 4-4 and 4-8 for a preliminary assessment of potentially eligible wells).
- Potentially-affected wells of parties that agree to participate would be inspected and their current condition documented.
- If a participating well owner experiences expenses associated with pumping, rehabilitating, modifying, deepening or replacing their well as a result of the project, they would submit a claim under the program. Based on review of the claim by BLM, the UDWRi, or a designated third party, the well owners would be reimbursed for the reasonable and customary cost of these actions.

Detailed requirements and responsibilities are outlined in Table F2. The program includes:

- Notification of potentially affected water right holders;
- Collection of baseline data and drawdown data over time; and
- Providing compensation or mitigation to water right holders whose wells are damaged, go dry, experience decreased yield or increased operating expenses as a result of the PVWS Project.

Monitoring and Mitigation Measures

The purpose of the programs set forth below is to further assess the effects of implementing the PVWS Project and inform the timely and effective implementation of mitigation measures under NEPA and FLPMA. These monitoring and mitigation programs will focus on the following:

- Monitoring and mitigation of potential impacts related to spring flow depletion will be implemented to address potential adverse impacts to habitat, wildlife and senior water right holders of groundwater discharged from the springs;
- Monitoring and mitigation of potential impacts related to ET discharge depletion will be conducted to address potential adverse impacts related to habitat, wildlife, erosion and air quality; and
- Monitoring and mitigation of potential impact related to land subsidence will be implemented to address potential impacts related to surface infrastructure damage and flooding.

The measures implemented under these programs are designed to avoid, minimize, and mitigate impacts to environmental values that could be adversely affected by groundwater extraction for the PVWS Project. Since groundwater development presumes some level of vegetation change and significant reduction of groundwater levels in some parts of Pine Valley, not all effects will be avoided by these mitigation measures.

Implementation of these monitoring and mitigation programs will be informed partly by analysis of the groundwater level and quality monitoring data collected during implementation of the Applicant-Provided Measures described in the previous section, and partly by collection of monitoring data focused on the specific resources addressed by each program. Each monitoring and mitigation program will be implemented in a stepwise fashion with escalating tiers of monitoring, investigation and mitigation requirements. Implementation will start with baseline characterization, followed by implementation of a routine (Tier I) monitoring program to assess whether adverse effects may be occurring as a result of the PVWS Project. If the Tier I monitoring data indicate that potentially adverse effects could be occurring as a result of the PVWS Project, monitoring will escalate to Tier II. In this phase, focused investigations and monitoring will be conducted to confirm whether adverse impacts are occurring or likely. If so, the programs escalate to Tier III, which includes implementation of mitigation measures to prevent or offset potential significant impacts and implementation of targeted monitoring programs to assure their effectiveness.

Spring Flow Depletion Monitoring and Mitigation

Wah Wah Springs is the only spring resource anticipated to experience a measurable effect as a result of groundwater extraction for the PVWS Project. As discussed in Section 4.2.4 of the GRIA, if Wah Wah Springs receives all of its discharge from the regional aquifer and operates as simulated in the GBCAAS-PV model, spring flow depletions of 14 to 15% may be anticipated as a result of implementing the Proposed Action and the ANWS Alternative, respectively. The remaining regional springs, Clay Spring, Dearden Spring Group, and Big Springs, are located outside the Area of Project Effects (APE) and are not reasonably expected to experience measurable or observable effects as result of project pumping (predicted flow depletions are well under 1%). As such, the only identified regional spring to be included in the monitoring program will be Wah Wah Springs.

The remaining springs in the mountains surrounding Pine Valley are believed to derive their discharge from perched mountain aquifers and, based on investigations performed by the USGS (Gardner *et al*. 2020), are not expected to be affected by pumping from the regional aquifer (Sections 3.7.2 and 4.2.4 of the GRIA).

Nevertheless, because a potential connection between some of these springs and the regional aquifer system cannot be conclusively ruled out without verifying whether they respond to significant stresses to the regional aquifer system, the spring flow depletion monitoring program will include a number of key local springs. The locations of springs proposed to be included in the monitoring program and progression of simulated drawdown effects at the water table in the underlying regional aquifer are shown on Figure 6-4 of the GRIA of the GRIA for the Proposed Action and the ANWS Alternative. Figure 6-5 of the GRIA highlights the selected spring areas with color infrared imagery details. These springs were selected based on the following criteria:

- They are located near the contact between valley-fill alluvium and bedrock of the surrounding mountain fronts (however, in some cases, important springs at somewhat higher elevations were selected);
- They are generally predicted to experience 1 foot or more of drawdown in the regional aquifer within approximately 10 to 50 years after pumping begins;
- They are associated with a measurable area of ET influence;
- They generally surround the area of predicted wellfield drawdown effects; and
- Data are available for the springs from other studies, such as biological resource surveys and monitoring for the PVWS Project, or prior investigations by the USGS.

Information regarding the springs adopted under the monitoring program for the Proposed Action and ANWS Alternative is summarized in Table F1.

TABLE F1
LOCATIONS PROPOSED FOR SPRING FLOW DEPLETION MONITORING PROGRAM

Name (NHD Number)	HA	Elevation (ft)	Discharge (AFY)	Prior Investigations	Comments
Meadow Spring (79033322)	Beryl-Enterprise	5,806	80.7	BLM (2010); Transcon (2020)	On BLM Land; Associated with an area of ET discharge near the head of a broad swale and extending about 2,000 feet downstream.
Sheep Creek Spring (81421683)	Pine Valley	6,914	17.7	Gardner *et al.* (2020), BLM (2010)	On BLM Land; Located in a drainage and associated with an area of ET discharge extending about ½ mile downstream.
Water Hollow Spring (81421789)	Pine Valley	7,322	44.4	Gardner *et al.* (2020), BLM (2010)	On BLM Land; Higher elevation, but close to wellfield; Located in a drainage and associated with an area of ET discharge extending about ½ mile downstream.
Unnamed Spring (81421751)	Pine Valley	6,784	NA	None known	State of Utah Land; Located near the head of drainage swale with an area of ET discharge extending about 1,000 feet downstream.
Meadow Spring (81421743)	Pine Valley	6,842	NA	Transcon (2020)	On BLM Land; Located in a swale and in an area of ET discharge measuring about 500 by 1,000 feet.
Biting Spring (81421725)	Pine Valley	6,590	1.6	BLM (2010)	On BLM Land; Located in a hollow at the head of a small drainage with an ET discharge

TABLE F1 LOCATIONS PROPOSED FOR SPRING FLOW DEPLETION MONITORING PROGRAM					
Name (NHD Number)	**HA**	**Elevation (ft)**	**Discharge (AFY)**	**Prior Investigations**	**Comments**
					area measuring about 100 by 200 feet.
Pots Sum Pa Spring (81421767)	Pine Valley	6,334	30.2	Gardner *et al*. (2020), BLM (2010)	Private Land; Located in a hollow at the head of a swale, with an ET discharge area measuring about 500 by 1,000 feet
Kiln Spring (75959491)	Wah Wah Valley	5,846	12.9	Gardner *et al*. (2020), BLM (2010)	On BLM Land; Located in a hollow at the head of a drainage swale, with an ET discharge area extending about 250 feet downstream.
Unnamed Spring but reported by Gardner (2020) as Wah Wah Springs (75959455)	Wah Wah Valley	5,487	1,800	Gardner *et al*. (2020), BLM (2010)	Private Land; Spring complex located on a side slope near the contact between carbonate and underlying siliciclastic rock near the alluvial valley fill boundary; The ET area around Wah Wah Springs measures about 380 acres.
Big Basket Spring (86909851)	Snake Valley	7,662	NA	Transcon (2020)	On BLM Land; Located in a drainage swale with ET areas extending for over 1,000 feet downstream and encompassing Unnamed Spring 869099581.
Scraper Spring (86909895)	Snake Valley	7,122	NA	Transcon (2020)	On BLM Land; Located in a drainage containing ET discharge areas about 1 mile upstream and ½ mile downstream.
Unnamed Spring (79032388)	Hamlin Valley	6,595	NA	Transcon (2020)	On BLM Land; Located in a drainage saddle on volcanic bedrock near the crest of the southern Needle Range. Reported moderate flow and found to contain springsnails
Notes: HA = Hydrographic Area; NA = not available					

Unnamed spring 79032388 did not meet all of the selection criteria (it is located on volcanic bedrock near the crest of the Needle Range, is not predicted to experience drawdown for 50 to 100 years, and is unlikely to be connected to the regional aquifer system); however, it is included because it is the only spring found to support a population of living springsnails during the surveys conducted by Transcon (2020).

The monitoring and mitigation program is discussed in Table F3 and will include the following components:[1]

- Baseline spring characterization;

[1] Because Unnamed spring 79032388 does not meet all of the monitoring criteria and is the only spring located outside of the Landsat satellite scene used to develop ET data in this GRIA, it will not be monitored for ET and LAI changes but will be visited periodically to assess potential spring discharge, vegetation and springsnail population changes.

- Development and submittal of a Spring Resource Monitoring and Mitigation Plan for BLM review and approval;
- Implementation of the Spring Resource Monitoring and Mitigation Plan, including monitoring and reporting;
- Monitoring of ET and LAI changes using remote sensing data;
- Periodic monitoring of spring discharge, vegetation changes, and (if applicable) springsnail population changes; and
- Escalation of the monitoring program, completion of supplemental investigations, and/or implementation of spring discharge mitigation as required under the Plan.

ETg Depletion Monitoring and Mitigation

ETg discharge areas for the groundwater flow system that includes Pine Valley occur around Sevier Lake and in Tule Valley. These areas are located remotely from the proposed PVWS Project wellfield, and drawdown effects, if they were to occur, are predicted to be limited to about 1 foot or less, would take decades or longer to begin, and progress slowly over a period of years. The amount of ETg depletion that could be induced by the PVWS Project around Sevier Lake is predicted to be less than 5% and the amount of ETg depletion predicted in the Tule Valley HA is less than 1%. This assumes that all of the ETg from phreatophytes in this area is derived from the regional aquifer, which is a conservative assumption. A recent study near Baker Ranch in Snake Valley demonstrated that greasewood shrubs (*S. vermiculatus*) were able to maintain groundwater connectivity during a period of steady, pumping-induced groundwater level decline of more than 4 feet between 2007 and 2013 (Devitt and Bird 2016). This suggests the GBCAAS-PV model may overpredict the rate and timing of ETg depletion and that actual impacts may be less and spread over a broader area.

Based on the information above, significant ETg depletion impacts are not anticipated. The PVWS Project will include a Wellfield Operation Adaptive Management Program that includes long-term monitoring of drawdown responses in wells north of the wellfield to help assure that drawdown and ETg depletion are similar to or less than predicted amounts. If this program were to identify a potential concern related to ETg discharge at the GDAs in Tule Valley and around Sevier, that data would place the UDWRi on notice that withdrawals from the basin may potentially be exceeding the safe yield of the basin. If UDWRi determines that safe yield is exceeded, UDWRi may take action to impose Groundwater Management Plan, which would have the indirect effect of reducing the chances of an adverse ETg depletion effect. Nevertheless, ETg depletion monitoring is proposed to document long-term conditions in the ETg discharge areas and verify these assumptions are correct. ETg discharge areas selected for monitoring are discharge areas around Sevier Lake and in Tule Valley. Locations that will be used for ETg discharge depletion monitoring are the GDAs and ET Units mapped by the USGS and shown on Figure 6-6 (Gardner *et al*. 2020).

Due to size of the mapped GDAs and the relatively diffuse nature of the predicted ETg depletion effects, the monitoring program will focus on the use of remote sensing derived ETa and LAI measurements. The monitoring and mitigation program will include the following components outlined in detail in Table F3:

- Baseline GDA characterization;
- Development and submittal of a GDA Resource Monitoring and Mitigation Plan for BLM review and approval;
- Implementation of the GDA Resource Monitoring and Mitigation Plan, including monitoring and reporting; and
- Escalation of the monitoring program, completion of supplemental investigations, and/or implementation of mitigation as required under the Plan and in consultation with Utah DWRi and BLM.

Because ETg depletion is more likely to be more greatly affected by local pumping by existing water rights than by the PVWS Project, the technical team will conduct further investigations before ETg mitigation measures are required. These site-specific investigations will determine whether ETg discharge effects can be attributed to local pumping or project pumping.

Subsidence Monitoring and Mitigation

The distribution and extent of unconsolidated clay sediments in Pine Valley that may be susceptible to subsidence has not been established, but they are likely to be most extensive in the north-central portion of Pine Valley. Compressible clays could also occur farther south in the central portion of the valley, and potentially beneath the southwest portion of the valley, where finer-grained sediments may be more prevalent at some locations. Permanent development and infrastructure that could be adversely impacted by subsidence is relatively sparse in Pine Valley, and limited to State Route 12, a network of dirt roads, and a few permanent structures at the US Forest Service Desert Research Station in the northern portion of the valley that are occasionally occupied.

The Subsidence Monitoring and Mitigation Program will focus on monitoring of surface elevations and infrastructure conditions, re-distribution of pumping as may be needed to avoid potentially damaging impacts, and implementation of remedial grading or infrastructure repair as may be needed. A network of 12 subsidence monitoring monuments will be required to be installed throughout the valley floor by the applicant and will serve as the primary basis for subsidence monitoring. The locations of these monuments are shown on Figure 6-7 of the GRIA relative to drawdown predicted for implementation of the Proposed Action, and on Figure 6-8 of the GRIA relative to drawdown predicted or the ANWS Alternative. Field adjustments may be made in the selection of final monument locations.

The Subsidence Monitoring and Mitigation Program will include the following components outlined in detail in Table F3:

- Development and submittal of a Subsidence Monitoring and Mitigation Plan for BLM review and approval;
- Baseline elevation, drainage and infrastructure characterization;
- Implementation of the Subsidence Monitoring and Mitigation Plan, including routine monitoring and reporting;
- Escalation of the monitoring program to focused monitoring, elevation surveys and/or implementation of supplemental geotechnical investigations if evidence of subsidence is observed; and
- Implementation of mitigation as required under the Plan if needed, including re-distribution of pumping as may be needed to decrease subsidence and avoid potentially damaging impacts, and, if damaging subsidence has occurred, implementation of remedial grading or infrastructure repair as needed.

TABLE F2 APPLICANT-PROVIDED MEASURES AS PART OF THE PVWS PROJECT						
ID	**Measure**	**Verification**	**Timing**	**Frequency**	**Responsible Party**	**Enforcement Responsibility**
APM-1 PVWS Project Groundwater Diversion Accounting						
APM-1a	**Meter Installation.** Prior to extraction of groundwater from the proposed PVWS Project supply wells, CICWCD will install a meter at each well that records the groundwater extraction rate and cumulative volume of groundwater extracted from each well. Metering devices shall: • Be a propeller type (turbine-meter, McCrometer or equivalent) suitable for the range of extraction flows expected; • Installed in straight piping runs ≥ 10 pipe diameters from valves, bends, or fittings; and • Register total volume (in gallons or acre-feet) and instantaneous flow rate in gallons per minute.	Proof of meter installation and operation will be provided to the Utah DWRi and the BLM in the form of a manual and photos.	Prior to well operation	One-time or upon installation or replacement	CICWCD	Utah DWRi
APM-1b	**Monitoring and Recording.** During wellfield operation, a log shall be kept for each production well, including the following: • Well status, including active, standby or maintenance; • Volume of groundwater extracted each month from each well in gallons and acre-feet; • Operating time of the well and average extraction rate in gallons per minute; • Bi-annual meter calibration records; and • Description of any well, pump or meter service, repair, rehabilitation, modification or replacement.	An annual Wellfield Operation Report for the prior year shall be submitted to the Utah DWRi and BLM. Records shall be maintained at the site and made available to DWRi staff upon reasonable notice.	By January 31 of each year	Annually	CICWCD	Utah DWRi
APM-2 PVWS Project Wellfield Construction *Monitoring and Adaptive Management Program*						
APM-2a	**Wellfield Construction Monitoring and Adaptive Management Plan.** CICWCD will develop a Wellfield Construction Monitoring and Adaptive Management Plan, to be implemented during the first phase of wellfield development. The plan will detail the following: • Final proposed production and monitoring well locations and completion details; • Well construction, development and logging procedures; • Well pump testing and data analysis procedures; • Long term well field testing and data analysis procedures; • Data management, evaluation, and modeling procedures; and • Reporting.	A draft work plan shall be submitted for approval to the DWRi and BLM and finalized based on the comments received.	A draft work plan shall be submitted at least 3 months prior to beginning well construction	One time	CICWCD	Utah DWRi
APM-2b	**Qualified Engineer/Hyrdogeologist.** Production and monitoring well construction and testing shall be performed by a qualified engineer or hydrogeologist.	Resume(s) shall be submitted the Utah DWRi and BLM	A least 1 month prior well construction	One time	CICWCD	Utah DWRi

APM-2c	**Phase 1 Well Construction and Testing.** The following data shall be collected during construction of each production and monitoring well:
	• Lithologic log and well completion record;
	• Geophysical log, including at a minimum: total gamma radiation, spontaneous potential; single-point resistivity, short- and long-normal resistivity (or induction), and caliper;
	• Well construction and development field record;
	• In addition, for each production well:
	    o Conduct a 6-hour step drawdown test with three 2-hour steps, perform well efficiency and yield analysis;
	    o Conduct a 24-hour constant discharge test (with recovery), holding discharge within +/- 5% and continuously recording water levels in the pumping well and any nearby inactive wells; Conduct a curve-matching aquifer parameter analysis;
	    o Collect and analyze at least one representative groundwater sample for analysis of general minerals, major anions and cations, and water quality parameters required by the Utah Division of Drinking Water.
		A Well Completion and Testing Data Package shall be submitted to DWRi and BLM for each production and monitoring well.	Within 10 days following construction and/or testing of each new well.	One time, for each well drilled.	CICWCD	Utah DWRi

APM-2d	**Initial Wellfield Operation Test.** During the initial operation of the first six production wells, the following data shall be collected and analyzed for the first approximately 3 to 12 months of operation: • Recording transducers shall be placed in each production and monitoring well to collect a continuous record of drawdown; • A barometric logger shall be deployed for barometric pressure recording, unless vented transducers are used; • Discharge in gallons per minute shall be logged continuously for each pumping well; and • All major events shall be logged, including adjustments, down-time, equipment replacement, and other events.	Drawdown and production data shall be provided monthly to DWRi and BLM during the test.	Data shall be provided within 10 days of the end of each month that the test is conducted.	Monthly, during initial operation of the first six production wells.	CICWCD	Utah DWRi
APM-2e	**Data Analysis and Wellfield Completion Planning.** After completion of the Initial Operation Test, the data shall be analyzed and recommendations shall be developed for Phase 2 wellfield completion. • Update the GBCAAS-PV model using the lithologic, log, and geophysical log data and results from the step tests, constant-rate pumping tests, and Initial Wellfield Operation Test conducted for the first six supply wells and monitoring wells. • Use the updated GBCAAS-PV model to simulate the Initial Operation Test and recalibrate the model as necessary; • Model the future operation of the project wellfield using the updated and recalibrated GBCAAS-PV model. If groundwater drawdown or IBF depletion effects in southern Pine Valley and the Beryl-Enterprise Area HA exceed those predicted in Section	A draft Wellfield Construction and Adaptive Management Program Report shall be provided to DWRi and BLM for review and approval documenting the initial wellfield construction, testing and operation; updates to the GBCAAS model,	Within three months after completing the Initial Wellfield Operation Test and before any	Once after completion of the Initial Wellfield Operation Test	CICWCD	Utah DWRi

TABLE F2 APPLICANT-PROVIDED MEASURES AS PART OF THE PVWS PROJECT						
ID	**Measure**	**Verification**	**Timing**	**Frequency**	**Responsible Party**	**Enforcement Responsibility**
	4.2.1 and 4.2.2 of the GRIA, respectively, use the updated GBCAAS-PV model to develop recommendations for an alternative wellfield configuration that results in similar effects to those predicted in the GRIA by shifting some or all of the remaining wells to their alternative locations shown in Figure 4-3 (GRIA 2021).	updated predictive modeling results; and recommendations for Phase 2 wellfield expansion.	Phase 2 wells are constructed			

APM-2f	**Phase 2 Well Construction and Testing.** The following data shall be collected during construction of each production and monitoring well constructed during Phase 2 wellfield expansion:
	• Lithologic log and well completion record;
	• Geophysical log, including at a minimum: total gamma radiation, spontaneous potential; single-point resistivity, short- and long-normal resistivity (or induction), and caliper;
	• Well construction and development field record;
	• In addition, for Phase 2 production wells:
	  ○ Conduct a 6-hour step drawdown test for each well with three 2-hour steps, analyze well efficiency and yield;
	  ○ Conduct a 24-hour constant discharge test (with recovery) on four selected wells, holding discharge within +/- 5% and continuously recording water levels in the pumping well and any nearby inactive wells and water levels have recovered to at least 90% of pre-test levels; Conduct a curve-matching aquifer parameter analysis;
	  ○ Collect and analyze at least one representative groundwater sample for analysis of general minerals, major anions and cations, and water quality parameters required by the Utah Division of Drinking Water.
		A Well Completion and Testing Data Package shall be submitted to DWRi and BLM for each production and monitoring well.	Within 10 days following construction and/or testing of each new well.	One time, for each well drilled.	CICWCD	Utah DWRi

APM-3 PVWS Project Wellfield Operation Monitoring and Adaptive Management Program						

APM-3a	**Wellfield Operation Monitoring and Adaptive Management Plan**. CICWCD will develop a Wellfield Construction Monitoring and Adaptive Management Plan, to be implemented during the first phase of wellfield development. The plan will detail the following:
	• Final locations of any proposed new and existing monitoring wells to be used;
	• Procedures for construction of new monitoring wells and retrofitting of existing wells for use in the monitoring program;
	• Completion details for the program monitoring wells;
	• Anticipated drawdown effects at the monitoring wells simulated using the updated and recalibrated GBCAAS-PV model and the final production wellfield configuration;
	• Frequency and procedures for groundwater level monitoring (annual monitoring in March is assumed);
	• Frequency and procedures for groundwater quality monitoring (annual monitoring in March for general minerals, major anions and cations, and Deuterium/Oxygen-18 is assumed);
	• Quality Assurance/Quality Control (QA/QC) Procedures; and
	• Reporting requirements, including
	  ○ Tables summarizing wellfield operational data, groundwater levels and water quality results;
	  ○ Figures/graphs including groundwater level maps, well hydrographs, water quality graphs (e.g. Piper Plots, Stiff Diagrams and stable isotope graphs) and actual vs. predicted drawdown maps.
		A draft work plan shall be submitted for approval to the DWRi and BLM and finalized based on the comments received.	At least 3 months prior to beginning Phase 2 well construction	One time	CICWCD	Utah DWRi

APM-3b	**Annual Wellfield Operation Monitoring and Reporting.** Implementation of the Wellfield Operation Monitoring and Adaptive Management Plan will include annual collection, analysis and reporting of wellfield operation, groundwater level, drawdown, water quality and actual vs. predicted drawdown. Annual Wellfield Operation Monitoring and Adaptive Management Program Reports will be submitted documenting the above program.	Submit an Annual PVWS Project Wellfield Operation Monitoring and Adaptive Management Program Report to DWRi and BLM.	Annually by March 30 for the preceding calendar year.	Annually	CICWCD	Utah DWRi
APM-3c	**Five-Year Wellfield Operation Monitoring and Reporting.** Every fifth year, the Wellfield Operation Monitoring and Adaptive Management Program Report will include a comprehensive comparison of drawdown predicted by the GBCAAS-PV model and observed groundwater levels in the wellfield, nearfield and farfield monitoring wells and the following additional evaluations and recommendations:	Submit a Five-Year PVWS Project Wellfield Operation Monitoring and Adaptive Management Program Report to DWRi and BLM.	Combined with the above annual report every fifth year after PVWS	Every five years	CICWCD	Utah DWRi

TABLE F2 APPLICANT-PROVIDED MEASURES AS PART OF THE PVWS PROJECT						
ID	**Measure**	**Verification**	**Timing**	**Frequency**	**Responsible Party**	**Enforcement Responsibility**
	• If the predicted and observed data differ significantly, the GBCAAS-PV model will be updated and recalibrated; • The updated and recalibrated GBCAAS-PV model will be used to update predictions of drawdown and IBF depletion during planned future PVWS Project wellfield operation; • If groundwater drawdown or IBF depletion effects exceed those predicted in Section 4.2.1 and 4.2.2 of the GRIA, respectively, the updated GBCAAS-PV model will be used to evaluate alternative wellfield configurations and/or pumping distribution strategies that result in similar effects to those predicted in the GRIA, including changing the wellfield configuration and/or changing the pumping distribution within the wellfield.		Project operations begin.			
APM-3d	**Wellfield Operation Adaptive Management.** If groundwater drawdown or IBF depletion effects exceed those predicted in Section 4.2.1 and 4.2.2 of the GRIA, after submittal of the Five-Year Wellfield Operation Monitoring Report, CICWCD will consult and meet with Utah DWRi and BLM to develop an adaptive management strategy that includes one or more of the following approaches to maintain drawdown impacts within those predicted by the GRIA and prevent impairment of prior water rights: • Modification of the PVWS Project wellfield; • Redistribution of pumping within the PVWS Project wellfield; • Acquisition and retirement of water rights within the Beryl-Enterprise Area HA in an amount sufficient to offset the projected increase in IBF depletion.	Submit a draft Revised Wellfield Operating Plan for Utah DWRi and BLM approval.	Within 90 days of determining that predicted drawdown or IBF depletion will be exceeded.	One time	CICWCD	Utah DWRi
APM-4 Interference Drawdown Monitoring and Mitigation						
WR-4a	**Notification.** Prior (senior) water right holders within the area predicted to be impacted by more than 15 feet of well interference drawdown after 50 years of PVWS Project pumping will be notified they are eligible to participate in a Well Interference Drawdown Monitoring and Mitigation Program. At this time, this is believed to include the operators of five Points of Diversion (PODs) in Pine Valley (GRIA 2021, Table 4-3, Figure 4-6) and three PODs in the northern Beryl-Enterprise Area HA (GRIA 2021 Table 4-8, Figure 4-16). Under the ANWS Alternative, ten underground PODs senior to the PVWS water right are predicted to included (GRIA 2021, Table 4-4, Figure 4-7). A final list of eligible PODs will be prepared and certified letters will be sent to the water right holders prior to initiating project pumping.	A final list of eligible senior water right holders and a draft notification letter will be sent to Utah DWRi and BLM for approval. Copies of certified letters sent to eligible senior water right holders will be provided to Utah DWRi and BLM.	Final list and draft letter 1 year prior to wellfield operation; Copies of certified letters 1 month after approval.	One-time unless drawdown predictions change	CICWCD	Utah DWRi
WR-4b	**Participant Registration and Induction.** The holders of the above water rights and underground Points of Diversion will be notified regarding the mitigation program via certified mail. In order to be eligible to participate in the program, they must agree to the following: • Complete a Well Information Questionnaire that provides information regarding their wells, including the date of installation, completion details, pumping system details, the beneficial use and water demand supplied by the well, and any available information regarding the current well condition, standing and pumping water levels, pumping capacity and performance. • Water right holders must agree to allow reasonable access for inspection, monitoring and testing of the well to establish the current operating conditions, capacity and performance of the well, and to verify future changes in standing and pumping water levels, well production capacity and well condition.	Copies of all correspondence and information received will be provided to Utah DWRi and BLM	Outgoing: At the time of sending; Incoming: Within 1 week.	Ongoing	CICWCD (may be implemented by a deignated 3rd party at CICWCD's expense.	Utah DWRi
WR-4c	**Program Implementation.** Registered senior water right holders shall be eligible for reimbursement of reasonable and customary costs associated with well interference drawdown resulting from the PVWS Project, including the following: • Lowering of pumps to restore well function in wells that experience a reduction in capacity of more than 20% or can no longer meet the pre-project water demand as a result of groundwater level decline; • Rehabilitation of wells that experience an increased need for maintenance as a result of falling groundwater levels; • Replacement or deepening of wells that go dry, are damaged or have diminished capacity (if the lowering of pump intakes is not feasible); and/or • Increased pump operating and maintenance costs. Changes in well function and capacity can occur from a variety of causes, including interference drawdown from other wells, well condition, aquifer conditions, well construction and other factors. The cost of reimbursement shall be borne by CICWCD in proportion to the degree the well impact was caused by interference drawdown, and the extent to which this drawdown is attributable to the PVWS Project. If necessary, Utah DWRi or BLM may retain an engineering or hydrogeologic consultant to assess the degree to which the PVWS Project is responsible	Copies of all correspondence and information received will be provided to Utah DWRi and BLM	Outgoing: At the time of sending; Incoming: Within 1 week.	Ongoing	CICWCD (may be implemented by a deignated 3rd party at CICWCD's expense.	Utah DWRi

TABLE F2 APPLICANT-PROVIDED MEASURES AS PART OF THE PVWS PROJECT						
ID	**Measure**	**Verification**	**Timing**	**Frequency**	**Responsible Party**	**Enforcement Responsibility**
	for the cost. Alternatively, at CICWCD's discretion, an alternative water supply of suitable quantity and quality to meet the existing water demand supplied by the well may be provided. The cost of this water supply shall be borne by CICWCD for a period of 50 years after pumping starts.					

TABLE F3 MONITORING, MITIGATION AND REPORTING REQUIREMENTS FOR THE PVWS PROJECT						
ID	**Measure**	**Verification**	**Timing**	**Frequency**	**Responsible Party**	**Enforcement Responsibility**
WR-1 Spring Flow Depletion Monitoring and Mitigation						
WR-1a	**Spring Resource Baseline Characterization Plan.** CICWCD will develop a Spring Resource Baseline Characterization Plan, to be implemented before PVWS pumping begins. The plan will detail the following (see below for additional details): • A description of the spring resources that may be affected (see Section 3.7.2 of the GRIA); • A list of springs to be monitored, consisting at a minimum of the springs listed in Table 6-5 of the GRIA; • Procedures for baseline characterization of the springs in the monitoring program, as described below under WR-2b; and • Data management, evaluation and reporting.	A draft work plan shall be submitted for approval to the DWRi and BLM and finalized based on the comments received.	A draft work plan shall be submitted at least 3 months prior to beginning well construction	One time	CICWCD	BLM
WR-1b	**Baseline Characterization.** Characterization data shall be compiled and evaluated for each spring included in the Spring Flow Depletion Monitoring Program to document baseline conditions. The scope shall include the following: • A baseline biological survey shall be conducted to delineate the extent of protected wetlands, describe and determine the extent of groundwater-dependent vegetation, document habitat conditions and assess the presence of threatened, endangered and other special status species in the springs and surrounding groundwater-dependent vegetation. • An assessment of the hydrologic and hydrogeologic conditions at each spring, including a reconnaissance of the topographic and geologic control on spring discharge, the extent of the wetted area, and the extent of the ET discharge area associated with the spring. The investigation shall include exploration of shallow soil conditions and groundwater occurrence by excavating test pits or drilling test borings. If feasible, one or more monitoring devices such as piezometers, weirs, or stilling wells shall be installed. Installation shall be performed using hand powered equipment as necessary to avoid disturbance of existing habitat. In addition, the routing of all seepage or discharge through a single monitoring device typically will not be feasible; rather, the objective should be to select one or more monitoring locations and devices suitable to determine whether spring discharge is changing. It is expected that a shallow piezometer or stilling well fitted with recording transducers will be adequate in most cases. • Water samples of spring discharge shall be collected and analyzed for general minerals and major anions and cations to characterize the water quality of the spring discharge. • At least four photo points shall be identified and photographed at each spring. • Baseline compilation of ET data shall include at least 20 years of ETa and LAI data within the polygon of increased ETa surrounding the spring (the "Area of ET Influence") as determined from aerial imagery and verified during the surface reconnaissance. • Baseline compilation of precipitation data shall include identifying nearby representative weather stations and or BLM rain gauges and characterizing of the baseline ET years as either wet, normal or dry years based on long-term averages. In addition, the cumulative departure from long-term average precipitation shall be computed. • Baseline LAI data development shall include statistical evaluation of the historical LAI data to assess the probability-density (quantile) distribution of LAI in each 30-meter grid cell within the spring Areas of ET Influence.	A Baseline Spring Resource Characterization Report shall be submitted to DWRi and BLM.	Within 6 months of beginning PVWS Project pumping	One time	CICWCD	BLM

TABLE F3 MONITORING, MITIGATION AND REPORTING REQUIREMENTS FOR THE PVWS PROJECT						
ID	**Measure**	**Verification**	**Timing**	**Frequency**	**Responsible Party**	**Enforcement Responsibility**
WR-1c	**Spring Flow Depletion Monitoring and Mitigation Plan.** CICWCD will develop a Spring Flow Depletion Monitoring and Mitigation Plan, to be implemented after PVWS pumping begins. The plan will detail the following (see below for additional details): • A list of springs to be monitored, consisting at a minimum of the springs listed in Table 6-5 of the GRIA plus any modificactions made based on the baseline spring resource characterization; • Monitoring procedures, and reporting requirements for Tier I, Tier II and Tier III monitoring, as described below under WR-1d, WR-1e and WR-1f; • The monitoring schedule, assumed to be annually at springs predicted to be within the predicted 1-foot drawdown contour within 50 years of PVWS Project pumping, and every 5 years at more distant springs; and • Data management, evaluation and reporting.	A draft work plan will be submitted for approval to the DWRi and BLM and finalized based on the comments received.	Within 6 months of beginning PVWS Project pumping	One time	CICWCD	BLM
WR-1d	**Tier I Spring Resource Monitoring.** Tier I Monitoring shall include the following: • Spring flow or water level monitoring shall be conducted annually in March of each year (if feasible, data from dedicated transducers shall be downloaded annually to get a full year's record); • Water quality samples shall be collected and analyzed for general mineral content and major cations and anions; • Photos shall be taken at each photo point annually in March of each year; • ETa shall be estimated for the Area of ET Influence for the one-year period preceding the spring monitoring event (except Unnamed Spring 79032388); • Precipitation data from nearby weather stations or rain gauge stations shall be compiled and analyzed to characterize the year as either dry, normal, or wet; • The long term trends in ET and precipitation shall be calculated using the Mann-Kendall method or other suitable statistical technique, and by calculating cumulative departure from long-term average conditions; • Leaf Area Index (LAI) shall be calculated for each 30-meter grid cell in the Area of ET Influence and assigned a quantile score based on comparison to historical LAI for that grid cell; and • If the LAI quantile score is less than 0.10 for more than 25% of the cells in the Area of ET Influence and persists for at least two years, then monitoring shall escalate to Tier II.	An Annual Spring Resource Monitoring Report shall be submitted to Utah DWRi and BLM. The report shall describe the results of current and historical Tier I, II and III spring resource monitoring, data evaluation, summary of any triggering events and responses, and implementation of Spring Resource Mitigation and Monitoring Plan.	Field work shall begin with one year of beginning PVWS Project pumping; Reporting: Annually by July 31	Annually	CICWCD	BLM
WR-1e	**Tier II Spring Resource Monitoring.** Tier II Monitoring shall include the following: • The existence of a potential non-hydrologic trigger for Tier II Monitoring shall be verified by confirming the LAI quantile scores are not the result of fire, grazing or ground disturbing activities. If these causes are determined to be involved, they shall be documented and Tier I monitoring shall resume. • If a non-hydrologic trigger is not identified, supplemental biological resources and supplemental hydrologic investigations shall be conducted to verify the existence and investigate the cause and potential resource impacts of the suspected spring flow depletion. A work plan for supplemental biological resources and hydrologic investigations to verify the existence and investigate the cause and potential resource impacts of the suspected spring flow depletion. • The supplemental biological resources investigation shall assess potential changes in the extent of spring pools and wetlands, habitat quality, vegetation type and diversity, and/or species presence. • A supplemental hydrologic investigation shall be conducted to determine if the spring is responding to changes in the underlying regional aquifer system or only to a perched aquifer system or other local cause. Surface hydrologic changes to be assessed include changes in discharge rates, water quality, and pool size or configuration. Subsurface hydrologic changes may be investigated by excavation and logging of soil pits or borings, and installation and monitoring of well points or piezometers as warranted. • Tier II surface hydrologic and groundwater monitoring shall be collected on a focused and expanded basis as specified in the approved Supplemental Spring Flow Depletion Investigation Work Plan. It may be necessary to perform monitoring for a period of years, conduct aquifer pumping tests and perform additional geochemical or modeling studies to verify the potential depletion effect and hydrologic cause.	An Annual Spring Resource Monitoring Report shall continue to be submitted to Utah DWRi and BLM.	By July 31	Annually	CICWCD	BLM
		A Supplemental Spring Flow Depletion Investigation Work Plan shall be submitted to BLM for approval prior to conducting the supplemental investigations.	Within 90 days of a confirmed Tier II trigger event	One time	CICWCD	BLM
		A Supplemental Spring Flow Depletion Investigation Report shall be submitted to BLM for review and approval.	To be determined based upon Work Plan	One time	CICWCD	BLM

TABLE F3 MONITORING, MITIGATION AND REPORTING REQUIREMENTS FOR THE PVWS PROJECT						
ID	**Measure**	**Verification**	**Timing**	**Frequency**	**Responsible Party**	**Enforcement Responsibility**
WR-1e	**Tier III Spring Resource Monitoring and Mitigation.** If the Supplemental Spring Flow Depletion Investigation determines the spring is in hydraulic communication with the regional aquifer system and spring flow depletion may cause adverse impacts to habitat, aquatic or terrestrial wildlife species, or prior water rights to divert water from the springs, Tier III Monitoring and Mitigation shall be implemented. CICWCD shall submit a Spring Flow Mitigation and Monitoring Plan to BLM for review and approval. The plan shall include one or more of the mitigation measures listed below and a description of any updates to the monitoring plan to assure the effectiveness of the measures to prevent or offset significant impacts. In general, the measures should be selected in accordance with CICWCD's preferences but must be approved by BLM in consultation with the DWRi. Other measures may be proposed if they provide equivalent protection. One or more of the following mitigation measures shall be implemented at CICWCD's expense: • Replacement water may be provided to offset decreased diversions by senior water right holders. • Support may be provided to improve the efficiency of water uses associated with the spring. • Replacement water may be provided to maintain adequate flow for the maintenance and protection of aquatic and emergent wetland habitat, groundwater dependent vegetation and associated habitat, and water use by aquatic and terrestrial species. • A pumping plan may be implemented that decreases PVWS Project pumping near the affected spring. • A well may be installed to replace the decrease in spring discharge.	An Annual Spring Resource Monitoring Report shall continue to be submitted to BLM and Utah DWRi.	By July 31	Annually	CICWCD	BLM
		A Spring Flow Mitigation and Monitoring Plan shall be submitted to BLM and Utah DWRi for approval prior to implementing updated monitoring and mitigation measures.	Within 90 days of a confirmed Tier III trigger event	One time	CICWCD	BLM and Utah DWRi
WR-2 ETg Discharge Depletion Monitoring and Mitigation						
WR-2a	**Groundwater Discharge Area (GDA) Baseline Characterization Plan.** CICWCD will develop a GDA Resource Baseline Characterization Plan, to be implemented before PVWS pumping begins. The plan will detail the following (see below for additional details): • A description of the GDA resources that may be affected (see Section 3.9.4 of the GRIA); • The GDA locations to be characterized and monitored; • Procedures for baseline characterization, as described below under WR-2b; and • Data management, evaluation and reporting.	A draft work plan shall be submitted for approval to the DWRi and BLM and finalized based on the comments received.	A draft work plan shall be submitted at least 3 months prior to beginning well construction	One time	CICWCD	BLM
WR-2b	**GDA Baseline Characterization.** Characterization data shall be compiled and evaluated for the GDAs to document baseline conditions. The scope shall include the following: • Verification of GDA area species composition and distribution by review of aerial imagery and surface reconnaissance; • Identification and photographing of at least four photo points at each GDA; • Compilation of at least 20 years of ETa and LAI data within the mapped GDAs; • Compilation of precipitation data and characterization of ETa responses during wet, normal, and dry years; and • Statistical evaluation of the historical LAI data to assess the probability-density (quantile) distribution of LAI in each 30-meter grid cell within the spring Areas of ET Influence.	A Baseline GDA Resource Characterization Report shall be submitted to DWRi and BLM.	Within 6 months of beginning PVWS Project pumping	One time	CICWCD	BLM
WR-2c	**GDA Depletion Monitoring and Mitigation Plan.** CICWCD will develop a GDA Depletion Monitoring and Mitigation Plan, to be implemented after PVWS pumping begins. The plan will detail the following (see below for additional details): • A list of GDA areas and locations to be monitored; • Monitoring procedures, and reporting requirements; • The monitoring schedule, assumed to be annually at springs predicted to be within the predicted 1-foot drawdown contour within 50 years of PVWS Project pumping, and every 5 years at more distant springs; and • Data management, evaluation and reporting.	A draft work plan will be submitted for approval to the DWRi and BLM and finalized based on the comments received.	Within 6 months of beginning PVWS Project pumping	One time	CICWCD	BLM
WR-2d	**GDA Resource Monitoring.** Annual monitoring of conditions in the GDAs shall include the following: • Photos shall be taken at each photo point annually in March of each year;	A GDA Resource Monitoring Report shall be submitted to Utah DWRi and BLM.	Field work shall begin with one year of beginning	Annually	CICWCD	BLM

TABLE F3 MONITORING, MITIGATION AND REPORTING REQUIREMENTS FOR THE PVWS PROJECT						
ID	**Measure**	**Verification**	**Timing**	**Frequency**	**Responsible Party**	**Enforcement Responsibility**
	• ETa shall be estimated for each GDA for the period from March through February; • LAI shall be calculated for each 30-meter grid cell in the Area of ET Influence and assigned a quantile score based on comparison to historical LAI for that grid cell; • Precipitation data from nearby weather stations or rain gauge stations shall be compiled and analyzed to characterize the year as either dry, normal or wet; • The long-term trends in ET and precipitation shall be calculated using the Mann-Kendall method or other suitable statistical technique, and by calculating cumulative departure from long-term average conditions; and • If the LAI quantile score is less than 0.10 for more than 25% of the cells in any 64-cell area (approximately 14 acres) in a GDA and persists for at least three years, BLM Utah and DWRi shall be notified.		PVWS Project pumping; Reporting: Annually by July 31			
WR-2e	If the LAI quantile score is less than 0.10 for more than 25% of the cells in any 64-cell area (approximately 14 acres) in a GDA and persists for at least three years, a mitigation plan shall be developed in consultation with BLM and DWRi. Since the water rights proximal to the potentially-affected ETg discharge areas are junior to the water rights under which the PVWS Project will be implemented, it is assumed that this plan may include curtailment of groundwater withdrawal by the CPM project if necessary to prevent potentially significant impacts.	Preparation of an ETg Discharge Mitigation Plan in consultation with BLM and DWRi	Within six months after determining the WR-3d triggers have been reached	One time	CICWCD	BLM and DWRi
WR-3 Subsidence Monitoring and Mitigation						
WR-3a	**Baseline Subsidence Characterization.** The following characterization data shall be collected and compiled to establish a baseline for the subsidence monitoring and mitigation program: • Document existing location and condition of surface infrastructure, including roads, drainage ditches, pipelines (if any), other linears and buildings; • Characterize existing surface hydrology and drainage patterns in the alluvial basin; • Compile boring logs for existing wells and log proposed well borings to identify and assess the depth, thickness and continuity of potentially compressible clay deposits; • Document current elevations at subsidence monument locations; and • Establish photo points and document conditions at monument locations and key infrastructure locations.	A Baseline Subsidence Characterization Report shall be submitted to DWRi and BLM.	Within 6 months of beginning PVWS Project pumping	One time	CICWCD	BLM
WR-3b	**Subsidence Monitoring and Mitigation Plan.** CICWCD will develop a Subsidence Monitoring and Mitigation Plan, to be implemented after PVWS pumping begins. The plan will detail the following (see below for additional details): • A list of locations to be monitored, consisting at a minimum of the locations shown on Figures 6-7 and 6-8 of the GRIA plus any modificactions made based on the baseline subsidence characterization; • Monitoring procedures, and reporting requirements for Tier I, Tier II and Tier III monitoring, as described below under WR-3c, 3d and 3e, below; • The monitoring schedule, assumed to be annually; and • Data management, evaluation and reporting.	A draft work plan will be submitted for approval to the DWRi and BLM and finalized based on the comments received.	Within 6 months of beginning PVWS Project pumping	One time	CICWCD	BLM
WR-3c	**Tier I Subsidence Monitoring.** Tier I Monitoring shall include the following: • Photos shall be taken at each photo point annually in May of each year; • Subsidence monuments shall be surveyed annually in May of each year; and • If measured subsidence exceeds 6 inches, the program shall escalate to Tier II.	An Annual Subsidence Monitoring Report shall be submitted to Utah DWRi and BLM. The report shall describe the results of current and historical Tier I, II and III subsidence monitoring, data evaluation, summary of any triggering events and responses, and	Field work shall begin with one year of beginning PVWS Project pumping; Reporting: Annually by September 30	Annually	CICWCD	BLM

TABLE F3 MONITORING, MITIGATION AND REPORTING REQUIREMENTS FOR THE PVWS PROJECT						
ID	**Measure**	**Verification**	**Timing**	**Frequency**	**Responsible Party**	**Enforcement Responsibility**
		implementation of Subsidence Mitigation and Monitoring Plan.				
WR-3d	**Tier II Subsidence Monitoring.** Tier II Monitoring shall include the following: • Surveying of subsidence monuments shall continue as under Tier I; • Aerial LiDAR shall be used to generate transects across the area in which subsidence is inferred to be occurring and the transects shall be updated annually and evaluated to assess ongoing subsidence locations and rates, and evaluate potential changes in drainage patterns; • Surface infrastructure in the subsidence area shall be observed annually for potential damage; • Subsidence areas shall be observed annually for the potential formation of fissures; and • If damage to infrastructure, fissure formation or changes to drainage are observed, the program shall escalate to Tier III.	An Annual Spring Resource Monitoring Report shall continue to be submitted to Utah DWRi and BLM. If Tier III triggers are Documented, a work plan for a Geotechnical Subsidence Investigation shall be included for DWRi and BLM review and approval.	By September 30	Annually	CICWCD	BLM
WR-3e	**Tier III Subsidence Monitoring and Investigation.** Tier III Monitoring and Investigation shall include the following: • Surveying of subsidence monuments, aerial LiDAR surveys, infrastructure observations and land surface observation for fissuring shall continue as under Tier I and Tier II; • Infrastructure damage, drainage changes and fissuring shall be documented; • A geotechnical subsidence investigation shall be performed to assess the nature and extent of the observed subsidence, evaluate the potential for future subsidence, and provide recommendations for project wellfield or operational modifications to decrease the amount of future subsidence; and • If warranted based on the geotechnical subsidence investigation and ongoing physical inspection, implement an infrastructure, drainage, and fissure monitoring and maintenance program and recommend additional protective/response actions as warranted to protect public health and welfare.	An Annual Spring Resource Monitoring Report shall continue to be submitted to Utah DWRi and BLM.	By September 30	Annually	CICWCD	BLM
		Submit a Geotechnical Subsidence Investigation Report to DWRi and BLM.	Within 1 year after infra-structure damage, fissure formation or changes to drainage are observed.	One time	CICWCD	BLM
WR-3f	**Tier III Subsidence Mitigation**. Based on the findings of the Tier III Subsidence Monitoring and Investigation, the following Mitigation may be undertaken: • Damage to infrastructure shall be repaired, fissures filled, and drainage provided to prevent flooding and the formation of new lake or playa areas per the approved plans and specifications; • If infrastructure damage, drainage changes or fissuring are observed, plans and specifications shall be prepared and provided to BLM for review and approval to replace or repair the infrastructure, correct the drainage and/or fill fissures as necessary to protect public health and welfare, stock and wildlife; • Supplemental environmental reviews, if required, will be completed under the oversight and direction of BLM at CICWCD's expense; • All permits required for mitigation work will be the responsibility of CICWCD; • Damage to infrastructure shall be repaired, fissures filled, and drainage provided to prevent flooding and the formation of new lake or playa areas per the approved plans and specifications; and • If warranted based on the geotechnical subsidence investigation and ongoing physical inspection, implement an infrastructure, drainage, and fissure monitoring and maintenance program and recommend additional protective/response actions as warranted to protect public health and welfare.	Plans and specifications for earthwork or infrastructure repair.	At least 90 days prior to be-ginning work.	One time	CICWCD	BLM
		Proof that all required permits and approvals have been obtained for mitigation work.	Prior to beginning work.	One time	CICWCD	BLM
		As-built drawings and construction records.	Within 90 days after work completion.	One time	CICWCD	BLM
		Infrastructure, Drainage, and Fissure Monitoring and Maintenance Plan describing monitoring and maintenance program and recommendations for additional protective/response actions as warranted to protect public health and welfare submitted to DWRi and BLM.	Within 90 days of submitting Geotechnical Subsidence Report.	One time	CICWCD	BLM