GEOTECHNICAL AND
WATER RESOURCES ENGINEERING

FEASIBILITY STUDY REPORT

SAN JUAN HEADWATERS STORAGE PROJECT

ARCHULETA COUNTY, COLORADO

Submitted to
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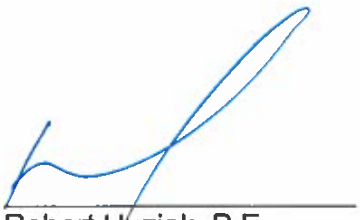
Project 25127



Robert Huzjak, P.E.
Project Manager

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

SECTION 1 - INTRODUCTION

1.1 Purpose

The purpose of this Feasibility Study Report (Report) is to present the methodology, results, and conclusions of the screening-level water storage evaluation performed by RJH Consultants, Inc. (RJH) for the San Juan Headwaters Storage Project (Project). This report was prepared by RJH on behalf of San Juan Water Conservancy District (SJWCD) to support a Small Storage Grant application from the United States Bureau of Reclamation (Reclamation) to advance planning, permitting, and design of the Project. The Project meets the requirements of Reclamation's Small Storage Program under section 40903 of Pub. L. 117-58 and as amended by Pub. L. 117-328.

1.2 Project Sponsor

The Project sponsor is SJWCD. SJWCD was formed in 1987, in accordance with the Water Conservancy Act, with a decree to conserve, maximize, and utilize the water resources of the San Juan River and its tributaries (Archuleta, 1987). The primary focus of SJWCD is managing the water rights ceded to the district upon its formation and exploring water storage options for the upper San Juan River basin. As an active leader in water resources issues in the upper San Juan River basin, SJWCD is pursuing construction of a new water storage reservoir to address the lack of regional water storage, facilitate water conservation, and ensure a reliable future water supply for the community.

SJWCD is funded through a mill levy that provides approximately $100,000 per year. Their funding is limited compared to other utility districts that provide water directly to municipal users. This limited funding emphasizes the need to work with Federal, State and private partners to find additional funding so SJWCD can fulfill its mission to meet the water needs of the region.

1.3 Study Area

SJWCD is located in Archuleta County in the southwestern portion of Colorado near the border with New Mexico. The SJWCD district boundary is about 100 square miles and generally includes the Town of Pagosa Springs (Pagosa Springs) and surrounding unincorporated areas. The district boundary contains about 90-percent of the County population (SJWCD, 2017).

The study area for constructing a new water storage reservoir is an approximate 10 square mile area located within the SJWCD district boundary, northeast of Pagosa Springs and east of the San Juan River and U.S. Highway 160. This area was selected based on its proximity to Park Ditch and the Dry Gulch site. SJWCD maintains shares in Park Ditch on the Dry Gulch site. Additional information regarding water rights is presented in Section 2.

The Dry Gulch site was jointly purchased by SJWCD and Pagosa Area Water and Sanitation District (PAWSD) in 2008 with the intent of constructing a new water storage reservoir at the site. PAWSD is the municipal water supplier for the Town of Pagosa Springs (Pagosa Springs) and some of the surrounding area. A plan of the study area is presented on Figure 1.1. Additional information on the Dry Gulch site is presented in Section 6.

1.4 Scope of Services

RJH is the prime consultant for the Project and led engineering analyses, alternatives evaluations, facilities layout, and development of cost estimates and provided overall project management and coordination. ERO Resources Corporation (ERO) performed environmental permitting evaluations as a subconsultant to RJH. Bohannan and Huston, Inc. (BHI) performed inflow hydrology analyses as a subconsultant to RJH. The RJH Team performed the following work tasks:

- Participated in a combined kickoff meeting and site visit.
- Performed a literature search to obtain available published information. Reviewed the collected data along with other data provided by SJWCD.
- Developed a topographic base map using publicly available U.S. Geological Survey (USGS) digital elevation mapping.
- Developed a preliminary purpose and need statement.
- Identified potential screening-level alternatives.
- Performed simplified engineering analyses to select sizes and configurations for embankments, spillways, outlet works, pipelines, and other key facilities.
- Developed screening-level figures to illustrate project components.
- Developed an American Society for Testing and Materials International (ASTM) E2516 Class 5 opinion of probable costs for each configuration.
- Performed a screening-level economic evaluation to evaluate life cycle costs for each configuration.

- Prepared a preliminary risk evaluation that includes technical and engineering, construction, environmental, regulatory, economic, water rights, operational, and maintenance.
- Performed a desktop study of existing environmental and cultural resources. Identified potential environmental permitting considerations.
- Identified potential legal requirements that could impact Project development.
- Prepared this Report.

1.5 Project Configurations

RJH evaluated two configurations at the Dry Gulch Site.

- Configuration 1: 11,000 ac-ft reservoir.
- Configuration 2: 4,000 ac-ft reservoir.

Additional information on the configurations is presented in Section 6.

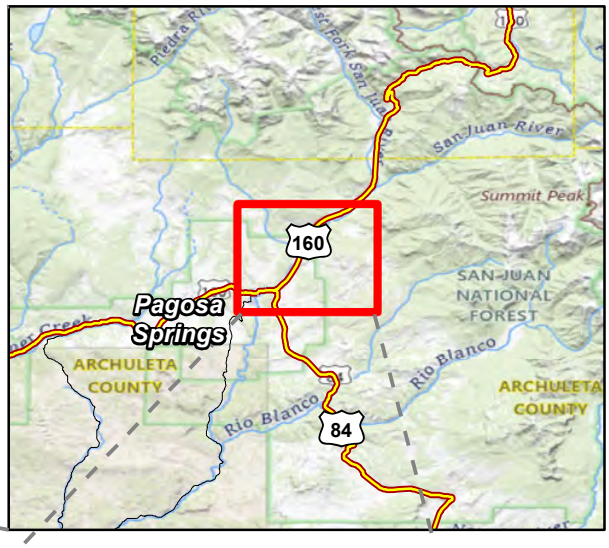
1.6 Project Personnel

The following personnel from the RJH Team are responsible for the technical work contained in this Report:

Project Manager	Robert Huzjak, P.E. (RJH)
Engineering Manager	Eric Hahn, P.E. (RJH)
Lead Geotechnical Engineer	Adam B. Prochaska, P.E., P.G. (RJH)
Lead Civil and Hydraulic Engineer	Chris Leclair, P.E. (RJH)
Lead Hydrologic Engineer	Rifka Wine, P.E. (BHI)
Lead Environmental Permitting Specialist	Kathy Croll (ERO)
Staff Engineer	Stephen Gialamas, EIT (RJH)
Technical Review	Craig Hoover, P.E. (BHI)

The work presented in this Report was coordinated and overseen by SJWCD. SJWCD also provided key information for multiple sections of the Report.

PROJECT VICINITY MAP
(NOT TO SCALE)



PROJECT LOCATION MAP
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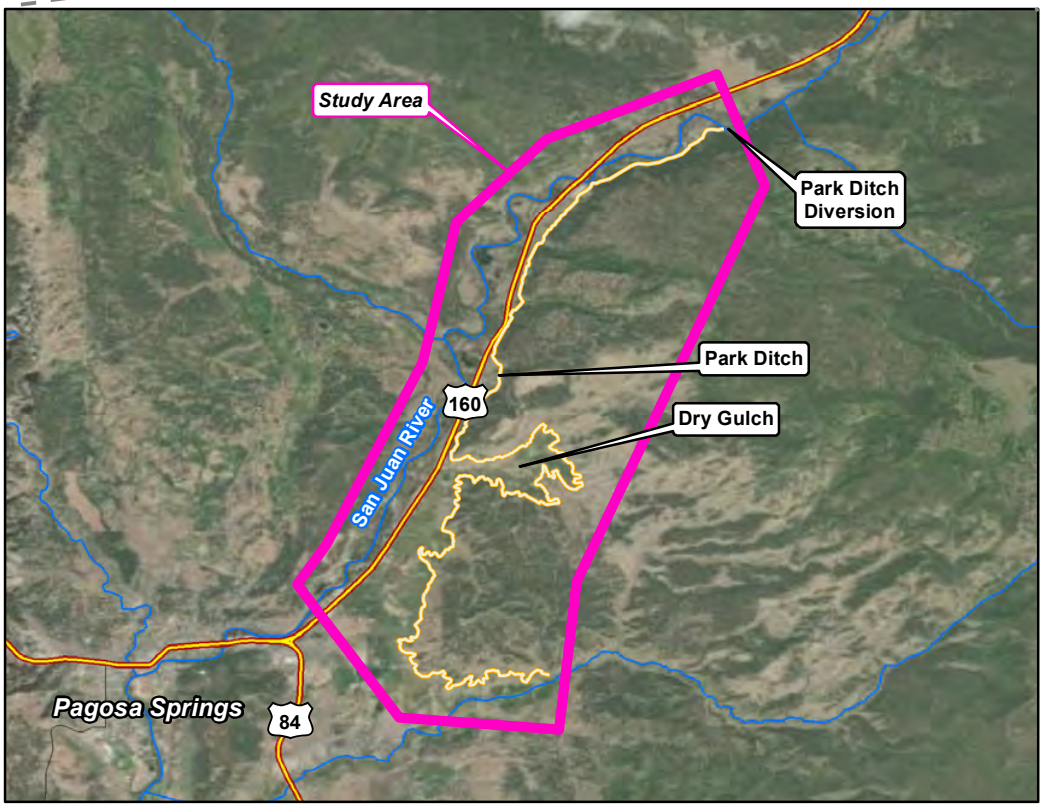

STUDY AREA MAP
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RJH CONSULTANTS, INC.	SAN JUAN HEADWATERS STORAGE PROJECT	STUDY AREA AND LOCATION MAPS
	PROJECT NO. 25127	February 2026 **Figure 1.1**

SECTION 2 - PURPOSE AND NEED

2.1 Project Purpose and Need

Current water uses in the region include municipal, rural residential, agricultural, tourism, recreation, industrial, and environmental. Seasonal demand varies considerably. Water storage in the District is limited, and future population growth, climate change impacts, lack of redundancy, and variable demand are expected to result in water scarcity in the District, adversely impacting the economy and residents.

The economy of the region is heavily reliant on agriculture, tourism, and recreation. These uses result in considerable seasonal spikes in water demand. The existing municipal water supply and distribution system are managed by PAWSD. Most of their current water needs are met by direct flows from a diversion along Four Mile Creek and two along the San Juan River: one on the mainstem and one on the West Fork. Existing raw water storage reservoirs connected to the PAWSD water distribution system can store up to about 4,000 ac-ft. However, not all of this storage is dedicated to water supply. The system currently has inadequate redundancy to provide a reliable water supply for a prolonged drought or if water quality in the source rivers is adversely impacted by wildfires or pollution. In addition, the population growth of Archuleta County was about 13-percent from 2010 to 2023 (Census, 2020) and is expected to continue to grow at a similar rate, which will magnify the demand for water.

Climate change is also reducing the duration of high flows in the rivers, which is shortening the river recreation season and adversely impacting the economy and residents. The frequency and severity of wildfires have also increased in the past decade, and the probability that wildfire will impact the basins above the existing diversion points along the San Juan River and Four Mile Creek is increasing with potentially severe impacts.

These concerns could be mitigated through additional water storage to create redundancy and provide consistent water access to those served by SJWCD. Therefore, SJWCD is proposing a new water storage reservoir within the study area. This reservoir would serve SJWCD's mission and purpose and assist with meeting current and future water needs, provide water to restore a portion of the recreation season, and create redundancy and reliability in the municipal water system to safeguard against impacts resulting from wildfire and drought.

With increased wildfire risk, uncertainty about population growth, changes in water demand, and limited water storage and transportation infrastructure, the lack of long-term storage and a stable water supply is an urgent issue that SJWCD must address.

The Project would allow for the use and continued protection of existing water rights overseen by SJWCD. The Project would provide resiliency against drought and potential contamination, flexibility in meeting demand, and redundancy in water storage in the Upper San Juan River Basin and would allow for stability and continued water availability for varied uses.

2.2 Water Supply

2.2.1 Water Storage Facilities

PAWSD currently maintains a reservoir system that provides approximately 4,000 acre-feet of water storage. However, not all of this storage is dedicated to water supply as houses with boat docks are located around the perimeter of several of the reservoirs. In addition, we understand some of these reservoirs may slowly be filling with sediment and experiencing increased turbidity when the reservoir levels are lowered. These facilities are hydraulically connected to the PAWSD water treatment facilities. Individual reservoirs include:

- Lake Hatcher: 880 ac-ft
- Steven Lakes: 1,730 ac-ft
- Lake Pagosa: 920 ac-ft
- Village Lake: 228 ac-ft
- Lake Forest: 269 ac-ft

We understand that PAWSD does not currently have plans to build a new water storage reservoir. SJWCD is primarily focused on building a new reservoir in the study area described herein.

2.2.2 Water Rights

SJWCD and PAWSD maintain a conditional water right for the Project, Water Rights Case No. 04CW85, which has an appropriation date of December 20, 2004 (SJWCD, 2023). In addition, SJWCD maintains a second conditional water right with a 1967 appropriation date, which would be used together with the 2004 water right. The 2004

water right is for a reservoir at the Dry Gulch site with a 4,700-acre-foot first-fill volume. Stipulations associated with the water right limit annual filling to 11,000 acre-feet and a cumulative 10-year refill volume of 93,000 acre-feet. Approved uses for the water include municipal, recreation, irrigation, exchange, and augmentation. The following additional criteria are included in the water right:

- The stored water can only be used in the SJWCD and PAWSD service areas.
- The reservoir can only be filled from a) native runoff from the Dry Gulch basin, b) Park Ditch flows diverted from the San Juan River, or c) a new pumping station and diversion structure at the confluence of the San Juan River and Dry Gulch. The reservoir fill rate is limited to 50 cfs from these sources.
- The first fill can be made in conjunction with a more senior conditional water right, Decree 73-308D, which is also a storage right in Dry Gulch. This water right has an appropriation date of July 22, 1967.
- Project diversions cannot reduce flows in the San Juan River to below 60 cfs from September to February and 100 cfs from March to August because of CWCB instream flow rights.

2.3 Water Demands and Shortages

In 2022, SJWCD retained Wilson Water Group (WWG) to perform a water supply, demand, and shortage analysis on the upper San Juan River Basin to inform this Project. The analysis considered the following demand categories: municipal, agricultural, environmental, and recreational. A summary of the 2022 WWG analysis is provided in the following sections.

2.3.1 Municipal

PAWSD is the largest municipal water supplier in the San Juan basin, and the PAWSD service boundary generally overlaps with SJWCD. PAWSD serves Pagosa Springs and the surrounding subdivisions and rural areas. A significant portion of the development in and around Pagosa Springs supports a temporary resident population comprised of vacation rental units and secondary homeowners. The area attracts year-round tourism for outdoor activities including skiing, rafting, fishing, hiking, hunting, biking, and the hot springs.

WWG performed a municipal demand forecasting analysis from 2020 to 2050 based on following growth scenarios:

- Low: 1.7 percent growth

- Medium: 2.6 percent growth
- High: 5 percent growth for 10 years and then 2 percent growth for 20 years

WWG used a per capita usage rate of 226 gallons per day to forecast the increase in demand, which included residential, irrigation, commercial, and system water loss. This estimate of per capita water usage was based on historical use data from the 2008 PAWSD Water Conservation Plan. A summary of projected increases in municipal demand is presented in Table 2.1.

TABLE 2.1
2050 PROJECTED MUNICIPAL DEMANDS

Parameter	Current (2020)	2050 Projections		
		Low (1.7% Growth)	Medium (2.6% Growth)	High (5% for 10 Years, 2% After)
Population	10,025	16,623	21,662	24,979
Gallons Per Capita Day (GPCD)	226	226	226	226
Demand (acre-feet)	2,536	4,208	5,481	6,323

The projected 2050 municipal demand ranged from about 70 to 150 percent higher than the 2022 municipal demand.

2.3.2 Agricultural

WWG performed an evaluation of agricultural water shortages based on estimates of demand of irrigated acres in the PAWSD service area and historic consumptive use recorded by Division of Water Resources from 1990 to 2019. Agricultural water shortages occurred every year between 1990 to 2019 and ranged from a low of 50 acre-feet in 2004 to a high of 5,000 acre-feet in 2002. The average agricultural water shortage during this time frame was 1,200 acre-feet. WWG considered that all shortages were caused by physical and legal water limitations, not selective reduction of irrigation for grazing land.

2.3.3 Environmental and Recreational

The 2022 WWG report considered the following environmental and recreational demands:

- CWCB instream flow and bypass flows requirements.

- Recreation needs including fishing (bank fishing, wading, floating) and whitewater activities (rafting, kayaking, tubing).
- Flow requirements to support river health in the San Juan River (i.e., sediment transport, etc.).

WWG developed three scenarios to estimate cumulative environmental and recreational demands:

- Minimum – Meets the minimum instream flow demands in the mainstem of the San Juan River. These flows are sufficient to support recreational flows for tubing but not wade fishing or float fishing. These flows are not sufficient to meet stipulated environmental bypass flows or sediment transport flows.
- Mid-range – Meets stipulated environmental bypass flows. These flows are sufficient to meet recreation for wade fishing and tubing but not float fishing. These flows are not sufficient to meet sediment transport flow requirements.
- Maximum – All flow demands for environmental and recreational are reasonably met. Only the moderate or higher flows required for float fishing cannot be met.

Comparing these demands to USGS stream gauge data from 1990 to 2021, the average annual shortages for each scenario were calculated to be about 1,300 acre-feet, 6,300 acre-feet, and 68,600 acre-feet, respectively, for the minimum, mid-range, and maximum demand scenarios.

2.3.4 Total Demands and Shortages

Based on the analyses described above, WWG developed three scenarios to estimate total projected demands for the Project in 2050:

- Low Demand – Low municipal growth scenario, minimum environmental and recreational scenario, and historical agricultural shortages.
- Mid-range Demand – Medium municipal growth scenario, mid-range environmental and recreational scenario, and historical agricultural shortages.
- High Demand – High municipal growth scenario, high environmental and recreational scenario, and historical agricultural shortages.

A summary of projected average annual shortages in 2050 is presented in Table 2.2.

TABLE 2.2
PROJECTED AVERAGE ANNUAL SHORTAGE IN 2050

	Low-Demand Scenario	Medium-Demand Scenario	High-Demand Scenario
Shortage Volume (acre-feet)	4,100	11,000	73,000

2.3.5 Reservoir Sizing

WWG performed a water availability analysis to develop sizes for potential reservoirs at the Dry Gulch site to meet the water shortages described above. Potential reservoir sizes were developed based on topographic limitations at the site and a 50 cfs inflow rate and are presented in Table 2.3.

TABLE 2.3
RESERVOIR SIZES TO MEET DEMAND SCENARIOS

	Low Demand Scenario	Mid-Range Demand Scenario
Potential Reservoir Size (acre-feet)	1,600	10,000

The high demand scenario described above cannot be met regardless of reservoir size because the required inflow rate would exceed the 50 cfs conditional water right. For this reason, WWG used a 10,000-acre-foot reservoir volume as the benchmark to evaluate capacity to meet the mid-range 2050 demands. This reservoir would be able meet the projected mid-range 2050 municipal demands every year during the evaluated period and could meet all other mid-range demands (environmental, agricultural, recreation) in 19 of 29 years. Using river flow data from 1990-2019 does not account for decreases in flow that could occur because of climate change.

The 2022 WWG study substantiates the need for additional storage in the upper San Juan basin. The WWG study report is provided in Appendix A.

2.4 Water Quality and Wildfire Resiliency

Increasing wildfire risk is a primary concern for SJWCD and Colorado, more broadly. Eight of the 10 largest wildfires in Colorado state history have occurred since 2012, and the statewide wildfire quantity and average size have increased dramatically since the 1990s (Barbier, 2025). In 2012, the Little Sand Fire ignited in Archuleta County under

extreme drought conditions and burned nearly 25,000 acres (NOAA, 2025). About 50-percent of the Archuleta County land area is the San Juan National Forest, which is generally at very high fire danger levels during warmer and drier months. Several forest fires including the 2013 West Fork Fire, 2022 Plumtaw Fire, and 2023 Quartz Ridge Fire have impacted or threatened SJWCD and PAWSD resources directly (SJWCD, 2025).

SJWCD is concerned that a wildfire could significantly impact water quality at PAWSD's direct diversions at Four Mile Creek and the San Juan River, which is their primary source of water supply. In addition, a wildfire could impact water quality in the existing PAWSD's water storage reservoirs, which all receive direct runoff from the Martinez Creek watershed (SJWCD, 2025) and are therefore vulnerable to a single wildfire event. Significant post-fire mitigation may be required to reclaim supply reservoirs, treatment facilities, and conveyance infrastructure following a wildfire in the Four Mile Creek, San Juan River, and Martinez Creek drainages.

The Project would improve wildfire resiliency in the region in the following ways:

- The reservoir would provide surface water storage in the upper San Juan River drainage, lessening reliance on the direct diversions and the existing reservoirs in the Martinez Creek basin, and provide a suitable water supply if a wildfire impacts these resources.
- The Project reservoir is not on the mainstem of the San Juan River and would only receive direct runoff from Dry Gulch Watershed, which is a relatively small (approximately 3.3 square mile) drainage basin tributary to the main San Juan River; this reduces the potential for direct wildfire runoff to impact the Project reservoir.

SECTION 3 - SMALL STORAGE OPPORTUNITIES

3.1 General

This section provides information about storage opportunities and the basis for the Project. The opportunity is primarily based on conditional water rights that enable water diversion and storage in a new reservoir at the Dry Gulch site, which is already co-owned by SJWCD. The stored water has a basis for use in the local water market, especially considering future growth and demand in the region.

3.2 Beneficial Uses

SJWCD anticipates that the additional water storage provided by the Project would provide the following benefits:

- Water supply reliability: The Project would increase the community's water storage by 11,000 ac-ft, lessening reliance on the direct diversions. The Project would also provide significant wildlife resiliency benefits by providing a water storage reservoir that would not be impacted by a wildfire in the Four Mile Creek, San Juan River, or Martinez Creek watersheds.
- Environmental: Strategic releases could be made to the San Juan River to offset shortages needed to achieve desired peak flow rates for sediment transport issues. Also, the stored water would provide additional sources to meet shortages for required environmental inflows and bypass flows.
- Agriculture: Strategic releases could be used for irrigation in dry years.
- Recreation and tourism: The reservoir could be used for boating and fishing. Strategic reservoir releases could be performed to provide increased water in the San Juan River for fishing and whitewater activities.

3.3 Potential Stakeholders

We have developed a list of potential stakeholders that could either be impacted or could benefit from advancement of the Project. Statements of support from these stakeholders have not been solicited at this stage of the Project. We anticipate potential stakeholders would advocate for the Project within the community, provide input and some potential ideas, and potentially assist with funding.

- PAWSD and PAWSD Customers: As the municipal water supplier for Pagosa Springs, PAWSD could benefit substantially from the Project with increased water supply reliability and wildfire resiliency for its customers.
- Colorado Parks and Wildlife (CPW): CPW is a state agency that manages 43 Colorado State Parks and 350 State Wildlife Areas. CPW has been a project stakeholder for new dam projects in the State of Colorado in recent years. For example, CPW has a significant stakeholder position in Northern Water's Chimney Hollow Reservoir Project, which is nearing completion and includes a new dam with an approximately 90,000-acre-foot capacity. CPW's stakeholder position generally focuses on environmental stewardship, wildlife and habitat protection, and public access and recreation (Northern, 2025). CPW could possibly assume a similar role for this Project. The closest CPW facilities to this Project include:
    - Echo Canyon Reservoir – This reservoir is a State Wildlife Area about five miles south of Pagosa Springs with a surface area of about 211 acres (CPW, 2025b).
    - Navajo Reservoir – This is an approximately 15,600 surface acre reservoir in both Colorado and New Mexico and owned by Reclamation (Reclamation, 2025). CPW operates the portion of the reservoir in Colorado as a State Park. This State Park is located about 35 miles southwest of Pagosa Springs.

There is a basis for CPW support in this area of the state and likely the recreational demand to support an additional reservoir facility, possibly motivating CPW interest in the project.

- Colorado Water Conservation Board (CWCB): CWCB is a state agency dedicated to the conservation, development, protection, and management of Colorado's water for future generations. SJWCD has a working relationship with CWCB and has received financial support in the past, including to purchase the Dry Gulch site. CWCB is aware of this project and has an incentive to construct the project to support their instream environmental water right in the San Juan River.
- Upper San Juan Watershed Enhancement Program (WEP): Upper San Juan WEP is a community group that works to improve water supply and quality in the San Juan basin for various agricultural, environmental, municipal, and recreational water users. San Juan WEP may consider supporting the project if environmental and water quality benefits are demonstrable and could assist with marketing the project to other potential stakeholders by performing studies to evaluate Project benefits.
- Pagosa Springs: Outdoor tourism is an established aspect of the region's economy, and this Project would provide an additional opportunity for water

recreation close to Pagosa Springs. The reservoir could also be used to augment water supplies in the San Juan River and maintain river recreation during periods of drought. Archuleta County and Pagosa Springs is likely to have strong interest in the Project because the reservoir would add a recreational amenity that could generate additional revenue from recreation and tourism.

- Park Ditch Company: The Park Ditch Company serves several older ranch properties on the east side of the San Juan River with irrigation water. The landowners cooperatively maintain the ditch. Water rights date back to the early 1890s (Hudson, 2023). A new reservoir at the Dry Gulch site would intersect the existing ditch, and additional facilities on the ditch would be required to fill the reservoir and bypass ditch flows around the reservoir.

3.4 Water Market

Water markets studies have not been performed for this Project yet. We anticipate that PAWSD would be a major purchaser of water in the future. We also anticipate that the reservoir could be used to generate money from recreation.

If the Project design is advanced, SJWCD plans to engage developers in discussions regarding a private-public partnership to develop potentially develop the site around the reservoir to generate funding for construction. Additional information on this concept is presented in Section 10.

3.5 Regulatory Agencies

Design and construction of the Project would require obtaining dam safety, environmental, cultural, and local permits. Anticipated regulatory agencies and corresponding permits are described below.

- Colorado Office of the State Engineer (SEO): The Project would involve construction of a jurisdictional dam. The SEO is responsible for regulatory oversight of design and construction of dams in Colorado. A dam safety permit for construction of a new dam would be required from the SEO.
- Federal Nexus: The project has two potential federal nexuses:
  - A Special Use Permit (SUP) from the USFS will be required.
  - The project may receive funding from the Bureau of Reclamation (Reclamation).

Projects on federal lands or federally funded projects require compliance with the National Environmental Protection Act (NEPA), the Clean Water Act (CWA), the Endangered Species Act (ESA), and the National Historic Preservation Act (NHPA) at a minimum. If both agencies are involved, coordination between the agencies to determine which agency is lead would be required. Additional information on federal permitting process is provided in Section 8.

- U.S. Army Corps of Engineers: The Clean Water Act (CWA), under the jurisdiction of the Environmental Protection Agency, establishes a program to protect the chemical, physical, and biological quality of Waters of the United States (WOTUS) including wetlands. The U.S. Army Corps of Engineers' (Corps) Regulatory Program administers and enforces Section 404 of the CWA. Under Section 404, a Corps permit is required for the discharge of dredged or fill material into wetlands and other WOTUS (streams, ponds, and other waterbodies). Consultation with the Corps would determine which wetlands, if any, in the project area are jurisdictional based on the most recent definition of WOTUS and, therefore, what mitigation could be required for implementation of the project.
- Colorado Parks and Wildlife (CPW): Coordination with CPW would be required for high potential habitat (HPH) species (mule deer and elk) at the site and potential mitigation.
- Archuleta County: The Project site is in unincorporated Archuleta County. The county may decide to require a 1041 permit. A 1041 permit has been required in other parts of the state for construction of new reservoirs. Public notices and public hearings would likely be required as part of the 1041 permitting process. Other requirements to obtain a 1041 permit would be determined by the county as part of the permitting process.
- State Historic Preservation Office (SHPO): Cultural resources have previously been identified at the Project site. SHPO would require a Class III cultural resources survey of the Project site and likely a mitigation plan.

3.6 Other Regional Projects

We are not aware of any other water storage projects that are currently being considered in the region.

SECTION 4 - ALTERNATIVES

4.1 Previous Alternative Evaluations

Since the formation of SJWCD in 1987, the District has performed several formal and informal evaluations of potential reservoir sites that have identified the Dry Gulch Reservoir Site as a primary viable reservoir site in the SJWCD boundary. Harris Water Engineering evaluated potential reservoir sites and identified two sites: the Hidden Valley Reservoir site to store diversions from Four Mile Creek; and the Dry Gulch Reservoir site to store diversions from the San Juan River (Harris, 1989). The Hidden Valley site was purchased by a private entity and is no longer available. In 2003, Harris Water Engineering and Davis Engineering prepared another report to evaluate future water supply demands and evaluate water storage alternatives. The 2003 report considered 13 potential reservoir sites within SJWCD and again identified Dry Gulch as the most effective reservoir site. The most recent feasibility study was performed in 2017 to provide technical support for a loan application from CWCB for this Project. The 2017 report, prepared by SJWCD, identified the selected alternative for the project as the development of a 11,000 acre-foot reservoir and 50 cfs diversion at the Dry Gulch site as provided in a settlement resolving Water Court Case No. 04CW85.

4.2 Criteria

Based on the 2022 WWG study, an 11,000 ac-ft reservoir would meet the 2050 projected mid-range demand scenario and would also maximize the existing water right, which allows an annual refill up to 11,000 ac-ft. For this reason, an 11,000 ac-ft reservoir at the Dry Gulch was selected as the baseline alternative for the screening-level study presented in this Report.

In theory, other locations could be developed using this water right; however, any other site would be constrained by the following criteria:

- Capable of providing up to 11,000 ac-ft of storage.
- Located within the SJWCD boundary.
- Located near Park Ditch to accommodate ditch diversions to fill the reservoir.
- Located at or near the Dry Gulch site because the water rights diversion for the reservoir must be located near the confluence of Dry Gulch and the San Juan River.

In addition, RJH considered the following alternatives as required by Reclamation:

- No Federal Funding Alternative – This alternative represents the status quo for SJWCD, including any actions the District would take if federal funding was not available to construct a storage project.
- Non-Structural Alternative – This alternative considers actions to solve water supply deficiencies without constructing a small storage project.

4.3 Storage Alternatives

4.3.1 General

RJH considered potential sites within the study area shown on Figure 1.1. We performed a desktop review of topographical data and aerial imagery along Park Ditch within the study area. Based on this review, we identified only one feasible reservoir site (other than the Dry Gulch site) about 0.5 miles south of Dry Gulch. This site is accessible from US Highway 160 by Paul Hood Place and is referred to as the Hood Site herein. A plan of both reservoir sites is provided on Figure 4.1.

4.3.2 Dry Gulch Site

Dry Gulch is an approximately 3.3 square mile ephemeral drainage located about three miles northwest of Pagosa Springs along Highway 160 on the east side of the San Juan River Valley. The Dry Gulch drainage basin would not yield adequate supply to fill and maintain a reservoir at the Dry Gulch site. A reservoir at this site would be filled primarily by water from Park Ditch or the San Juan River as described in the preceding sections.

The reservoir site is intersected by Park Ditch, which is an irrigation ditch that diverts from the San Juan River about three miles north of Dry Gulch and delivers water to rural shareholders downstream of Dry Gulch. Development of a reservoir at Dry Gulch would require maintaining continuity of Park Ditch across Dry Gulch.

4.3.3 Hood Site

The Hood Site does not have a prominent drainage channel and would primarily store water that was diverted from Park Ditch or the San Juan River. Park Ditch intersects this site, but the topography does not accommodate gravity inflows from the ditch. A pump station would be required for reservoir filling.

RJH used 1-meter resolution digital elevation mapping for the site to perform a screening-level layout of an embankment across the valley and estimate the storage capacity of a reservoir at this site. The storage efficiency of an embankment at the Hood Site is significantly lower than Dry Gulch. A 190-foot-tall earthen embankment would only store about 2,900 acre-feet of water, which is only about 15 acre-feet of storage per foot of embankment height, compared to an estimated 100 acre-feet per foot for an 11,000 acre-foot reservoir at the Dry Gulch site. The Hood site could potentially store a maximum of about 8,100 acre-feet.

This site was dismissed from further evaluation because it has a low storage efficiency and does not have any apparent advantages over the adjacent Dry Gulch Site. In RJH's opinion, the Dry Gulch site is the most effective reservoir storage site currently available to SJWCD for storing water in the study area, and it is already owned by SJWCD with PAWSD and financial support having been provided by CWCB.

4.3.4 Groundwater Storage

Groundwater storage was considered and dismissed as a feasible alternative for this Project because it does not utilize the existing water right and does not meet the purpose and mission statement of SJWCD, which is focused on the management and preservation of the San Juan River as a surface water resource. In addition, groundwater storage is not technically impractical for the following reasons:

- Bedrock at the Dry Gulch site is anticipated to be relatively shallow and surficial soils are predominantly fine-grained (i.e., low hydraulic conductivity and low storage capacity). These characteristics would severely limit the groundwater storage capacity.
- The San Juan River valley west of the dam and reservoir site has the potential to contain coarse alluvium (sand and gravel) that could be suitable for groundwater storage; however, we considered groundwater storage in the San Juan River valley to be impractical. The San Juan River alluvial valley is relative narrow, and an aquifer storage facility would need to encompass a significant length of valley to provide meaningful storage. This length of facility is impractical because it would significantly affect groundwater hydrology in the river valley and require excessive land acquisition.

4.4 Non-structural Alternative

A non-structural alternative for this project would likely require the following actions to increase water supply in the project area:

- Purchasing water or water rights from other entities.
- Municipal and agricultural water conservation.
- Water accounting projects to improve measurement at existing diversions.
- Developing improved water augmentation plans for the project area.
- Increasing taxes, levies, and fees to perform the above actions to a greater extent.
- Addressing leaks and other deficiencies in the conveyance system.

SJWCD routinely considers opportunities for non-structural actions to improve the water supply and management in the District. For example, Colorado's Diversion Measurement Installation Program recently worked with SJWCD to provide funding to install new measurement devices (such as a flume or weir) at diversions for agricultural users (SJWCD, 2024). While diversion improvements and similar non-structural actions are beneficial, they do not address several aspects of the purpose and need of this project, such as water supply redundancy, drought preparation, and wildfire resiliency.

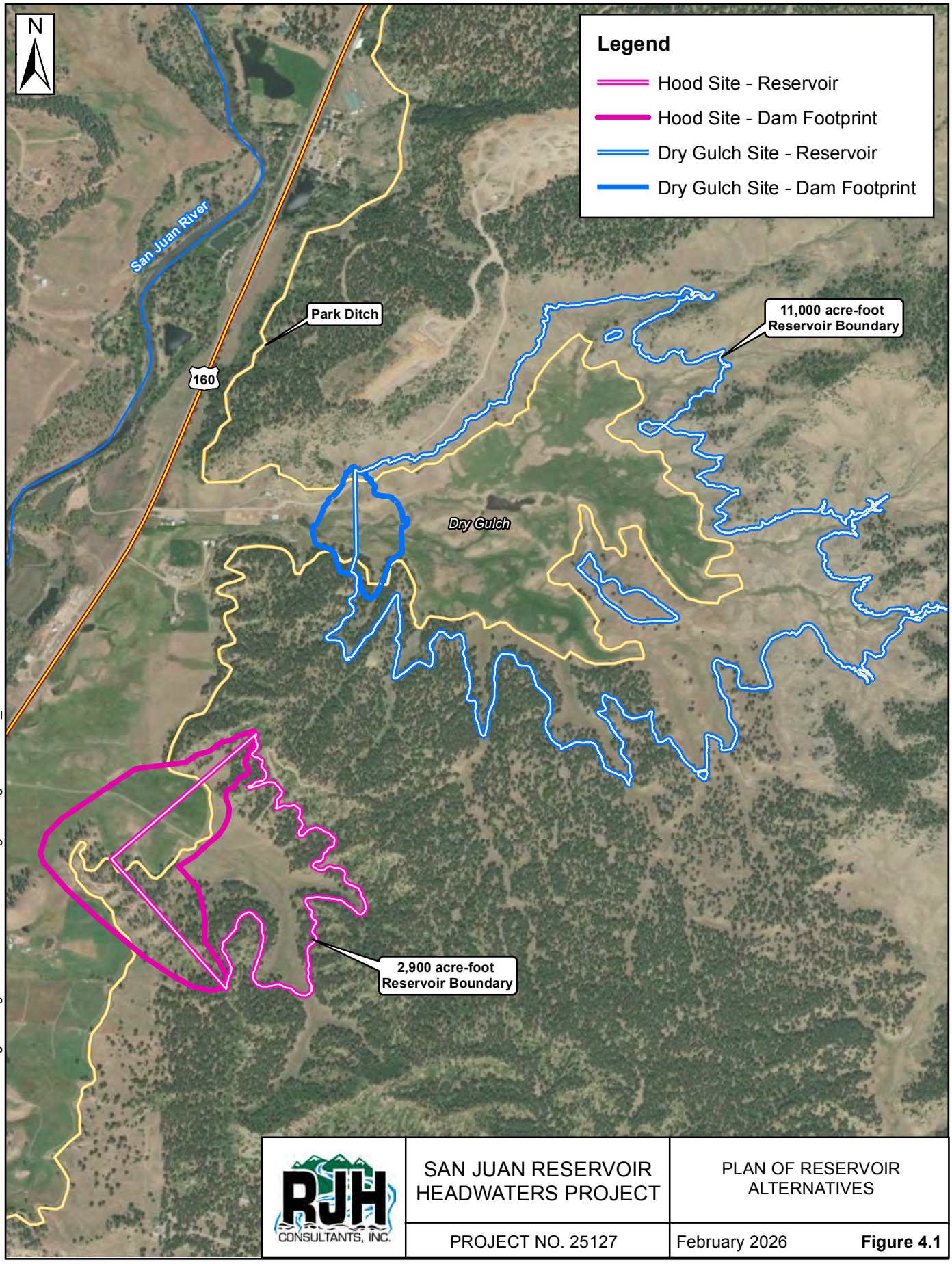
Moreover, the Pagosa Springs area is geographically isolated from other prominent water districts, limiting water purchase opportunities. A non-structural alternative is unlikely to address the purpose and need of this Project and the formulation criteria provided in Section 4.2.

4.5 No Federal Funding Alternative

The "No Federal Funding" Alternative is the baseline alternative to which all other alternatives are compared and represents the status quo of SJWCD operations. The projected water shortages and vulnerability to climate change and wildfires would not be addressed. In addition, if the project is not advanced, SJWCD's conditional water rights will expire, and the conditions of the financing agreement with CWCB to purchase the land would not be met, which may require selling the property.

4.6 Selected Alternative

The preferred alternative for this Project is a reservoir at the Dry Gulch site because it is the only alternative that meets the purpose and need in Section 2 and the formulation criteria in Section 4.2. Additional information about the proposed Project at Dry Gulch is provided in Section 6, and an economic evaluation of this alternative is provided in Section 5.



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SAN JUAN RESERVOIR HEADWATERS PROJECT

PLAN OF RESERVOIR ALTERNATIVES

PROJECT NO. 25127

February 2026

Figure 4.1

SECTION 5 - ECONOMIC ANALYSIS

5.1 Cost Opinion

RJH developed a Class 5 Opinion of Construction Project Costs (OPCC) as defined by ASTM E2516-11: Standard Classification for Cost Estimate Classification Systems. This class designation is used when the design is less than 2 percent complete. The reliability of a Class 5 OPCC is between about minus 30 to plus 50 percent. Costs are in February 2026 dollars. Cost opinions were developed by estimating quantities of primary elements of the work based on the concepts presented and unit costs developed from the following sources:

- Published and non-published bid price data for similar work.
- R.S. Means Heavy Construction Cost Data for 2025.
- Local suppliers' budgetary price quotes.
- Our previous experience and judgment.

The "Base Construction Subtotal" (BCS) component is the sum of construction costs for primary work elements. The OPCC is the sum of the BCS, construction contingencies, and engineering and administration costs and includes the following allowances:

- 2 percent of the BCS for the construction contractor's costs for bonds and insurance.
- 5 percent of the BCS for permitting.
- 15 percent of the BCS to account for design engineering and management including investigations; surveys; analyses; design documents; and construction observation, engineering, and testing.
- 15 percent of the BCS for construction engineering and testing.
- 40 percent of the BCS for design and construction contingencies. This includes an allowance for items that cannot be defined at the concept phase, unit price and quantity variations, and variable market conditions. This percentage will decrease as the Project is better defined in subsequent stages of design.

The OPCC for each configuration is presented in Table 5.1. Additional information on construction costs is provided in Appendix E.

TABLE 5.1
OPCC SUMMARY

Description	Configuration 1 ($ Million)	Configuration 2 ($ Million)
BCS	55.3	29.5
Bonds and Insurance (2%)	1.1	0.6
Permitting (5% of DCS)	2.8	1.5
Design Engineering and Management (15% of DCS)	8.3	4.4
Construction Engineering and Testing (15% of DCS)	6.7	3.6
Design and Construction Contingencies (40% of DCS)	22.1	11.8
OPCC	**96.3**	**51.4**

At this stage of design, significant uncertainties related to subsurface conditions exist because a subsurface investigation has not been performed. RJH made reasonable assumptions to develop the cost opinion. Uncertainties that could have a significant impact on the OPCC are described below:

- Required Foundation Treatments: We considered that the seepage barrier through alluvium would consist of an earthfill core trench with a double-row grout curtain along the dam centerline. We estimated the depth to bedrock and considered that the grout curtain would extend up to about 80 feet deep throughout the valley floor and about 50 feet deep in the abutments. If bedrock is shallower than estimated, the core trench will not need to be as deep. Also, if the bedrock has a lower permeability than anticipated, a grout curtain may not be required.
- Riprap and Bedding Source: We do not know if the bedrock materials at the site are appropriate for producing riprap and bedding. For the cost opinion, we assumed these materials would be imported from a regional quarry. The cost for these materials would be significantly lower if they are produced on site.

The OPCC is based on professional opinions and will change as design details are developed. Actual costs would be affected by a number of factors beyond current control, such as supply and demand for the types of construction required at the time of bidding, changes in material supplier costs, changes in labor rates, competitiveness of contractors and suppliers, availability of qualified bidding contractors, changes in applicable regulatory requirements, and changes in design standards. Conditions and factors arising as the Project proceeds from development through bidding and construction may result in constructions costs that differ from the estimate provided in this report.

5.2 Economic Benefits

A quantitative benefit-cost analysis has not been performed. This will be performed in the next stage of design if the Project receives funding. For this screening-level study, we identified the following qualitative benefits that are anticipated to result from construction of the Project:

- Increased drought and wildfire resiliency for municipal water supply
- Additional water storage for future population growth
- Increased recreational opportunities and tourism
- Additional water for irrigation
- Support river health of the San Juan River

SECTION 6 - PROPOSED PROJECT

6.1 General

RJH developed a screening-level design for a dam and reservoir at the Dry Gulch site for the purposes of evaluating project feasibility and developing a screening-level cost opinion and evaluation of possible impacts. A discussion of the screening-level design is provided below.

6.2 Existing Conditions

6.2.1 General

The Dry Gulch site (Site) consists of three parcels: 552.73 acres (main Dry Gulch), 68.11 acres next to San Juan River, and 5.49 acres immediately south of the second parcel.. The lower portion of the basin consists of wetlands and grasslands, and upper portions are predominantly scrub-land and forest. Developed features at the site include Park Ditch and gravel roadways; there are no dwellings or structures upstream of the proposed dam. The land at the Site was historically used for cattle ranching because the flat topography and grassland vegetation are favorable for grazing. SJWCD and PAWSD generally own the land at the mouth of Dry Gulch, the dam site, and most of the reservoir site. Other land ownership at the site consists of private property zoned for agriculture/ranching and San Juan National Forest. A property ownership map is provided on Figure 6.1. Additional information on wetlands is presented in Section 8.

Park Ditch begins at the San Juan River approximately 3 miles upstream of the site. The existing ditch is a trapezoidal earthen channel with a capacity of about 60 cfs and a total length of about 12.8 miles, likely constructed in the early 1900s (Hudson, 2021).

6.2.2 Site Geology

Based on published mapping (Steven et al., 1974) and previous project reports (Yeh, 2025), geologic units onsite generally include the following, from oldest to youngest:

- Cretaceous-age (66 million to 145 million years old) Mesaverde Formation (Kmv) exists beneath the proposed dam foundation and generally throughout the southwest portion of the site. This unit is reported to be up to 250 feet thick and consists of interbedded sandstone and shale, with some coal beds reported in the lower formation. (GSA, 2022).

- Cretaceous-age (66 million to 145 million years old) Lewis Shale (Kpcl) formation overlies the Mesaverde Formation and exists in the northeast portion of the site. This unit is reported to be up to 2,700 feet thick and generally consists of shale with some interbedded sandstone beds in the upper layers.
- Tertiary-age (2.6 to 66 million years old) terrace alluvium exists on top of the ridge on the north side of the valley. This deposit is expected to be up to about 50 feet thick and consist of a gravelly alluvium with clay and silt. Much of this deposit has been mined from the property for commercial aggregate production and a limited quantity is expected to remain.
- Quaternary (less than 2.6 million years old) alluvium exists in the valley floor. This unit is expected to be up to about 30 feet thick.
- In places where terrace alluvium and alluvium are not present the bedrock is expected to be covered by up to about 10 to 20 feet of colluvium.

Based data from the NRCS Soil Survey, alluvium and colluvium are expected to be predominantly fine-grained (clayey) soils with at least 50 percent fines, liquid limits of about 30 to 40, and plasticity indices of about 25 to 30. We anticipate that the plasticity and gradation composition of the alluvial and colluvial soils are also representative of the underlying bedrock.

A geologic map showing the distribution of these units is shown on Figure 6.2. Bedrock is expected to dip downward slightly to the northeast.

The following subsurface data is available near the Site:

- Three water wells have reportedly been drilled within about a half mile of the site (Yeh, 2025). We interpret that these wells are within the Mesaverde Formation. The well logs report predominantly shale bedrock and the wells yielded about 3 to 5 gpm.
- Two borings were performed at the site in 1990 (Yeh, 2025). The exact locations of these borings are unknown, but they were reportedly advanced about 600 feet apart with one hole on each side of the valley. The borings generally encountered about 12 to 27 feet of clayey soil overlying shale.

6.2.3 Hydrology

BHI performed inflow hydrology for the proposed dam in general accordance with Colorado Office of the State Engineer Dam Safety (SEO) standards and methods. Basin-specific rainfall depths and distributions were developed for the 2-hour Local Storm (LS),

6-hour LS, 72-hour General Storm (GS) and 72-hour Tropical Storm (TS) PMP events using the Regional Extreme Precipitation Study (REPS) Rainfall Estimation Tools. Hydrologic modeling was performed in the U.S. Army Corps of Engineers Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) using the Colorado State University-Soil Moisture Accounting (CSU-SMA) method. The CSU-SMA method estimates extreme flood production mechanisms by accounting for infiltration excess runoff, saturation excess runoff, and subsurface lateral flow. The Clark Unit Hydrograph (UH) method was used to estimate rainfall-runoff transformation in HEC-HMS and is generally applicable for undeveloped basins in Colorado.

The rainfall and basin runoff parameters were input into a hydrologic model in HEC-HMS Version 4.13 that included a 3.3-square-mile basin for the Dry Gulch watershed. A simulation run was developed for each of the four PMF storm events, and the runoff results for each storm event are provided in Table 6.1.

TABLE 6.1
BASIN RUNOFF (RESERVOIR INFLOW) RESULTS

PMP Storm Event	Peak Runoff (cfs)	Volume (acre-feet)
2-hr LS	2,859	1,657
6-hr LS	2,269	1,602
72-hr GS	926	1,470
72-hr TS	1,056	2,028

The SEO procedure includes verification of the model's reasonableness by evaluating if the peak flow of the PMF storm events are within the 90-percent confidence interval of the SEO's Regional Peak Flow Envelope Curve, which represents the likely PMF magnitude based on historic and paleoflood data. The peak flow of the 2-hour and 6-hour Local Storm PMFs are within the 90-percent confidence interval of the curve, generally indicating that the inflow hydrology is reasonable and suitable for use in this study. The inflow hydrology memorandum is presented in Appendix B.

6.3 Key Issues Impacting Concept Development

Based on our understanding of Project objectives, constraints, and Site conditions, RJH identified the following key considerations that influenced development of a concept:

- Depth and properties of the alluvium in the valley bottom.
- Consistency and permeability of bedrock in the valley and abutments.

- The need to construct the embankment and slope protection using onsite materials to manage Project costs.
- Gravity inflow from Park Ditch is desirable, if feasible, to avoid constructing a pump station. A pump station is less desirable because of capital and operating costs and on-going maintenance.
- Outlet works facilities will be required to convey both routine and emergency releases.
- Multi-level reservoir withdrawals may be desirable to provide flexibility to manage water quality of regulated releases from the reservoir, but this requirement is unknown at this stage of design. We have assumed a low-level outlet structure is acceptable.
- The outlet works conduit and structures should be founded on bedrock to reduce the likelihood of settlement.
- Park Ditch conveyance will need to be maintained across the site following construction of the dam and reservoir.
- The spillway will be used to control the maximum reservoir pool. The spillway should operate passively (i.e., without the use of gates or valves).
- Erosion of the spillway channel is acceptable during extreme flood events if it does not pose a risk to dam safety.
- Constructing Project facilities on SJWCD property is desirable to the greatest extent practicable.

6.4 Configurations

RJH developed screening-level concepts for the following two reservoir configurations:

- Configuration 1: 11,000 ac-ft reservoir. This is the largest possible reservoir that can be filled using SJWCD's conditional water right on Park Ditch.
- Configuration 2: 4,000 ac-ft reservoir. This is the largest reservoir size that would accommodate gravity inflows from Park Ditch near the right abutment of the dam.

A plan view of both configurations is provided on Figure 6.2. Key dam and reservoir characteristics for each configuration are presented in Table 6.2.

TABLE 6.2
DAM AND RESERVOIR CHARACTERISTICS

Parameter	Configuration 1	Configuration 2
Dam Height (ft)	109	78
Normal Storage Capacity (ac-ft)	11,000	4,000
Maximum Normal Pool Elev.(ft)	7,351	7,320
Dam Crest Elev.(ft)	7,356	7,325

6.5 Project Components

6.5.1 Overview

The primary Project components needed to address these primary issues are illustrated on Figures 6.4 to 6.11 and include:

- Embankment dam
- Outlet works
- Spillway
- Park Ditch diversion facility
- Park Ditch bypass facility

Additional information on primary Project components is described below.

6.5.2 Embankment

6.5.2.1 Design

An earthen embankment dam is a practical type of dam for this Site based on foundation conditions and available onsite borrow materials. Available borrow materials for embankment construction would include clayey soils from within the reservoir area and bedrock material excavated from the spillway channel. For this level of study, we considered that the embankment would consist of homogenous clayey fill and a filter/drainage system consisting of a chimney filter, blanket drain, and toe drain. The upstream slope would be 4.5 horizontal to 1 vertical (H:V), and the downstream slope would be 3H:1V. A 40-foot high, 80-foot-long stability berm along at the downstream toe of the dam using bedrock material excavated from the spillway channel.

We considered that much of the embankment would be founded on alluvium throughout the valley floor. The dam will likely require seepage barriers through the foundation alluvium and bedrock to reduce seepage losses and provide adequate seepage stability. The seepage barrier through alluvium could consist of an earthfill core trench or a soil-bentonite barrier wall. For this level of design, we considered that the seepage barrier through alluvium would consist of an earthfill core trench. Near the dam centerline, the core trench would be excavated through alluvium, and the embankment fill would key into bedrock to intercept potential seepage paths through the foundation alluvium.

We also considered that a double-row grout curtain would be installed along the dam alignment to reduce the hydraulic conductivity of foundation bedrock. The embankment core trench would connect to the top of the grout curtain. The drill holes in each row of the grout curtain would be angled in opposite directions to improve the likelihood of intercepting high-angle fractures. We considered that the grout curtain would extend up to about 80 feet deep throughout the valley floor and about 50 feet deep in the abutments. Foundation treatment techniques need to be re-evaluated after additional subsurface data is collected.

Gravel surfacing would be placed along the embankment crest to improve trafficability and protect the crest. The downstream slope would be covered with topsoil and vegetated with grass to reduce erosion. Upstream slope protection would consist of riprap and riprap bedding that would be imported to the site. A plan, centerline profile, and typical maximum embankment section are shown on Figures 6.4, 6.5, 6.6, 6.8, 6.9, and 6.10. The downstream toe of the dam embankment would be about 350 feet from the property boundary, which exceeds the height of the dam and therefore complies with SEO Rules.

6.5.2.2 Stability Analyses

RJH used GeoStudio Slope/W to perform two-dimensional limit equilibrium stability analyses for one maximum embankment section and evaluated key static loading conditions that are expected to control the embankment slopes. Material properties used during stability analyses are summarized in Table 6.3. These properties were developed based on judgment and our experience with materials similar to the anticipated foundation units and available onsite borrow materials.

TABLE 6.3
SUMMARY OF MATERIAL PROPERTIES FOR STABILITY ANALYSES

	Alluvium	Embankment Fill	Mesaverde Formation	Filter Sand
Moist Unit Weight (pcf)	N/A[1]	120	N/A	130
Saturated Unit Weight (pcf)	115	125	145	135
Drained Friction Angle, Φ' (deg.)	24	26	28[2]	35
Drained Cohesion (psf)	0	0	0	0
Undrained Friction Angle Φ^R (deg.)	14	15	18	N/A
Undrained Cohesion (psf)	600	550	1000	N/A
Residual Strength Friction Angle, Φ' (deg)	N/A	N/A	15	N/A

Notes:
1. N/A means the property is not applicable to the material.
2. Drained friction angle of bedrock corresponds to the fully softened strength.

RJH evaluated the downstream slope stability for steady state seepage conditions from a full reservoir with either fully softened or residual bedrock strength. We evaluated the upstream slope stability for rapid drawdown conditions using the Duncan 3-Stage Method. We considered rapid drawdown from a full reservoir to empty. This is a standard loading condition for evaluating upstream slope stability of embankment dams; however, it is very conservative and might not be achievable because of outlet works hydraulic capacity. Based on these analyses, adequate safety factors would be provided by a 3H:1V downstream slope with a stability berm and a 4.5H:1V upstream slope. Calculated safety factors are summarized in Table 6.4. This evaluation was performed for Configuration 1 and conservatively applied to Configuration 2.

TABLE 6.4
SUMMARY OF STATIC SLOPE STABILITY RESULTS

Slope	Key Loading Condition	Calculated Safety Factor	Minimum Required Safety Factor
3H:1V Downstream Slope with Berm	Steady State Seepage from Normal Pool (Fully softened bedrock strength)	1.5	1.5
3H:1V Downstream Slope with Berm	Steady State Seepage from Normal Pool (Residual bedrock strength)	1.2	1.0
4.5H:1V Upstream Slope	Rapid Drawdown from normal pool to empty	1.3	1.3

6.5.3 Outlet Works

The outlet works would be used to enable releases from the reservoir to the San Juan River for routine operations and for emergency evacuation. This facility would consist of a low-level intake structure at the upstream toe of the dam with a guard gate and a trashrack, a conduit through the dam, a downstream valve vault, and an impact basin near the downstream toe of the dam to dissipate energy from discharges.

RJH considered an outlet works alignment near the exposed rock outcrop at the left abutment to provide a bedrock foundation. The outlet works would be installed at about the grade of the existing stream, and upstream and downstream channels would be excavated to connect the outlet works intake and discharge to the main channel of Dry Gulch. A plan and profile of the outlet works is provided on Figures 6.6 and 6.10.

Routine release requirements are not known yet; therefore, emergency release requirements were used to size the feasibility-level outlet works. For emergency releases, SEO Rule 7.8.2.1 requires that outlet works are sized to release the top five feet of the reservoir in five days and the entire reservoir in a reasonable amount of time (SEO, 2020). The conduit would need to be a 36-inch-diameter pipe for Configuration 1 and 30-inch-diameter pipe for Configuration 2, respectively. The downstream end of the pipe would bifurcate to one or more smaller pipes within a valve vault to provide smaller reservoir discharges for a broader range of operational flows. All flow meters, control valves, and operational controls for the reservoir would be provided within the valve vault.

6.5.4 Spillway

We considered the dam to be classified as an extreme hydrologic hazard because the estimated life loss of a hydrologic failure would very likely exceed 1. The Rules (SEO, 2020) require a dam to safely convey the inflow design flood (IDF) through a spillway. The IDF for an extreme hydrologic hazard dam is the PMF. The controlling storm event is the event that results in the highest reservoir water surface elevation when routed through the spillway. Based on reservoir routing in HEC-HMS, the controlling PMF event and IDF for the dam is the 2-hour Local Storm.

RJH developed a spillway design concept to convey the 2-hour Local Storm PMF event. The concept generally consists of a short approach channel, a concrete control weir to control reservoir outflow into the spillway channel, and a rock-cut spillway channel. The spillway channel would discharge to a natural drainage downstream of the left abutment of the dam, which would eventually convey flows into Dry Gulch. A plan and profile of the spillway concept is provided on Figures 6.7 and 6.11. Spillway discharge flows and channel geometries for both dam configurations are provided in Table 6.5 below.

TABLE 6.5
SPILLWAY FLOW CHARACTERISTICS AND GEOMETRY

Parameter	Configuration 1	Configuration 2
Capacity (cfs)	290	1200
Bottom Width (feet)	20	50
Side Slopes (H:V)	1.5:1	1.5:1
Channel Slope (%)	0.5	0.5
Flow Depth (feet)	2.5	5.5
Flow Velocity (fps)	5	3.5

RJH performed preliminary two-dimensional hydraulic modeling of the spillway channel and downstream drainage to evaluate velocities and erosion potential during the PMF. We expect the native rock comprising the spillway channel will withstand the approximately 5 fps spillway flow velocity. Based on engineering judgement and published literature in Hydraulic Design of Flood Control Channels (USACE, 1994), sedimentary rock can typically withstand velocities up to about 10 fps. Erosion of surficial alluvial material is expected to occur in the downstream drainage and in the valley, but this is not expected to be a dam safety concern. The PMF storm events are unlikely to produce peak flow rates or durations capable of eroding the significant volume of bedrock material between the downstream drainage and the reservoir, and erosion of the spillway during an extreme event is not expected to result in an uncontrolled reservoir release.

6.5.5 Hydraulic Conveyance Facilities

Additional hydraulic facilities would be required to bypass Park Ditch flows and fill the reservoir. Concepts for these hydraulic facilities are provided in the following sections.

6.5.5.1 Park Ditch Bypass Facilities

Park Ditch intersects Dry Gulch and continues downstream but would be disconnected if a dam was constructed across Dry Gulch. Bypass facilities would be constructed to maintain continuity of Park Ditch and deliver water to shareholders downstream of Dry Gulch. As part of the Project, SJWCD would also be required by Water Right Case No. 04CW85 to enter into an operations and maintenance agreement with Park Ditch Company.

The Park Ditch bypass would consist of constructing a gravity pipeline along the downstream slope of the dam embankment. The bypass pipe would be installed in a casing pipe to mitigate dam safety concerns. This concept would generally improve the conveyance efficiency in Park Ditch because about four miles of open ditch in Dry Gulch would be bypassed, reducing seepage and evaporation losses and maintenance requirements.

A concrete intake structure would be located at the bypass inlet along near the right abutment of the dam. An energy dissipation facility would be located at the bypass outlet. RJH performed preliminary hydraulic calculations and identified that a 24-inch diameter bypass pipe is required.

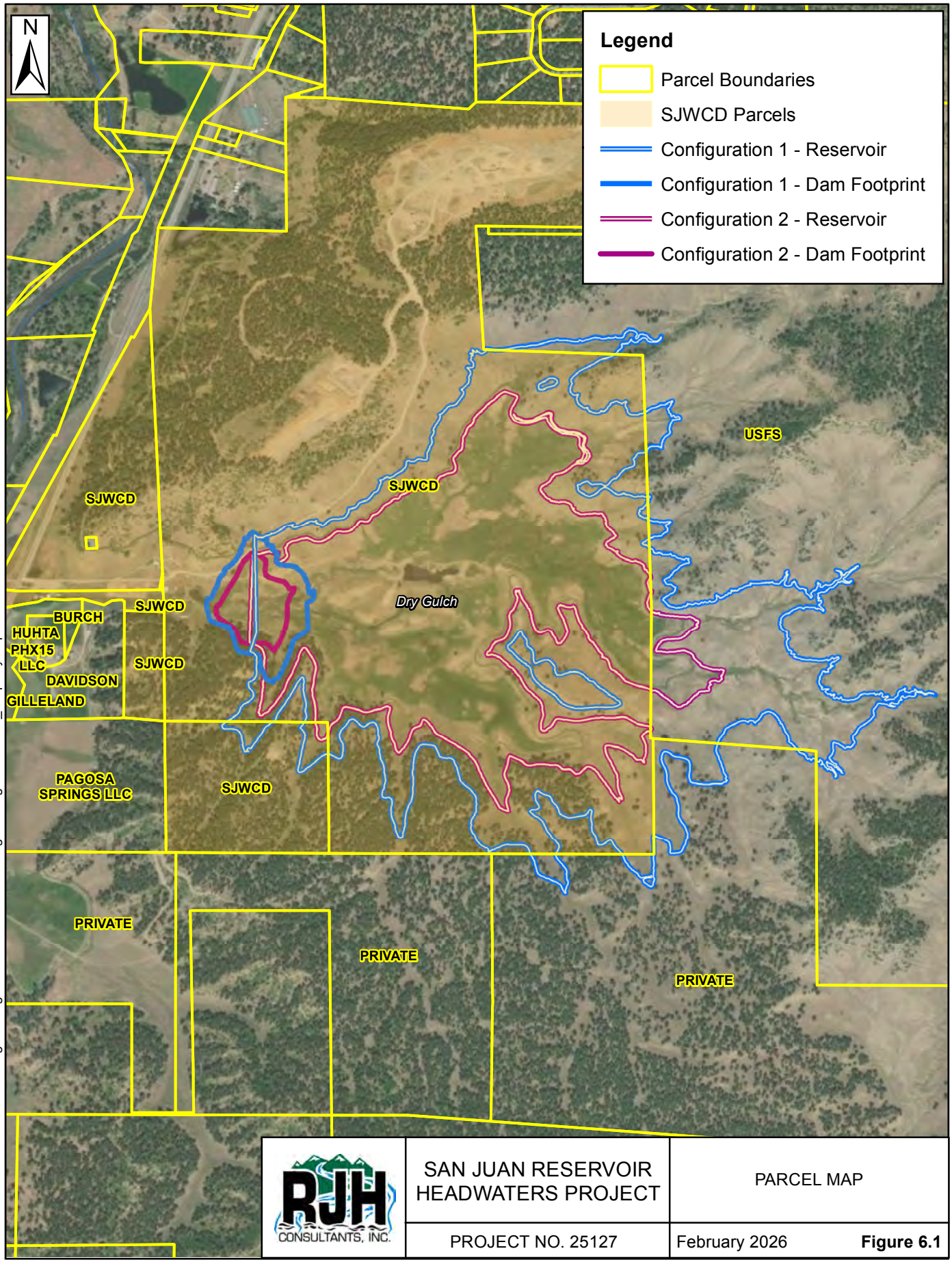
6.5.5.2 Reservoir Filling Facilities

The reservoir would be filled by diverting flow from the San Juan River through the existing Park Ditch diversion structure and irrigation canal. Park Ditch would convey reservoir filling flows (up to 50 cfs) in the ditch to the reservoir site. Flow would be conveyed from Park Ditch into the proposed reservoir in the following ways:

- Configuration 1: A pump station would be constructed near the dam to pump Project flows from Park Ditch over the embankment to fill the reservoir.
- Configuration 2: Park Ditch flows would be routed into the reservoir by gravity through the right abutment of the dam. Flow would be conveyed in a pipe and discharged into the reservoir on a concrete rundown structure.

Additional work is required to evaluate if the reach of Park Ditch upstream of the reservoir requires a) enlargement to facilitate Project diversions or b) improvements to address stability or seepage loss issues. The Project would require a conveyance agreement and coordination with Park Ditch Company.

The water right would allow for a new diversion to be constructed on the San Juan River near its confluence with Dry Gulch. This concept would be evaluated further in future phases of design is likely less desirable than a diversion from Park Ditch because a) it would require a new diversion on the river and b) costs associated for the pump station, diversion, and conveyance pipeline from the river to the reservoir would be more expensive. For these reasons, this option was not considered as part of the screening-level study.



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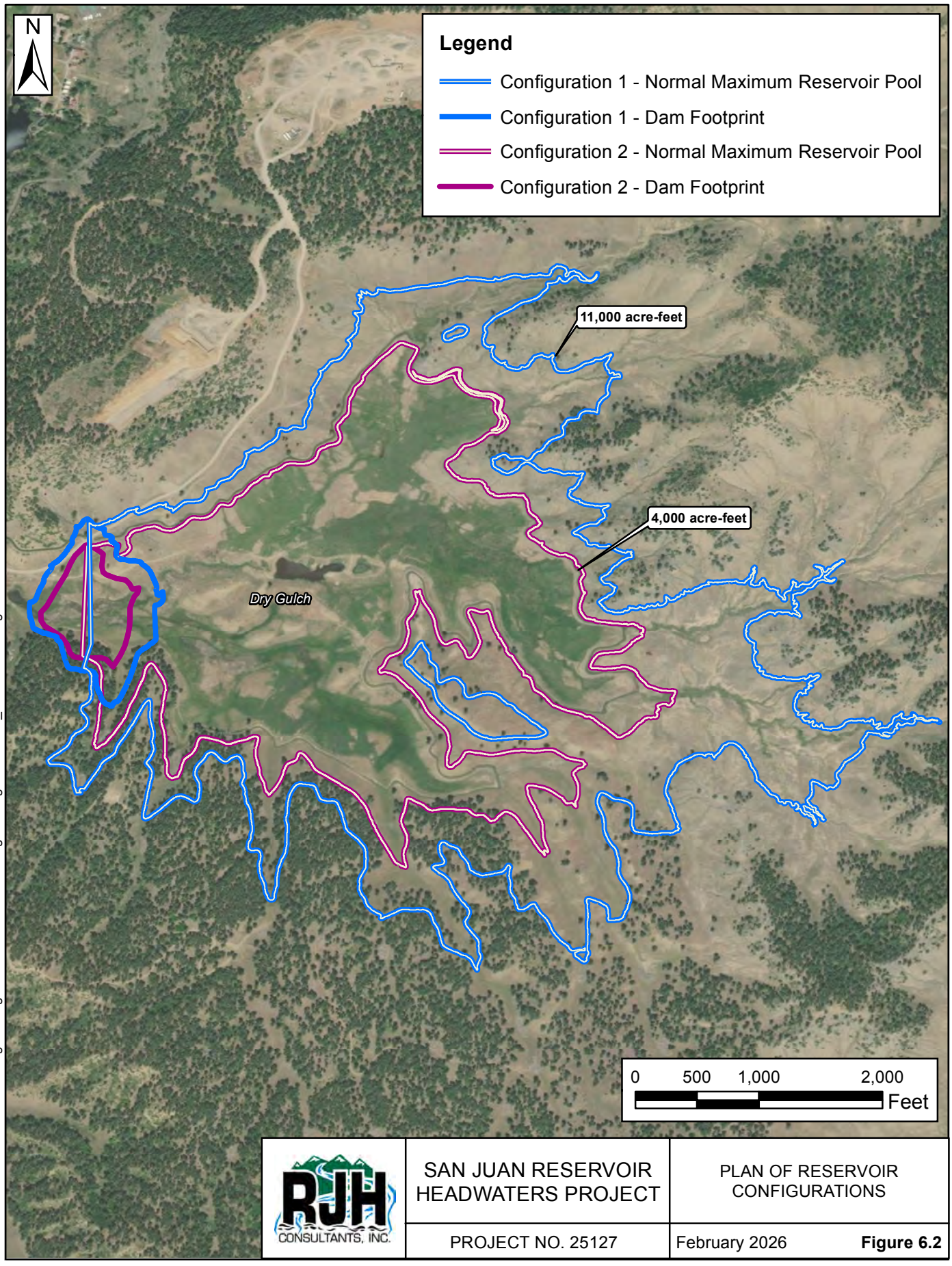
	SAN JUAN RESERVOIR HEADWATERS PROJECT	PARCEL MAP
	PROJECT NO. 25127	February 2026 **Figure 6.1**



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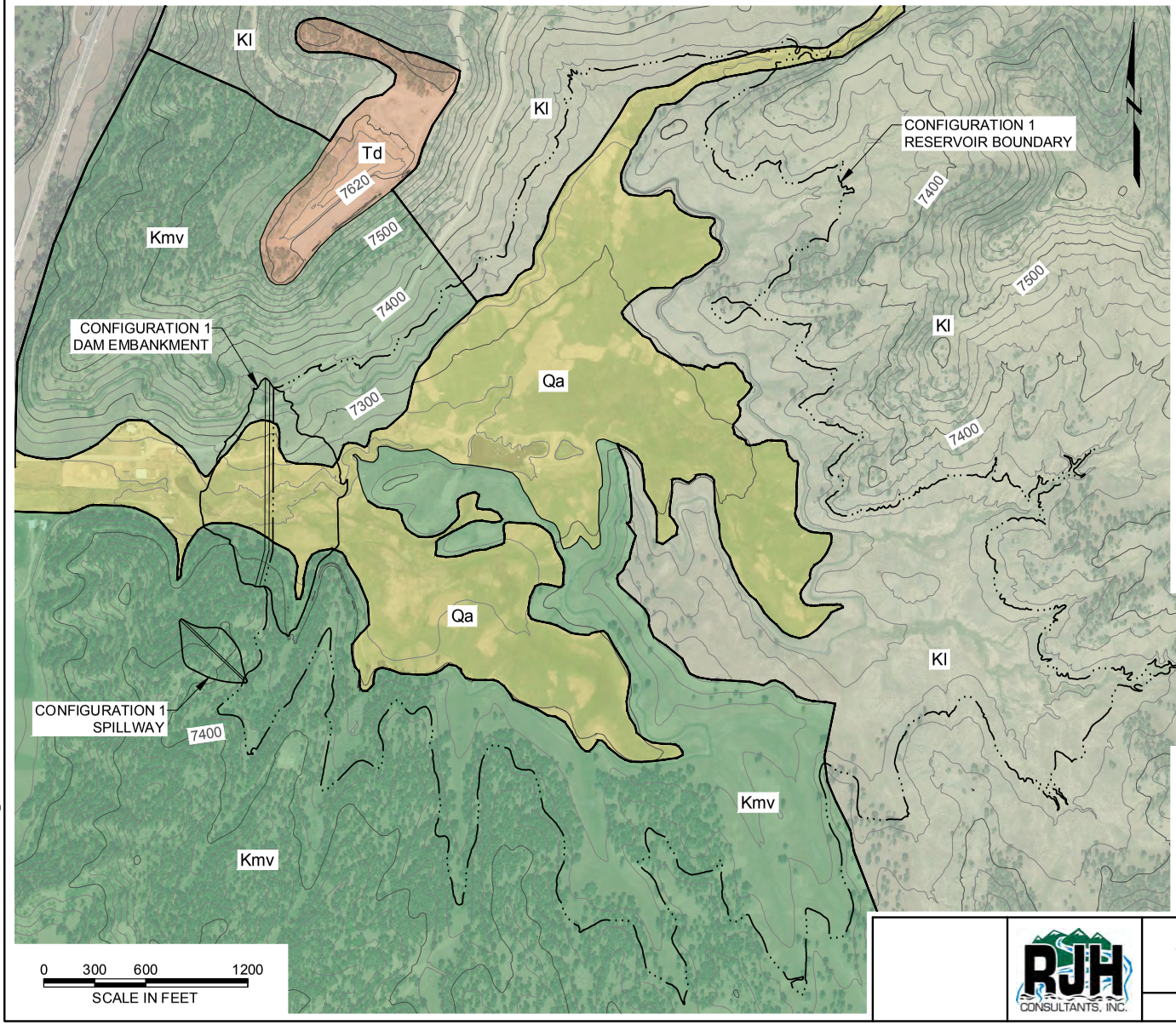
SAN JUAN RESERVOIR HEADWATERS PROJECT		PLAN OF RESERVOIR CONFIGURATIONS
PROJECT NO. 25127	February 2026	**Figure 6.2**



LEGEND

- QUATERNARY ALLUVIUM (Qa)
- TERTIARY TERRACE DEPOSITS (Td)
- CRETACEOUS LEWIS SHALE (Kl)
- CRETACEOUS MESAVERDE FORMATION (Kmv)

NOTES

1. ALL GEOLOGIC CONTACTS ARE APPROXIMATE AND ARE BASED ON PUBLISHED MAPPING BY (STEVEN ET AL., 1974) AND PREVIOUS PROJECT REPORTS (YEH, 2025).
2. BEDROCK IS INTERPRETED TO BE DIPPING DOWNWARD SLIGHTLY TO THE NORTHEAST.

PRELIMINARY
NOT FOR CONSTRUCTION

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SAN JUAN HEADWATERS STORAGE PROJECT

GEOLOGIC MAP

PROJECT NO. 25127

February 2026

Figure 6.3

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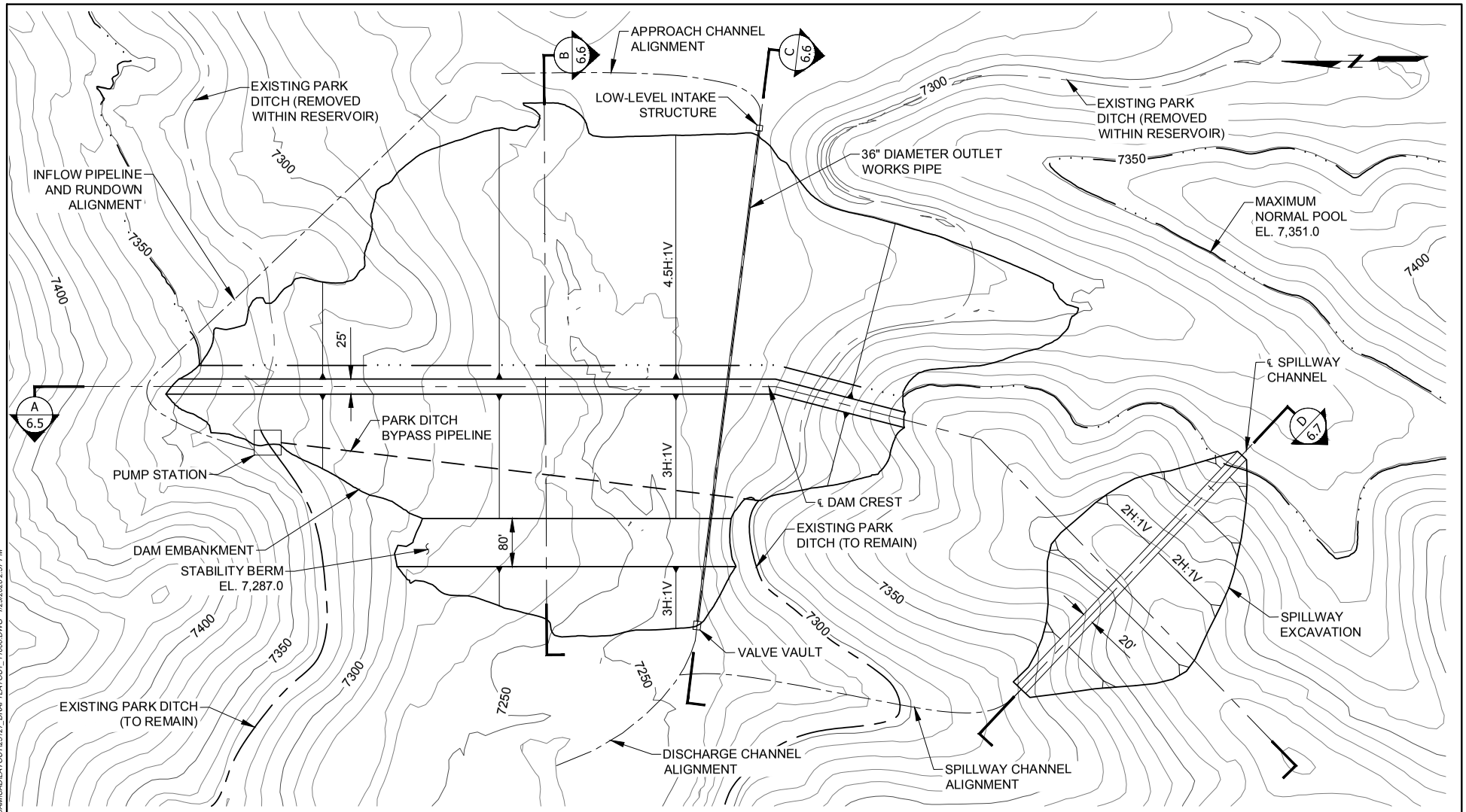

PRELIMINARY
NOT FOR CONSTRUCTION

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SAN JUAN HEADWATERS STORAGE PROJECT

PLAN OF CONFIGURATION 1 (11,000 AC-FT RESERVOIR)

PROJECT NO. 25127 | February 2026 | Figure 6.4

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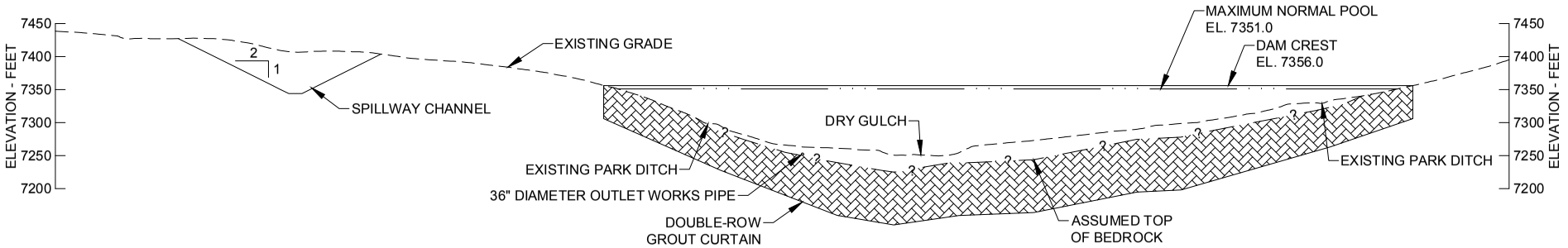

PROFILE A
DAM CREST 6.3

0 75 150 300
SCALE IN FEET

PRELIMINARY
NOT FOR CONSTRUCTION

	RJH CONSULTANTS, INC.	SAN JUAN HEADWATERS STORAGE PROJECT	CONFIGURATION 1 EMBANKMENT PROFILE (11,000 AC-FT RESERVOIR)
		PROJECT NO. 25127	February 2026 Figure 6.5

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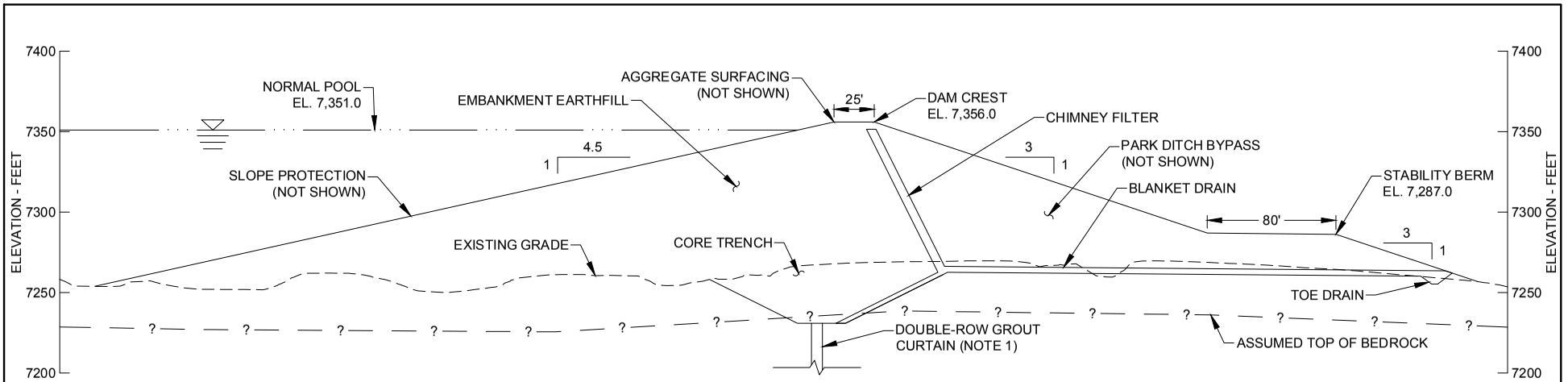
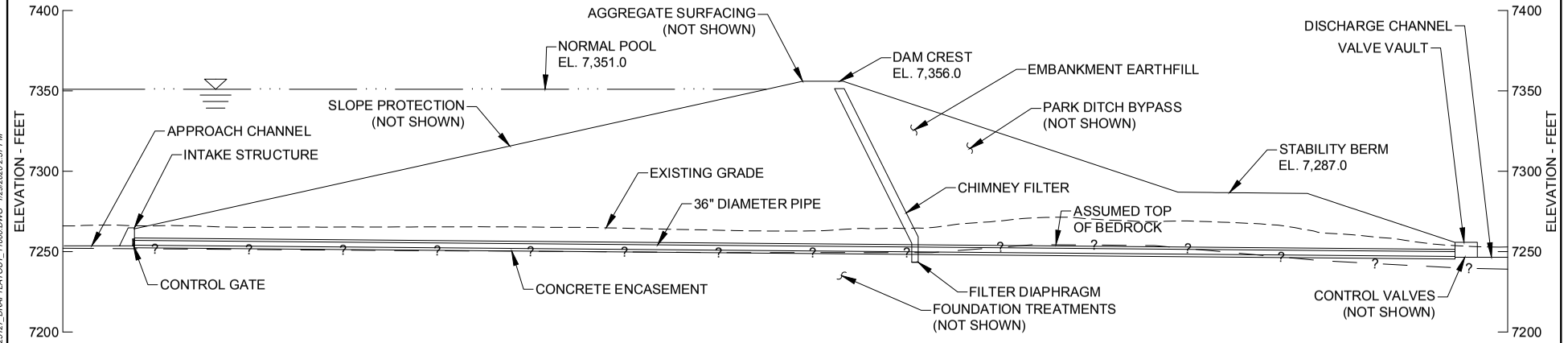


SECTION B
MAXIMUM SECTION 6.3



SECTION C
OUTLET WORKS 6.3

NOTE:
1. GROUT CURTAIN EXTENDS ABOUT 80 FEET BELOW TOP OF BEDROCK AT MAXIMUM DAM SECTION AND MINIMUM 50 FEET BELOW TOP OF ROCK AT THE ABUTMENTS.

0 30 60 120
SCALE IN FEET

PRELIMINARY
NOT FOR CONSTRUCTION

RJH CONSULTANTS, INC.

SAN JUAN HEADWATERS STORAGE PROJECT

CONFIGURATION 1
OUTLET WORKS PROFILE
(11,000 AC-FT RESERVOIR)

PROJECT NO. 25127 | February 2026 | Figure 6.6

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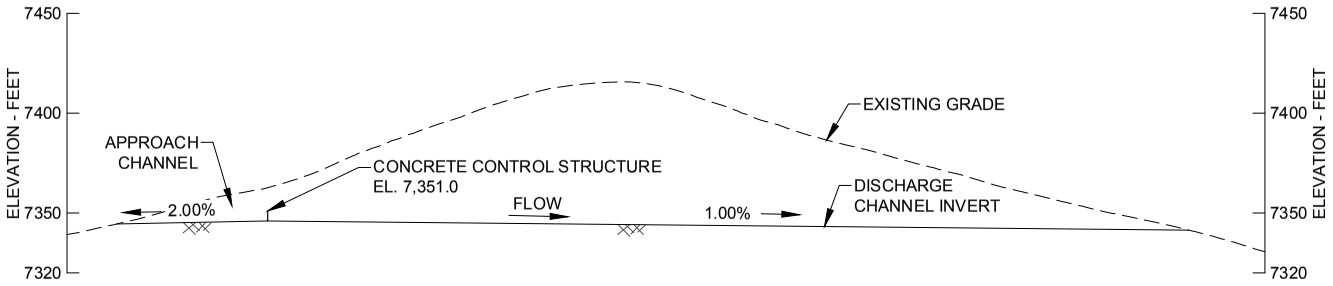

PROFILE D
SPILLWAY 6.3

PRELIMINARY
NOT FOR CONSTRUCTION

0 30 60 120
SCALE IN FEET

RJH CONSULTANTS, INC.

SAN JUAN HEADWATERS
STORAGE PROJECT

CONFIGURATION 1
SPILLWAY PROFILE
(11,000 AC-FT RESERVOIR)

PROJECT NO. 25127

February 2026 Figure 6.7

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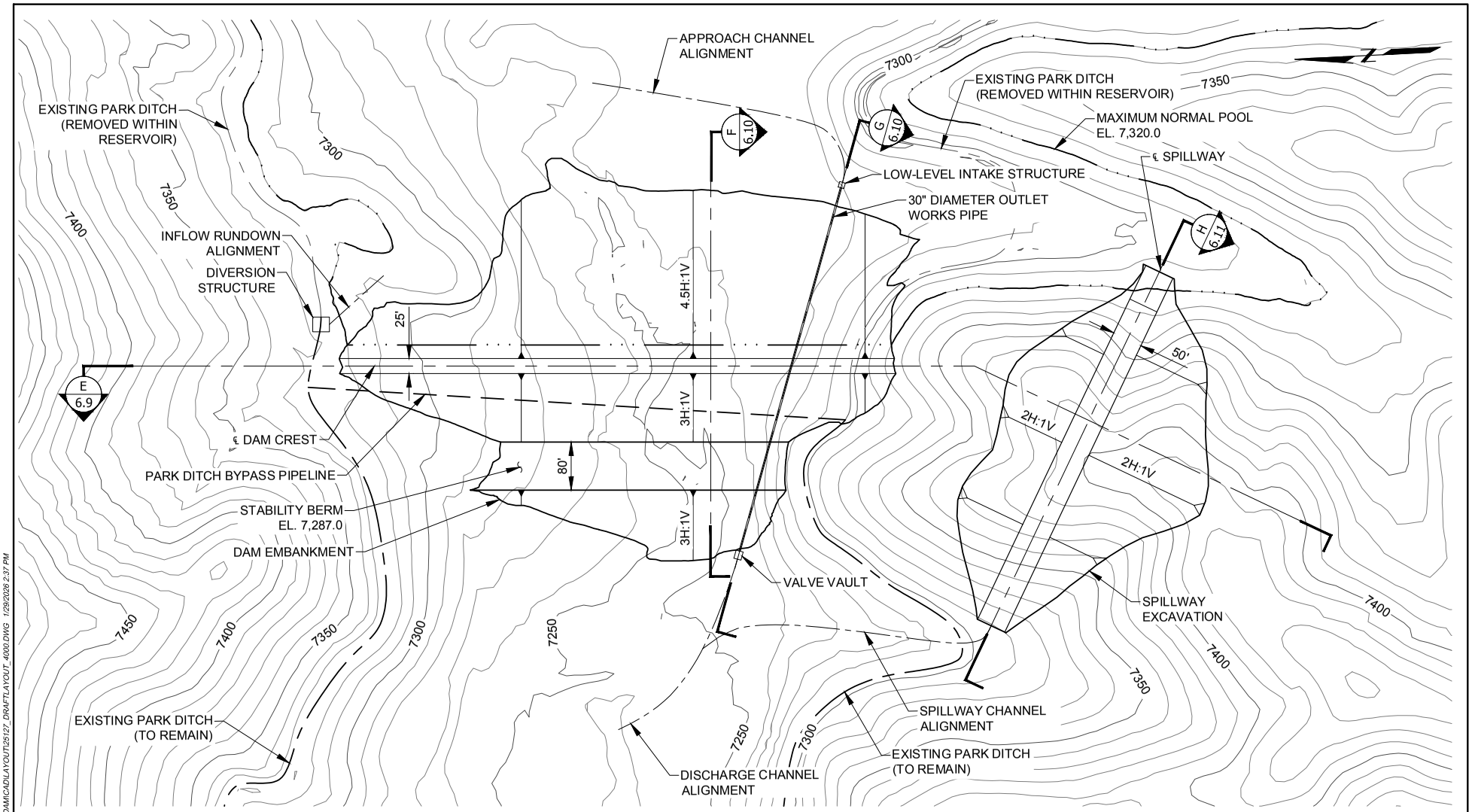

PRELIMINARY
NOT FOR CONSTRUCTION

RJH CONSULTANTS, INC.

SAN JUAN HEADWATERS STORAGE PROJECT

PLAN OF CONFIGURATION 2 (4,000 AC-FT RESERVOIR)

PROJECT NO. 25127

February 2026

Figure 6.8

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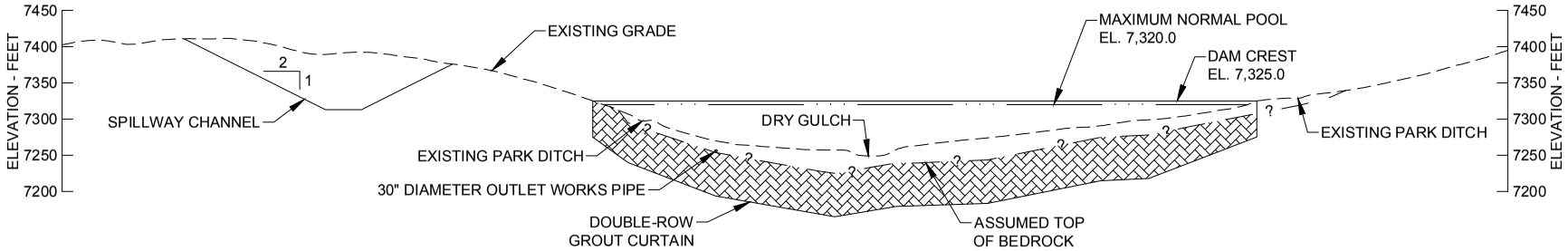

PROFILE E
DAM CREST 6.7

PRELIMINARY
NOT FOR CONSTRUCTION

0 75 150 300
SCALE IN FEET

RJH CONSULTANTS, INC.

SAN JUAN HEADWATERS STORAGE PROJECT

CONFIGURATION 2
EMBANKMENT PROFILE
(4,000 AC-FT RESERVOIR)

PROJECT NO. 25127 | February 2026 | Figure 6.9

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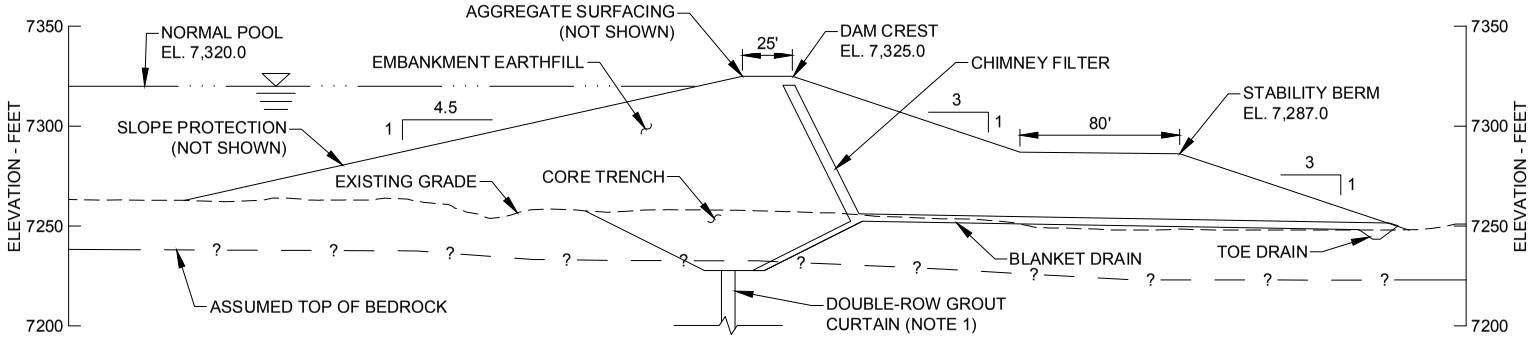
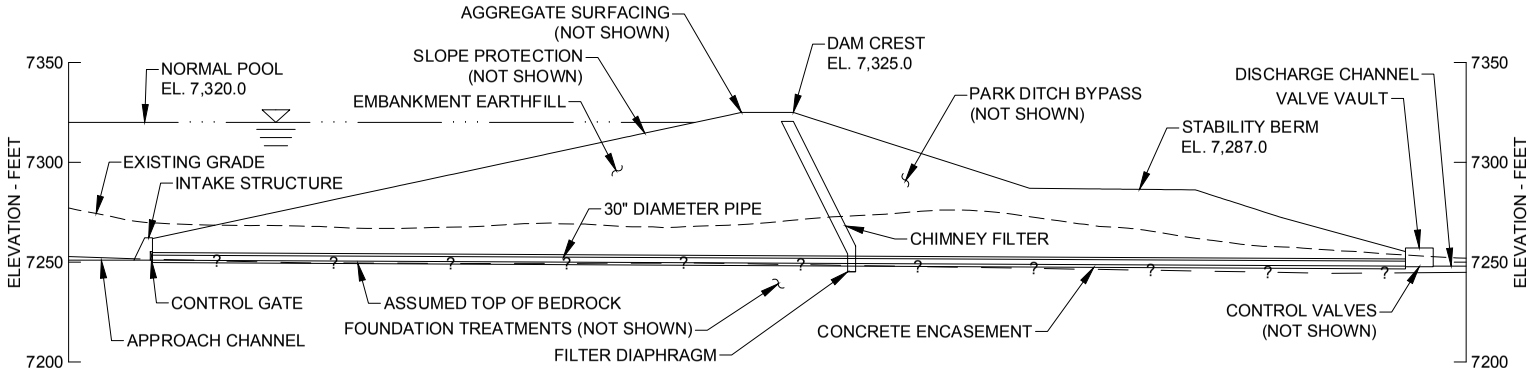


SECTION F
MAXIMUM SECTION 6.7



SECTION G
OUTLET WORKS 6.7

NOTE:
1. GROUT CURTAIN EXTENDS ABOUT 60 FEET BELOW TOP OF BEDROCK AT MAXIMUM DAM SECTION AND MINIMUM 50 FEET BELOW TOP OF ROCK AT THE ABUTMENTS.

0 30 60 120
SCALE IN FEET

PRELIMINARY
NOT FOR CONSTRUCTION

RJH CONSULTANTS, INC.

SAN JUAN HEADWATERS STORAGE PROJECT

CONFIGURATION 2
EMBANKMENT SECTIONS
(4,000 AC-FT RESERVOIR)

PROJECT NO. 25127 | February 2026 | Figure 6.10

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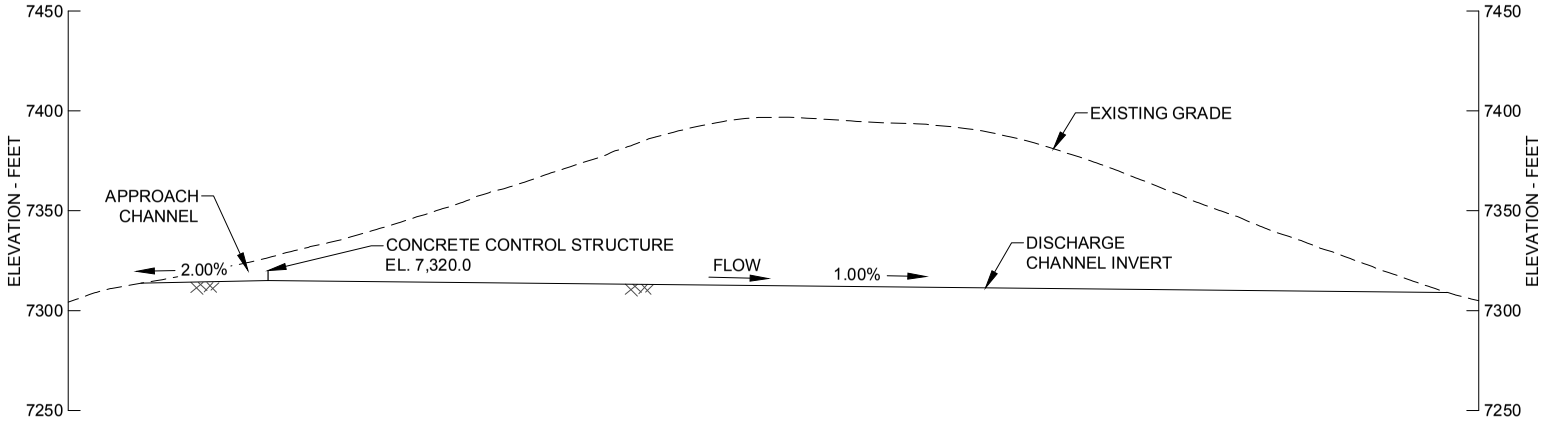

PROFILE H
SPILLWAY 6.7

PRELIMINARY
NOT FOR CONSTRUCTION

0 30 60 120
SCALE IN FEET

RJH CONSULTANTS, INC.

SAN JUAN HEADWATERS STORAGE PROJECT

CONFIGURATION 2
SPILLWAY PROFILE
(4,000 AC-FT RESERVOIR)

PROJECT NO. 25127 | February 2026 | Figure 6.11

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SECTION 7 - RISK AND UNCERTAINTY

RJH has identified several considerations that introduce risk and uncertainty to the Project, which are described as follows.

Water Rights and Supply:

- Changing climate conditions and precipitation patterns will impact the water supply in the upper San Juan River. The magnitude of this change is difficult to predict but recent trends generally show an increased likelihood of prolonged drought. Extrapolation of historical water supply supports the viability of this Project (see Section 2.3), but the uncertainty of future climate conditions introduces risk to the Project.
- Others have upstream conditional water rights that are senior to the CWCB instream flow right (not including the Project water right). The Project must bypass the CWCB instream flow right, so annual shortages and reduced diversions would impact the Project if the upstream conditional water rights were developed.
- The conditional water rights for the Project will expire if SJWCD cannot meet CWCB's due diligence requirements by demonstrating an intent to use the water right.

Water Demand:

- Population growth in Pagosa Springs area may remain steady or increase but are not projected to decrease, impacting the demand for municipal water, recreation, and conservation.
- Minimum environmental releases and sediment flushing flows to meet environmental permit requirements are currently unknown and flows to address these needs could impact the Project.

Technical:

- Additional subsurface geologic and geotechnical investigation may indicate that the Dry Gulch Reservoir site requires significantly more below-grade work than anticipated, which could dramatically increase Project costs.
- Historical documentation of Park Ditch has indicated that the first three miles of the ditch upstream of the Project is generally unstable and susceptible to landslides. The viability of expanding Park Ditch and using an open channel to reliably convey water to the reservoir is currently unknown and would require geotechnical evaluation.

- Spillway and outlet works alignments could change based on the location of competent bedrock identified in future subsurface geologic and geotechnical investigation.

Permitting:

- Environmental permitting regulations may change during Project development and substantially alter Project feasibility, cost, or schedule.

Legal and Property:

- The grant funding from CWCB used to purchase the property requires that the planning period for the project be completed by 2035.
- The land in Dry Gulch is jointly owned by PAWSD and SJWCD. Advancement of the project will require cooperation from PAWSD.
- The private property owner for the parcel along the spillway alignment may decide not to sell or grant an easement.
- The U.S. Forest Service (USFS) may not accept water storage on their property.

Stakeholders and Public Outreach:

- Lack of funding has limited public outreach efforts to date. The Project could be difficult to implement without sufficient public support. Currently, there are various groups in the community that both support and oppose the project.

Economics:

- SJWCD does not have sufficient funds to cover the next phases of planning, permitting, and design for a project of this magnitude, which is consistent with other local rural entities in Colorado. Other funding sources would be required to advance the Project.

SECTION 8 - ENVIRONMENTAL ANALYSIS

8.1 General

ERO performed a site visit and desktop environmental resources study to identify the following:

- Potential waters and wetlands, threatened and endangered (T&E) habitat, and cultural resources at the site.
- Environmental and cultural studies and permits that would likely be needed to construct the Project.

This study pertains only to the proposed reservoir footprint and did not consider additional disturbance areas that may be associated with the project including, but not limited to, temporary construction areas, staging areas, new access roads, relocation of Park Ditch, dam features, other pump or pipeline features, and borrow areas. The environmental resources study memorandum is presented in Appendix C and summarized below.

8.2 Methods

On November 11, 2025, ERO staff assessed the project area for potential environmental issues. In addition to the 2025 site visit, ERO reviewed publicly available data, online maps and inventories, topographic maps, and aerial photographs, and reports from previous cultural surveys in the project area to identify environmental resources. This records review included water resources (including wetlands), threatened and endangered species, USFS sensitive species, wildlife habitat, raptors and migratory birds, archaeological and historical resources, and other potentially sensitive or listed species with the potential to occur in the project area.

8.3 Results

8.3.1 Water Resources

8.3.1.1 Streams and Open Waters

The USGS Jackson Mountain, Colorado topographic quadrangle map and the NWI show multiple unnamed intermittent drainages with eventual connections to the San Juan River and one ditch (Park Ditch) in Dry Gulch in the project area (USGS, 2022; USFWS,

2025). During the 2025 site visit, these features did not have flowing water; however, the drainage features with associated wetlands were observed in the project area as described in more detail below.

8.3.1.2 Wetlands

Wetlands in the project area are categorized as riverine, freshwater emergent wetlands, and freshwater ponds (Cowardin et al., 1979). Table 8.1 summarizes each of the potential WOTUS features and includes the Cowardin classification for each potential WOTUS in the proposed project alternatives.

TABLE 8.1
STREAM, OPEN WATER, AND WETLAND SIZE AND CLASSIFICATION IN THE PROJECT AREA

Water/Wetland	Configuration 1 Wetlands/Water Size (acres)	Configuration 2 Wetlands/Water Size (acres)	Cowardin Classification
Park Ditch (riverine)	12.16	7.27	R4SBC, R4SBCx, R5UBH
Freshwater emergent wetland	53.92	53.75	PEM1B, PEM1C
Freshwater pond	1.16	1.16	PABFh
Total Wetlands and Open Water Areas	67.24	62.18	-

8.3.2 Endangered Species Act Compliance

During the 2025 site visit, ERO assessed the project area for potential habitat for threatened, endangered, proposed, and candidate (T&E) species listed under the Endangered Species Act (ESA) of 1973, as amended (16 United States Code 1531 et seq.). Adverse effects on a federally listed T&E species or its habitat require consultation with the USFWS under Section 7 or 10 of the ESA. The USFWS IPaC resource list for the project area identifies several T&E species with potential habitat in the project area or with potential to be affected by the project. Federally listed T&E species were analyzed based on the location and available habitat in the project area, not by alternative.

There is potential habitat for monarch butterfly and silverspot in the project area; however, further surveys are needed to identify if host plant species are present that could result in the presence of the monarch butterfly or silverspot and, therefore, potential impacts on the species if the project were to occur. If host species are observed during

surveys, further consultation with the USFWS would be required and a biological assessment (BA) would be required.

For Colorado pikeminnow and razorback sucker, populations are known from downstream below the Navajo Reservoir Dam in the San Juan River. Depletions from diversions for the proposed reservoir may result in reduced water availability or could result in adverse impacts, but further analysis of diversion amounts and anticipated impacts downstream would need to be described in the BA. Consultation with the USFWS would be necessary to determine effects.

8.3.3 U.S. Forest Service Sensitive Species

ERO identified USFS Region 2 sensitive wildlife species with potential to occur on San Juan National Forest lands in the project area that could be affected by the proposed project. USFS sensitive species were not analyzed by alternative but based on habitat availability in the project area. Over 30 species were identified where some form of suitable habitat was identified in the project area.

8.3.4 Other Wildlife, Raptors, and Migratory Birds

In 2021, Colorado Parks and Wildlife (CPW) released a High Priority Habitat (HPH) table that identifies species and habitats, and recommendations to avoid and minimize impacts on wildlife from land use development (CPW, 2023). Data from CPW map databases available on CODEX (CNHP, 2025) were reviewed, and HPH in the project area includes elk migration corridor, elk winter concentration area, and mule deer migration corridor. These HPH habitats overlap both configurations. ERO recommends discussing the project with CPW early in the process to identify impacts on elk and mule deer and potential mitigation measures to reduce or offset impacts.

Additionally, raptor species and bald and golden eagles that are protected under the Bald and Golden Eagle Protection Act have the potential to occur in the project area, such as red-tailed hawk (Buteo jamaicensis), bald eagle, golden eagle (Aquila chrysaetos), ferruginous hawk, American peregrine falcon, northern harrier, American goshawk, and osprey (Pandion haliaetus). Surveys should be completed to identify any active nests are present, and they will need to be avoided during construction or other proposed project activities, and avoidance measures should be followed as outlined by CPW recommendations (CPW, 2020) and any other input from the USFS or U.S. Bureau of Reclamation (Reclamation).

8.3.5 Cultural Resources

ERO reviewed available data on known and potential cultural resources in the project area. The file search with Compass showed that no previous inventories have been conducted in the project area and no sites have been documented; however, La Plata Archaeological Consultants (LPAC) surveyed 1,257 acres from 2007 to 2009 at the request of Pagosa Area Water and Sanitation District and Harris Engineering. A report was prepared and submitted to San Juan Water Conservancy District in 2017 (Fuller, 2017). The report does not appear to have been submitted to the State Historic Preservation Office (SHPO); no site state numbers were assigned and there is no record of the project on Compass.

LPAC documented 50 sites during the 2007-2009 survey. A total of 30 sites are within one or both proposed reservoir footprints. A total of 15 resources are within the smaller reservoir footprint (Configuration 1). These sites are primarily prehistoric artifact scatters (n=12), with 2 multicomponent sites with both precontact and historic components and 1 historic artifact scatter. Many of these sites had diagnostic artifacts indicative of an Archaic Period association. Two sites were recommended eligible and six sites were recommended needs data (undetermined). The remaining seven sites are officially not eligible (n=1) or recommended not eligible.

The remaining 15 sites from the LPAC 2007-2009 survey are located outside of the smaller reservoir but within the boundaries of the larger reservoir footprint (Configuration 2) and are all precontact artifact scatters. Two of these sites were recommended eligible and nine sites were recommended needs data (undetermined). The remaining four sites were recommended not eligible.

In addition to the OAHP file search, ERO conducted a review of historical maps, historic aerials, Colorado Division of Water Resource records, and General Land Office (GLO) records to assess the potential for unknown historical resources, such as roads, ditches, and buildings, in the project area. No additional resources were observed in the records reviewed.

Because these survey results were never finalized, SHPO consultation is incomplete, and the survey is more than 15 years old, a new cultural resource survey would be required and SHPO consultation would need to be completed.

8.4 Expected Permitting Needs

Overall, adverse impacts could be possible for T&E species, USFS sensitive species, and cultural resources, and consultation with the associated agency is recommended to identify mitigation requirements. The following are the anticipated surveys, documentation, and consultation needs; however, additional information and planning may identify the need for further survey, reporting, or permitting requirements.

- Preparation of Standard Form (SF) 299 for the USFS to apply for a special-use permit (SUP).
- Preparation of the appropriate NEPA document (Categorical Exclusion, Environmental Assessment, or Environmental Impact Statement) as determined by the lead agency to satisfy NEPA compliance. Once written and reviewed by all cooperating agencies, a finding of no significant impact (FONSI) would be issued by the lead agency to allow the project to proceed.
- Natural resource surveys and reports to support the SUP, Reclamation, environmental permitting, and ESA Section 7 consultation process:
    - General habitat assessment survey and necessary species-specific surveys.
    - Biological Assessment for submittal to the USFWS.
    - Biological Evaluation for submittal to the USFS.
    - Discussion with CPW on HPH species and potential mitigation.
- Wetland surveys and reporting for compliance with Section 404 of the CWA:
    - Wetland delineation. The wetland delineation report and associated forms would be submitted to the Army Corps of Engineers (Corps) to begin consultation.
    - A Preconstruction Notification form (PCN) for submittal to the Corps.
    - Consultation with the Army Corps of Engineers (Corps) will determine if any documented wetlands are jurisdictional and whether a Nationwide or Individual Permit would be required.
- Cultural Resource surveys and reporting for NHPA compliance:
    - A Class III cultural resource survey that complies with the Colorado State Historic Preservation office (SHPO) and agency requirements.
    - Results would be compiled in a report that meets SHPO and agency standards, and site and isolated find forms would be completed.
- Phase I Environmental Site Assessment may also be required by agencies for NEPA compliance.

SECTION 9 - LEGAL AND INSTITUTIONAL REQUIREMENTS

9.1 Water Rights Issues

SJWCD owns water rights sufficient to fill and store 11,000 acre-feet of water for all contemplated Project uses, with priorities dating to 1967 and 2004 as detailed in Section 2.2.2. In addition, there remains water available for appropriation in the San Juan River, so additional water rights could be obtained for the Project if necessary.

9.2 Legal and Institutional Requirements

This off-stream raw water storage project has water rights which allow for an initial fill and a refill each year as described in detail in Section 2.2.2. The adjudicated fill rate is limited to 50 cfs from the sources described and subject to terms and conditions intended to protect instream flows in the San Juan River.

9.3 Multi-Jurisdictional and Interagency Agreements

Depending on the selected reservoir configuration, there may be a requirement to coordinate with the USFS for an inundation permit or a possible land swap agreement. In addition, if the larger storage option is selected (Configuration 1), there will be a negotiation with a private landowner for storage for inundation. Representatives of SJWCD have previously had discussions with both the USFS and private land owner, but definitive arrangements have not been reached with either.

9.4 Permitting Procedures

Permits that are anticipated to be required to advance the Project are described in Sections 3.5 and 8.4. We plan to implement the following strategies to accelerate the permitting process:

- Develop a permitting matrix: At the start of the Project, we would identify federal, state, and local permits and approvals that are required to advance the Project, including how they are interconnected. Federal reviews such as NEPA and Clean Water Act Section 404 will likely drive the critical path, but they will be influenced by state dam safety, wildlife consultations, historic preservation reviews, and county land-use approvals. We would develop a permitting matrix and schedule early in the Project, which would facilitate discussions with agencies and help identify data collection needs and key issues.

- Early engagement of agencies: We would coordinate with the U.S. Army Corps of Engineers, Colorado Parks and Wildlife, the State Engineer's Office, and other key agencies would early in the Project. Early coordination would help clarify agency roles and align expectations around study methodologies, modeling assumptions, and impact thresholds. We would also maintain regular, structured check-ins throughout permitting - rather than waiting for formal comment letters - to allow critical issues to be resolved quickly, preventing delays caused by multiple rounds of revisions.
- Perform early, targeted data collection: Early, high-quality, and defensible data collection shortens review timelines by reducing uncertainty, limiting requests for supplemental studies, and strengthening the record against potential challenges. We would work with regulators to identify agency-accepted methodologies and coordinate data collection plans prior to performing the field work.
- Reduce impacts through design and mitigation: We would work to reduce impacts to the greatest extent possible through the design process. This will involve clear documentation showing how impacts were reduced or avoided through design decisions. We will consider "right-sizing" the Project by changing the normal pool elevation several feet if environmental permitting impacts can be reduced and will consider ways design features such as multi-level outlets, environmental bypass flows, or sediment management features can reduce downstream impacts.

9.5 Unresolved Issues

The Project land is owned jointly by PAWSD and SJWCD. CWCB provided funding for the purchase, including a grant to SJWCD and loan to PAWSD. PAWSD, SJWCD, and CWCB are parties to an agreement that set out certain conditions relating to repayment of the loan, including a planning period during which PAWSD is restricted from selling the Project Property. The planning period ends in 2036.

There is a pending dispute between SJWCD and PAWSD regarding future water supply and demand, which influences PAWSD view of the feasibility of the Project and its willingness to continue to hold the land where the Project is to be built. The districts have agreed to address this dispute with professional mediation which is scheduled for early March 2026. If the dispute is not resolved, then there is a risk that the land and conditional water rights could be lost.

SECTION 10 - NON-FEDERAL FUNDING

10.1 Non-Federal Funding Sources

10.1.1 General

SJWCD is funded through a mill levy that provides approximately $100,000 per year. Their funding is low compared to other water conservation and utility districts. Increasing the mill levy would require a vote by district residents; the additional revenue could contribute to project funds but would not likely be sufficient to plan permit, design, or construct the project. This limited funding emphasizes the need to work with Federal, State, and private partners to find additional, significant funding to meet the water needs of the region.

If Federal funding were received and the Project was advanced, the project could be marketed to potential stakeholders. The following sections include potential partners that may have an interest in funding the Project and contribute to the non-Federal cost share.

10.1.2 Colorado Water Conservation Board

CWCB operates the Colorado Water Plan Grant Program, which generally includes two grant cycles per year and allocates funds for storage and supply projects. In 2026, CWCB expects to have about $38 million in total funds to award in this program across several qualifying project categories. Other grant opportunities available through CWCB that are potentially applicable to this project include Water Supply Reserve Fund Grants and Project Bills Grants. CWCB also provides low-interest loans for the design and construction of municipal water projects through the Water Project Loan Program (CWCB, 2025).

SJWCD has a working relationship with CWCB and has received financial support from them in the past, including to purchase the Dry Gulch Reservoir site, because CWCB supported the project. CWCB has an incentive to construct the project to increase their instream environmental water right in the San Juan River.

10.1.3 Private Development

If the Project design is advanced, SJWCD plans to engage developers in discussions regarding a private-public partnership. This collaborative financing and management

model could help cover a significant portion of capital costs. We anticipate this would include controlled real estate development around the reservoir with careful regulation to maintain public access for dam safety operations and to protect water quality in the reservoir from developed areas.

SJWCD would retain ownership of the dam and water, and either sell or lease land to the developer. Based on projected growth of the Pagosa Springs area and strong tourism, we anticipate this concept would generate significant interest from the development community. The site has exceptional mountain views and is relatively flat, which would both be attractive to developers.

SECTION 11 - SUMMARY AND CONCLUSIONS

RJH offers the following summary conclusions based on this screening level storage evaluation:

1. SJWCD was formed in 1987, in accordance with the Water Conservancy Act, with a decree to conserve, maximize, and utilize the water resources of the San Juan River and its tributaries.
2. Water storage in the District is limited, and future population growth, climate change impacts, lack of redundancy, and variable demand are expected to result in water scarcity, adversely impacting the economy and residents.
3. Constructing a new reservoir would serve SJWCD's mission and purpose and assist with meeting current and future water needs, provide water to restore a portion of the recreation season, and create redundancy and reliability in the municipal water system to safeguard against impacts resulting from wildfire and drought.
4. PAWSD is the municipal water supplier for Pagosa Springs. Most of their supply is from direct diversions on Four Mile Creek and the San Juan River. We understand that PAWSD does not currently have plans to build a new water storage reservoir. PAWSD maintains a water storage system of about 4,000 ac-ft, but not all of this is dedicated to water supply.
5. The existing PAWSD water storage reservoirs all receive direct runoff from the Martinez Creek watershed and are vulnerable to a single wildfire event in this basin. A new reservoir at the Dry Gulch site would be located on a relatively small drainage basin outside of the Martinez Creek watershed, which would improve wildfire resiliency.
6. SJWCD and PAWSD purchased the Dry Gulch site property with the intent of constructing a new reservoir at the site.
7. SJWCD maintains conditional water rights (1967 and 2004) that would accommodate a reservoir at the Dry Gulch site with an annual fill volume of 11,000 acre-feet.
8. SJWCD's conditional water rights will expire if the Project is not advanced.
9. WWG performed a water supply, demand, and shortage analysis on the upper San Juan River Basin to inform this Project and estimated that in 2050, the average annual water shortage in the district would range from 4,100 to 73,000 ac-feet.
10. WWG identified that a 10,000-acre-foot reservoir would be able meet the projected mid-range 2050 municipal demands every year during the evaluated period (29 years) and could meet all other mid-range demands (environmental, agricultural, recreation) in 19 of 29 years.

11. The preferred alternative for this Project is a reservoir at Dry Gulch site because it is the only alternative that meets the purpose and need, meets the formulation criteria, and can store 11,000 ac-ft. The Hood site is a less efficient site and can only store a maximum of 8,100 ac-ft at significantly higher costs.
12. A reservoir at the Dry Gulch site would involve constructing the following components: embankment dam, outlet works, spillway, Park Ditch diversion facility, and Park Ditch bypass facility. These facilities appear to be technically viable; however, additional data, analysis, and coordination are needed to better define the components.
13. SJWCD is funded through a mill levy that provides approximately $100,000 per year, which is not sufficient to design or construct the project. This limited funding emphasizes the need to work with Federal, State, and private partners to find additional, significant funding to meet the water needs of the region.
14. Potential ways to obtain non-federal funding include CWCB grants and a public-private partnership to develop the site around the reservoir.

SECTION 12 - NEXT STEPS

If the Project receives funding from Reclamation, we anticipate the following Project components would subsequently be advanced concurrently:

Public Outreach

This task would involve engaging potential customers in the Pagosa Springs area and marketing the Project to potential stakeholders. At the onset of this phase, we would develop a detailed outreach package. These techniques are expected to include a combination of educational and informative activities, surveys, public meetings, user-friendly materials, branding, and various input and communication methods that can be easily used and shared both online and in-person. We would also develop branded materials to build trust and recognition of the Project and create a study-specific website. Several public events would likely be held to educate the stakeholders and public and to solicit input for future decision making.

Water Modeling

We would perform water resources modeling to better refine existing estimates of demands, inflows, storage volumes, evaporation losses, releases, and reliability under different conditions (average years, drought years, and climate-change scenarios). This modeling would show how often the reservoir would fill, how much water it could reliably supply, how frequently shortages might still occur, and support selection of an appropriate reservoir size. A key part of this study would be evaluating how the proposed reservoir would operate alongside existing water rights, downstream obligations, and environmental flow requirements.

Economic Analysis

This task would involve economic forecasting and modeling to better assess the overall financial viability of the Project. This would likely involve performing a benefit-cost analysis and a financial feasibility assessment. A benefit-cost analysis would compare the full range of long-term costs—such as construction, permitting, operation, and maintenance—against expected economic benefits from improved water reliability, drought resilience, fire protection, agricultural support, and recreation. Related evaluations such as life-cycle cost analysis and risk/sensitivity analysis would help ensure that long-term maintenance, climate variability, and cost overruns are realistically being

considered. This task would also consider how various funding sources and approaches could generate sufficient revenue to advance the project.

Feasibility Design

A feasibility-level design would be developed to an approximately 10-percent design stage. This would be used to confirm the technical viability of the Project; better define the size, location, and configuration of key Project facilities; improve Project cost opinions; defining land acquisition needs; and provide a basis for environmental permitting assessments. We anticipate the feasibility-level design would include:

- Identifying key design criteria including operational, maintenance, stakeholder, regulatory, and aesthetic criteria.
- Performing a geotechnical investigation program to evaluate subsurface conditions and potential on-site borrow materials.
- Developing feasibility-level configurations for the embankment dam, outlet works, spillway, and water conveyance facilities.
- Developing feasibility-level cost opinions.

Permitting

We would conduct pre-application coordination with key regulatory agencies, specifically USFS, USFWS, USACE, CPW, and SHPO. This step would assist with identifying which permits will likely be required, NEPA requirements, and level of environmental review (Categorical Exclusion, Environmental Assessment, or Environmental Impact Statement, etc.). We would also perform field surveys including wetland delineations, habitat surveys, and cultural surveys.

Funding Assistance

This task would involve coordination with potential funding partners and applying for additional grants. We would also perform site development studies to better assess the potential revenue that could be generated by developing the site.

San Juan Headwaters Storage Project
Configuration 1 - Dry Gulch Site

Item	Description	Unit	Total Quantity	Unit Price	Extension
1	Mobilization @ 10% of BCS	LS	1	$ 5,534,278	$ 5,534,000
2	Clearing and Grubbing	AC	350	$ 4,000	$ 1,400,000
3	Site Reclamation	AC	25	$ 5,000	$ 125,000
4	Erosion Control	LS	1	$ 300,000	$ 300,000
5	Dewatering	LS	1	$ 150,000	$ 150,000
6	Stream Control/Cofferdam	LS	1	$ 250,000	$ 250,000
7	Surveying	LS	1	$ 200,000	$ 200,000
8	Dam Crest Aggregate Surfacing	CY	850	$ 60	$ 51,000
9	Drain Gravel and Filter Sand	CY	49,000	$ 120	$ 5,880,000
10	Embankment Fill from Reservoir Basin	CY	903,000	$ 10	$ 9,030,000
11	Core Trench Excavation	CY	125,000	$ 8	$ 1,000,000
12	Grout Curtain	SF	87,000	$ 100	$ 8,700,000
13	Riprap and Riprap Bedding	CY	54,000	$ 120	$ 6,480,000
14	Embankment Fill from Spillway Excavation	CY	100,000	$ 15	$ 1,500,000
15	Spillway Control Weir - Reinforced Concrete	CY	20	$ 2,500	$ 50,000
16	36" Welded Steel Pipe (encased in reinforced concrete)	LF	825	$ 4,500	$ 3,712,500
17	Gates, Valves, and Controls	LS	1	$ 1,000,000	$ 1,000,000
18	Low-Level Intake Structure	LS	1	$ 300,000	$ 300,000
19	Terminal Discharge Facilities	LS	1	$ 600,000	$ 600,000
20	Park Ditch Bypass Pipeline	LF	800	$ 600	$ 480,000
21	Park Ditch Bypass Pipeline Discharge Structure	LS	1	$ 200,000	$ 200,000
22	Park Ditch Pump Station / Diversion Structure	LS	1	$ 8,000,000	$ 8,000,000
23	Park Ditch Pump Station Discharge Pipeline	LF	1,000	$ 400	$ 400,000
Base Construction Subtotal (BCS)					**$ 55,340,000**
Bonds/Insurance (2% of BCS)					$ 1,110,000
Permitting (5% of BCS)					$ 2,770,000
Design Engineering (15% of BCS)					$ 8,300,000
Construction Engineering and Management (12% of BCS)					$ 6,640,000
Contingencies (40% of BCS)					$ 22,140,000
Opinion of Probable Construction Cost (OPCC)					**$ 96,300,000**

Note: Costs rounded to nearest 10,000.

San Juan Headwaters Storage Project
Configuration 2 - Dry Gulch Site

Item	Description	Unit	Total Quantity	Unit Price	Extension
1	Mobilization @ 10% of BCS	LS	1	$ 2,952,017	$ 2,952,017
2	Clearing and Grubbing	AC	200	$ 4,000	$ 800,000
3	Site Reclamation	AC	20	$ 5,000	$ 100,000
4	Erosion Control	LS	1	$ 300,000	$ 300,000
5	Dewatering	LS	1	$ 120,000	$ 120,000
6	Stream Control/Cofferdam	LS	1	$ 250,000	$ 250,000
7	Surveying	LS	1	$ 200,000	$ 200,000
8	Dam Crest Aggregate Surfacing	CY	640	$ 60	$ 38,400
9	Drain Gravel and Filter Sand	CY	30,000	$ 120	$ 3,600,000
10	Embankment Fill from Reservoir Basin	CY	385,000	$ 10	$ 3,850,000
11	Core Trench Excavation	CY	72,000	$ 8	$ 576,000
12	Grout Curtain	SF	53,000	$ 100	$ 5,300,000
13	Riprap and Riprap Bedding	CY	23,000	$ 120	$ 2,760,000
14	Embankment Fill from Spillway Excavation	CY	40,000	$ 18	$ 720,000
15	Spillway Excavation to Waste	CY	170,000	$ 12	$ 2,040,000
16	Spillway Control Weir - Reinforced Concrete	CY	40	$ 2,500	$ 100,000
17	30" Welded Steel Pipe (encased in reinforced concrete)	LF	825	$ 3,750	$ 3,093,750
18	Gates, Valves, and Controls	LS	1	$ 840,000	$ 840,000
19	Low-Level Intake Structure	LS	1	$ 250,000	$ 250,000
20	Terminal Discharge Facilities	LS	1	$ 500,000	$ 500,000
21	Park Ditch Bypass Pipeline	LF	800	$ 600	$ 480,000
22	Park Ditch Bypass Pipeline Discharge Structure	LS	1	$ 200,000	$ 200,000
23	Park Ditch Diversion Structure	LS	1	$ 250,000	$ 250,000
24	Park Ditch Reservoir Inflow Pipeline	LF	500	$ 400	$ 200,000
Base Construction Subtotal (BCS)					**$ 29,520,000**
Bonds/Insurance (2% of BCS)					$ 590,000
Permitting (5% of BCS)					$ 1,480,000
Design Engineering (15% of BCS)					$ 4,430,000
Construction Engineering and Management (12% of BCS)					$ 3,540,000
Contingencies (40% of BCS)					$ 11,810,000
Opinion of Probable Construction Cost (OPCC)					**$ 51,370,000**

Note: Costs rounded to nearest 10,000.