FINAL DRAFT

Hazard Mitigation Plan

Prepared for
Jordan Valley Water
Conservancy District
West Jordan, Utah
September 2021
(Updated October 2021)

JORDAN VALLEY WATER
CONSERVANCY DISTRICT

Prepared by:
ELWELL Consulting Group Team
3014 W. Chimney Rock Circle
Taylorsville, Utah 84129
(801) 870-9709

ELWELL
CONSULTING GROUP

Table of Contents

List of Figures

List of Tables

Introduction

Created in 1951 under the Water Conservancy Act, JVWCD is Primarily a wholesaler of water to cities and improvement districts within Salt Lake County, Jordan Valley Water Conservancy District (JVWCD or District) is a political subdivision of the State of Utah and one of the largest water districts in the state. The District also supplies potable water to retail customers within Salt Lake County and is responsible for supplying water for upwards of 750,000 people in the Salt Lake Valley.

JVWCD is governed by a board of nine trustees representing eight geographical divisions. They are nominated either by the Salt Lake County Council or a city council, depending upon the division they represent. The Governor then appoints Trustees for a 4-year term from those nominated. The District also has approximately 150 full-time employees.

Jordan Valley Water has a retail service area primarily in unincorporated areas of the county, making up about 10 percent of its deliveries; approximately ninety percent of its municipal water is delivered on a wholesale basis to cities and water districts. Metropolitan Water District of Salt Lake & Sandy (MWDSLS) owns 2/7ths of the Jordan Valley Water Treatment Plant (JVWTP) capacity and (in addition to primary) 2/7ths of the Jordan Aqueduct conveyance and storage facilities to get the water from the plant Salt Lake City and MWDSLS delivery points. JVWCD operates the facilities and delivers to Salt Lake City and MWDSLS. Jordan Valley Water also delivers untreated water to irrigators in Salt Lake and Utah Counties to meet commitments under irrigation exchange agreements.

The District has identified it's mission, vision and core values as follows:

Mission - Delivering quality water and services every day.

Vision - Our vision is to provide a sustainable water supply to promote individual and community well-being.

Values:

1. Safety – We are committed to employee and public safety.
2. Service - We care about our customers' needs and strive to fulfil them.
3. Respect - We care about our employees and invest in their success.
4. Integrity - We believe in doing the right thing—individually and as an organization.
5. Leadership - Our passion for quality drives us to employ innovative practices.

The Water System

The JVWCD water system consists of multiple facilities including pump stations, reservoirs, and treatment plants. There are also conveyance systems (aqueducts, transmission, and distribution pipelines) for moving the raw water sources to the District's treatment plants and through the distribution system to deliver treated water to the District's 17 member agencies and retail service area shown in Figure I.1 JVWCD Service Area.

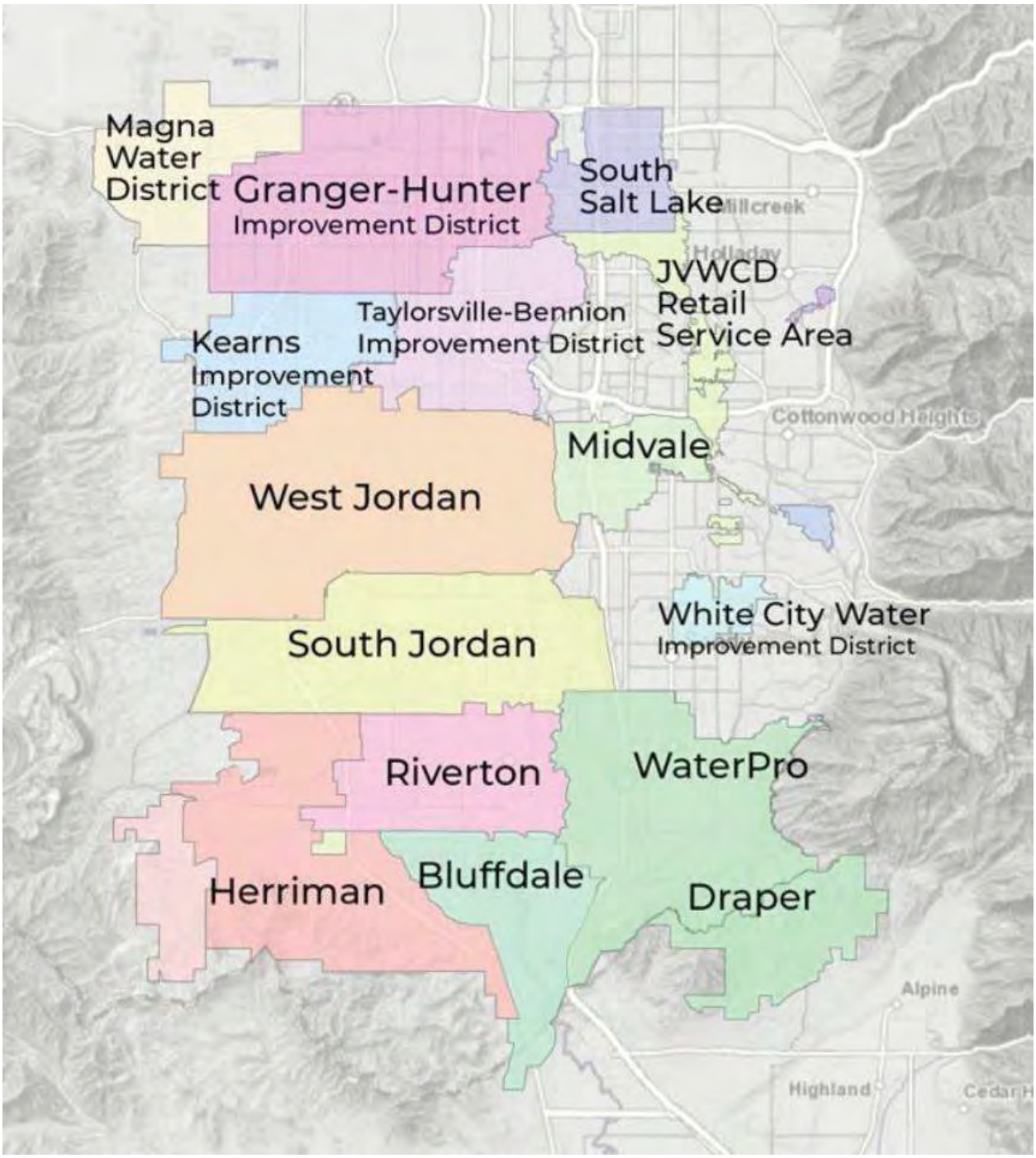


Figure I.1 JVWCD Service Area (Member Agencies & Retail Customers)

An inventory of the District's primary types of facilities/assets types is shown in Table I.1 below, along with a summary of each one.

Table I.1 Facility/Asset Types

Types of Facilities/Assets	Inventory
Water Treatment Plants (WTPs)	4
JVWTP SERWTP SWGWTP	180 MGD 20 MGD 7 MGD
High quality groundwater sources	31 wells
Brackish remediation wells	8 wells
Tanks	33 tanks at 16 sites
Booster pump Stations	14 pump stations
Major conveyance piping (>36 in)	720,000 linear feet
Transmission piping (16 in to 36 in)	540,000 linear feet
Distribution piping (<16 in)	200,000 linear feet

1. *Owned and operated by Rio Tinto Kennecott.*

Next, an overview of some of JVWCD's facilities is presented in the following paragraphs.

There are three primary **Water Treatment Plants (WTPs)** supplying the JVWCD system:

1. Jordan Valley Water Treatment Plant (JVWTP)

   Constructed in 1974, with expansions in 1979 and 1987, Jordan Valley Water Treatment Plant is the largest conventional water treatment plant in the state of Utah. Its rated treatment ability is 180 million gallons per day, and it frequently operates at capacity during the summer months. Originally owned by Central Utah Water Conservancy District, the deed was transferred to Jordan Valley Water Conservancy District and Metropolitan Water District of Salt Lake & Sandy in 2007.

2. Southeast Regional Water Treatment Plant (SERWTP)

   Constructed in 1985 with a major process enhancement in 2000. It is owned and operated by Jordan Valley Water Conservancy District and uses high-rate clarification technology. The rated capacity is 20 MGD.

3. Southwest Groundwater Treatment Plant (SWGWTP)

   Constructed in 2012, this plant is owned and operated by Jordan Valley Water Conservancy District and uses reverse osmosis technology to remediate a contaminated aquifer. The rated capacity is 7 MGD.

Jordan Narrows Pump Station (PS)

Constructed in 1989, this pump station draws Utah Lake water from the Jordan River and pumps it into the Provo Reservoir Canal siphon pipe for conveyance of irrigation water to the Welby and Jacob Canals Diversion Structure. The pump station delivers up to 140 cfs to meet the requirements of the Welby-Jacob Exchange Agreement.

Wells and Booster Stations

Jordan Valley Water owns and operates 39 deep wells throughout the Salt Lake Valley, as well as multiple booster stations with a combined design capacity of approximately 500 cubic feet per

second. The three wells and four booster pump stations (PSs) selected by the District to be included in their top 20 Assets are shown in Section 2.4, Table 2.3.

Reservoirs and Pipelines

Jordan Valley Water owns and operates reservoirs throughout the valley with a total storage capacity of 177.6 million gallons. More than 300 miles of water transmission pipelines allow for the transport and deliver approximately 44 billion gallons of culinary water annually. The five Reservoirs and six Pipelines selected by the District to be included in their top 20 Assets are also shown in Section 2.4, Table 2.3.

Finally, there are 2 water treatment plants were selected and included in the District's top 20 Assets. These 20 key assets are also shown on the asset location and hazard maps in Appendix A.

Past Development

JVWCD has seen significant growth and development within its service area. The population served by JVWCD increased 2.7 times faster the average growth rate of the United States from 2000 to 2018, and grew 19.6% from 2008 to 2018. While this population growth has not made the District nor its water system more vulnerable to natural hazards, the consequences of potential hazard vulnerabilities have increased.

Recent development within JVWCD' s water system included new construction, as well as upgrades to existing facilities to increase system resiliency and meet growing demand. Supply side improvements include:

- Construction of new wells and rehabilitation of existing wells,
- Construction of the new Central Water Pipeline adding a new treated groundwater source from Central Utah Water Conservancy District (CUWCD) to further diversify the District's supply portfolio,
- High-rate sedimentation added to the SERWTP,
- Portable power generators that can be deployed to multiple wells or pump stations and permanent, on-site generators at select pump stations and SERTP. Relocation and upgrade to the JVWTP generator
- Seismic upgrades completed on much of the JVWTP.
- Recent improvements in the storage and conveyance side of the system include:
- Construction of the Southwest aqueduct adding conveyance redundancy to and from JVWTP,
- Ongoing replacement of the 3300 South transmission main,
- Construction of the parallel pipe to 10200 South transmission main,
- Construction of the new 11800 South transmission main and pump station,
- Ongoing Distribution main replacement,
- Repair and upgrades of 2 MG Naniloa tank and recommission back into service,
- Construction of the new 12.5 MG finished water storage reservoir at JVWTP

Future Development

The District anticipates significant growth within its service area and is solidifying its capacity to meet those demands through a combination of focused water conservation and new supply and conveyance development. The District is also increasing the resiliency of its system through extensive rehabilitation and renewal work (R/R) and drouth contingency planning.

The JVWCD service area coincides with the municipal boundaries of its member cities and improvement districts. The 2020 population served by JVWCD, and its member cities and improvement districts is approximately 750,000. Population projections developed by the Wasatch Front Regional Council in coordination with the State of Utah Governor's Office of Management and Budget estimate the total 2065 population within the current JVWCD boundaries will grow to approximately 1.1 million. In addition to the current JVWCD service area, there are thousands of acres of developable land adjacent (west) to existing municipal boundaries which will likely annex into the JVWCD service area.

The growing population served by JVWCD will require further conservation to extend the beneficial use of existing supplies and will also require the development of new supplies. The majority of new development will occur on lands that historically have not been irrigated. Therefore, it will be critical for land development to be done in a way that uses water efficiently and is as drought resilient as possible. The District's 2019 Water Conservation Plan update included an expansion of conservation activities to further accelerate a reduction in the per capita usage rate in JVWCD service area. Based on previous success with conservation efforts and planned future conservation activities, the District is projecting that total M&I water use in 2065 will be limited to a 35% increase, even with a population increase of 53% and increased evapotranspiration from climate change.

The projected increase in demand, along with the constant need to upgrade and rehabilitate existing infrastructure, results in total projected capital expenditure of $3.5 billion through 2065. Beyond conservation, future projects include a phased expansion of JVWTP, continued extension of the Southwest Aqueduct to provide redundant and additional water conveyance capacity from JVWTP, three new high quality groundwater wells, and additional treatment capacity for Utah Lake/Jordan River water rights, new potable water storage reservoirs, pump stations, conveyance pipelines and storage reservoir renewal and replacement work, and a large regional water supply development project multiple county water supply project.

The remaining lands available for development are located in areas which are generally less susceptible to ground movement associated with seismic events than currently developed lands served by JVWCD. However, JVWCD will employ the same rigor to design and construction of future facilities to serve the future growth. In compliance with applicable seismic standards, JVWCD will also consider all the hazards outlined in this plan as it builds new facilities.

The design of future JVWCD facilities will meet current Utah Building Code and International Building Code (IBC) standards, which account for conditions associated with natural hazards (i.e., earthquake, severe winter weather, severe winds, etc.). The District will also continue in its current efforts to address and incorporate natural hazard mitigation (i.e., seismic upgrades/standards, lightning protection, backup power, etc.) into future design and construction projects whether they are for new facilities or for rehabilitation and renewal projects.

The District is currently completing a Drought Contingency Plan (DCP) to minimize the negative impacts of future droughts to its service area. The DCP identifies 15 mitigation measures that will be implemented to reduce the likelihood and consequence of adverse drought conditions. It also defines 14 response actions that will be taken during a drought to minimize both health and safety risks as well as economic impacts.

Section 1

Planning Process

A four-phase approach was used in the preparation of this new JVWCD Hazard Mitigation Plan (HMP or Plan) as outlined:

- Phase A Planning Process
- Phase B Natural Hazard Risk Assessment
- Phase C Mitigation Strategy Development
- Phase D Plan Update & Adoption

Phase A was used to define the planning process and included the project Kickoff, identification of the Planning Team, and Asset Prioritization. In addition, a stakeholders list and outreach strategy were prepared for the public involvement program along with plan maintenance procedures. During this phase, other existing plans and resources were reviewed for use in the Plan's development. Included, the original 2004 Hazard Mitigation Strategy compiled by the District. The new Plan would also include new facilities/assets not previously reviewed and assessed by the District. Also, during the planning process, the District's top 20 key assets were identified and prioritized based on the District's mission specific criteria to determine their criticality. A Planning Team meeting was held with the District at the end of this phase to review all the Phase A tasks, followed by the first Stakeholder meeting to solicit input, and present the scope of work and schedule for the remaining phases of the development of the new Plan to the identified stakeholders.

Phase B, consisted primarily of hazard identification and risk/vulnerability assessment. This was accomplished through tasks of hazard identification and profiling, assessing vulnerabilities, and consequence assessment. District assets that were identified and prioritized during Phase A Planning Process were first screened at a Risk Screening Workshop and then the District JVWCD's selected 40 asset-hazard pairs for assessment during this Phase B, Risk Assessment. Descriptions of the natural hazards affecting key water assets are documented in Section 2.0 of the Plan including an analysis of how hazards vary across assets, location & (severity) for each natural hazard affecting the facilities. Previous hazard occurrences were also reviewed and documented. A two-step screening process was used to limit the assets assessed to only those determined to be at High risk of hazard, in order to limit the number of asset-hazard pairs. The vulnerability assessment task included research, document reviews, and interviews of JVWCD staff for critical JVWCD assets. The assessment also included a review of other plans, existing hazard studies, reports and other information gathered during Phase A. A summary was compiled documenting each of the 40 selected asset-hazard pairs for the asset's vulnerability to each hazard. This included rating of the impact of each hazard. The consequence assessment task included determining the system loss of service and cost of infrastructure repair/replacement for each of the top 5 assets for the selected asset-hazard pairs. Towards the end of this phase, a Planning Team meeting was held to review the results of Phase B. A second Stakeholder meeting was then held to present the results of Phase B to Stakeholders, receive input, and provide a scope and schedule update for the new Plan.

During Phase C, the mitigation strategy was developed for the Plan. The mitigation strategy included identification of mitigation goals and actions, and development of general and specific mitigation actions based on Phase B assessment results to lower the natural hazard risk and consequence of failure of District assets. This was accomplished by conducting the following tasks: review previous

mitigation actions and determine their status, identify and develop specific mitigation actions, prioritize action items, and develop a new implementation plan. The mitigation actions for the top 5 assets were further developed with planning level rough order of magnitude cost estimates. A basic benefit-cost analysis was performed for each mitigation project using the benefits estimated during Phase B of the planning process and using the results of the consequence assessment. A mitigation implementation plan was developed for the specific hazard mitigation projects (i.e., mitigation actions of top 5 assets) and included project prioritization, potential funding source identification, and proposed implementation schedule. A Risk Assessment Workshop was held with the District's Planning Team to review the results of Phase C. Next, a third Stakeholder meeting was held to present the results of Phase C to the Stakeholders, receive Stakeholder input, and provide a scope and schedule update for completion of this new Plan.

During Phase D, this new draft Plan was prepared with results from work performed during Phases A-C. The draft Plan was reviewed by the District, presented to Stakeholders, then revised and submitted to the State of Utah for review. After addressing State comments, the Final draft Plan was submitted to FEMA for review and approval. After receiving conditional approval of the Final Draft Plan from FEMA, the Plan was presented to the JVWCD Board for adoption. Finally, the signed adoption resolution was submitted to FEMA for final Plan approval.

1.1 Planning Team

The JVWCD Hazard Mitigation Plan (HMP) was prepared by the Elwell Consulting Group (ECG) Team under contract and the direction of the Jordan Valley Water Conservancy District. The planning team was made up of District managers, engineers, and technicians, as well as consultant civil, facilities, structural, electrical/instrumentation/controls, geotechnical engineers, geologists, and GIS specialists. Team members were chosen based on their knowledge of the JVWCD system and their engineering expertise in the area of natural hazards, water systems, and mitigation planning. The JVWCD managers and other key personnel, and the Elwell Consulting Group Team's project manager, facilities engineer, and geotechnical engineering lead, who served as the key planners for the project, are listed in Table 1.1. The remainder of the planning team members provided technical contributions throughout the planning process and are listed in Table 1.2 below.

Table 1.1 Planning Team - Key Planners

Team Member	Organization, Position Title
Alan Packard	Jordan Valley Water Conservancy District, Assistant General Manager – Engineering, Strategic & Long-term Planning, & New Initiatives
Brian Callister	Jordan Valley Water Conservancy District, Maintenance Dept. Manager
Bryon Elwell	Elwell Consulting Group, Project Manager/ HMP Lead
David McLean	Jordan Valley Water Conservancy District, Senior Engineer
Gordon Batt	Jordan Valley Water Conservancy District, Operations Dept. Manager
Hiram Alba	GeoStrata (ECG subconsultant), Geotechnical Engineering Lead
Jeff King	Jordan Valley Water Conservancy District, Security & Emergency Response Coordinator
Jeremy Williams	Brown & Caldwell (ECG subconsultant), Facility Specialist
Marcelo Anglade	Jordan Valley Water Conservancy District, Project Manager
Matt Hinckley	Jordan Valley Water Conservancy District, Operations Dept. Manager
Shane Swensen	Jordan Valley Water Conservancy District, Engineering Manager

Table 1.1 Planning Team - Key Planners	
Team Member	**Organization, Position Title**
Shazelle Terry	Jordan Valley Water Conservancy District, Assistant GM – Operations & Maintenance

Table 1.2 Planning Team -Technical Contributors	
Team Member	**Organization, Position Title**
Jack Grayson	Brown & Caldwell (ECG subconsultant), GIS
Jacob Young	Brown & Caldwell (ECG subconsultant), QA/QC
Jason Brown	Jordan Valley Water Conservancy District, IS Dept. Manager
Jeanette Perry	Jordan Valley Water Conservancy District, Customer Service Supervisor
Johnathan Jackson	Brown & Caldwell (ECG subconsultant), Principal EIC Engineer
Jon Harper	Brown & Caldwell (ECG subconsultant), Principal Structural Engineer
Jon Peadon	GeoStrata (ECG subconsultant), GIS Specialist
Lorrie Cowles	Jordan Valley Water Conservancy District, GIS Administrator
Matt Olsen	Jordan Valley Water Conservancy District, Assistant General Manager – Communications & Conservation
Robert Squire	Jordan Valley Water Conservancy District, Electronics & Instrumentation Manager
Shem Liechty	Brown & Caldwell (ECG subconsultant), QA/QC
Sophia Agopian	GeoStrata (ECG subconsultant), Staff Geologist
Tim Thompson	GeoStrata (ECG subconsultant), Engineering Geologist

1.2 Stakeholder Involvement

This section documents the involvement of federal, state, regional, and local stakeholders in the development of this JVWCD Hazard Mitigation Plan. The JVWCD Plan affects many jurisdictions, agencies, and organizations including wholesale member agencies/retail service & local jurisdictions, regional and county organizations, and federal and state agencies. Public involvement was attained throughout the planning process by holding periodic meetings with JVWCD stakeholders during all four phases of plan development. The meetings were provided to inform the stakeholders about the planning process, provide progress updates, brief them on evaluation results, and solicit comments and feedback. Table 1.3 identifies the stakeholder jurisdictions/agencies and organizations, and their participation in the planning process. Comments from the various public meetings were documented by the District's mitigation planning consultant and were incorporated into the JVWCD Hazard Mitigation Plan, as appropriate.

The District solicited public/stakeholder participation in the planning process by sending out Stakeholder Meeting invitation letters to all potential interested parties. A copy of the invitation list, invitation letters, and attendance records for each Stakeholder Meeting held during the planning process is provided in Appendix B along with Stakeholder comment sheets and survey forms completed during the planning process.

In addition, the District provided project briefings on the JVWCD HMP at Executive Committee/Board meetings, which were advertised with multiple notices (i.e., District website, Utah Public Notice website, etc.). The public was able to attend these District meetings in person or remotely and were

provided the opportunity to comment on the District's project and HMP. The District also made the HMP (hard copy) available at their District office for interested public for in person review and accepted comments. Documentation of the meeting notices, meeting minutes, and any comments received are also included in Appendix B.

Table 1.3 Stakeholder Planning Participation

Stakeholder	Stakeholder Meeting Attendance			
	Phase A Mtg #1:	Phase B Mtg #2:	Phase C Mtg #3:	Phase D Mtg #4:
Wholesale Member Agencies				
City of Bluffdale	✓	✓	✓	✓
Draper City	✓	✓	✓	✓
Granger-Hunter Improvement District	✓		✓	✓
Herriman City		✓		
Hexcel Corporation	✓	✓	✓	
Kearns Improvement District	✓	✓	✓	✓
Magna Water District	✓			
Midvale City	✓	✓	✓	
Riverton City	✓			
City of South Jordan	✓	✓	✓	✓
City of South Salt Lake	✓		✓	✓
Taylorsville-Bennion Improvement District	✓			
Utah Department of Corrections			✓	✓
WaterPro, Inc.	✓	✓		
City of West Jordan		✓		
White City Water Improvement District			✓	
Retail Service & Local Jurisdictions				
Holladay City		✓		
Murray City	✓			
Sandy City				
South Salt Lake				
County or Regional Agency				
Metropolitan Water District of SL & Sandy	✓	✓	✓	✓
Salt Lake County Emergency Management/Unified Fire Authority	✓			
Mountainland Association of Governments				
Salt Lake County	✓			
Utah Lake Water Users Association	✓	✓	✓	✓
State Agency				
Utah Division of Emergency Management	✓	✓	✓	

Table 1.3 Stakeholder Planning Participation				
	Stakeholder Meeting Attendance			
Stakeholder	Phase A Mtg #1:	Phase B Mtg #2:	Phase C Mtg #3:	Phase D Mtg #4:
Utah Division of Drinking Water	✓	✓	✓	✓
Utah Division of Water Rights	✓	✓		
Utah Geological Survey				
Utah Division of Forestry, Fire & State Lands		✓	✓	
Federal Agency				
U.S. Bureau of Reclamation			✓	
U.S. Forest Service – Intermountain Region	✓	✓		
FEMA – Region VIII	✓	✓		
Other				
Rocky Mountain Power	✓	✓	✓	
Dominion Energy				✓

1.3 Planning Timeline

The JVWCD hazard mitigation planning project began at the end of March 2021 with approximately a 9-month planned project duration. The key milestones and their corresponding completion dates are shown in Table 1.4 below. The project was divided into four phases. Phase A, Planning Process started with the Kickoff Meeting in March 2021 and ended with the Phase A Stakeholder meeting in April 2021. Phase B, Risk Assessment began in April 2021 and ended in June 2021 with the Phase B Stakeholder meeting. Phase C, Mitigation Strategy began in June 2021 and ended in July 2021 with the Phase C Stakeholder meeting. Phase D, Plan Review & Adoption started in July 2021 and was completed upon JVWCD Board adoption of the Plan in November 2021.

A review meeting to discuss the draft Plan was held on August 26, 2021, with the District's planning team, after which the District provided comments for incorporation into the final Plan. The final Stakeholder Meeting was held in September 2021. The final Plan was then prepared and submitted to the State of Utah for review. After making State-requested changes, the Plan was submitted to FEMA for review in September 2021. FEMA completed review of the Plan in October 2021 and granted conditional approval of the Plan pending JVWCD Board adoption. The District presented the JVWCD Hazard Mitigation Plan to the JVWCD Board of Trustees for adoption on November 10, 2021. The JVWCD Board adoption resolution was submitted to FEMA, and FEMA issued a letter of Plan approval on November 29, 2021.

Table 1.4 Planning Process Timeline		
Date	Action	Description
March 23, 2021	Kickoff Mtg	Kickoff meeting with District personnel lead by planning consultant to begin Hazard Mitigation Plan project
April 1, 2021	Phase A Planning Team Mtg #1 & Asset Prioritization	Planning process results reviewed with District and Phase B Asset prioritization (collaborative pairwise comparison asset criticality ranking) completed with District
April 6, 2021	Phase A Stakeholder Mtg #1	Stakeholders briefed on Phase A results and feedback/comments solicited with Stakeholder Survey #1

Table 1.4 Planning Process Timeline		
Date	**Action**	**Description**
April 28, 2021	Phase B Planning Team Mtg #2 – Risk Screening	District personnel participate in a workshop discussing consequences of identified hazard vulnerabilities of top 20 assets & selected highest 40 Asset-Hazard Pairs for Risk Assessment
May 27, 2021	Phase B – Risk Assessment Workshop	Risk Assessment results reviewed with District & Top 5 Assets ranked for Mitigation Actions during Phase C
June 8, 2021	Phase B Stakeholders Mtg #2	Stakeholders briefed on hazard evaluation & risk assessment results, and feedback/comments solicited with Stakeholder Survey #2
July 13, 2021	Phase C Planning Team Mtg #3	Hazard mitigation actions and plan for implementation reviewed with District
July 20, 2021	Phase C Stakeholders Mtg #3	Stakeholders briefed on hazard mitigation strategy & Stakeholder Survey #2 results reviewed and feedback/comments solicited
August 25, 2021 - September 2, 2021	District review of Draft Hazard Mitigation Plan	District reviewed the draft plan and provided comments
August 26, 2021	Phase D Planning Team Mtg #4 – Draft Plan Review	District personnel briefed on Plan and District review comments discussed
September 2, 2021	Phase D Final Stakeholders Briefing	Mitigation Plan briefing
September 7, 2021 - September 8, 2021	State of Utah review of Mitigation Plan	State of Utah reviewed the Plan and provided comments
September 8, 2021 - October 20, 2021	FEMA review of Mitigation Plan	FEMA reviewed the Plan and provided comments
October 22, 2021	Updated JVWCD Plan to FEMA	District updated & resubmitted Plan to FEMA addressing comments received
October 22, 2021 - October 29, 2021	FEMA review of Updated Plan	FEMA reviewed the updated Plan and provided conditional approval
November 10, 2021	JVWCD Board Mtg	JVWCD Board passed a resolution to adopt the JVWCD Hazard Mitigation Plan
November 29, 2021	FEMA approval	FEMA issued final approval of the Plan
December 3, 2021	Final Hazard Mitigation Plan	Final Plan submitted to the District with JVWCD Board adoption and FEMA approval

1.4 Plan Adoption

FEMA provided conditional approval of the JVWCD Hazard Mitigation Plan on October 29, 2021, pending adoption of the Plan by the local governing body for JVWCD (the JVWCD Board). The JVWCD Board passed a resolution adopting the Plan during a board meeting held on November 10, 2021. A copy of the signed JVWCD Board resolution is provided in Addendum #1.

Section 2

Hazard Identification

In 2004, the District developed their original JVWCD Hazard Mitigation Strategy (Plan), which included an assessment of what it considered at that time as its prevailing natural hazards – earthquake, landslide and flood. There was also a brief assessment of a few other potential hazards – power outages due to natural hazards, and wildfire included in the 2004 Hazard Mitigation Strategy. This new Plan now addresses all the known, applicable natural hazards that pose a potential risk to the JVWCD water system.

2.1 Natural Hazards

The natural hazards that present potential risk to the JVWCD system were identified from the comprehensive list included in the Federal Emergency Management Agency (FEMA) Local Mitigation Planning Handbook dated March 2013. This FEMA guidance document lists the potential natural hazards as: avalanche, dam failure, drought, earthquake, erosion, expansive soils, extreme cold, extreme heat, flood, hail, hurricane, landslide, lightning, sea level rise, severe wind, severe winter weather, storm surge, subsidence, tornado, tsunami, and wildfire. Of this all-inclusive list, the natural hazards to which the JVWCD system is susceptible, based on climate and location, are:

avalanche	flood N(F)	severe wind
dam failure	landslide N(LS)	severe winter weather
debris flow	lightning N(L)	subsidence
drought N(D)	problem soils	tornado
earthquake N(E) & N(E-WF)	rockfall	wildfire N(W)

Note: The District added a few specific natural hazards that were not listed in FEMA's guidance document specifically but have been known to exist for their critical assets: Problem soils (collapsible soils, expansive soils, erosion, and undocumented fill), and debris flow. The landslide hazard also included rockfall.

The nomenclature used for each of the above natural hazards (i.e., N(D), N(E), N(F), etc.) will be used in presenting the Section 3 Risk Assessment and Section 4 Mitigation Strategy information, where the N stands for Natural Hazard and the letter in parenthesis stands for the specific hazard type. The second code used for the earthquake hazard of N(E-WF) is used to define the earthquake hazard along the Wasatch Front part of the JVWCD assets (applied to all 20 key assets) which has a higher likelihood than the N(E) hazard based on a regional study performed on the Wasatch Front faults in 2016. It is also important to note that only the six hazards (drought, earthquake, flood, landslide, lightning and wildfire) are shown in the table above with the naming convention (e.g., N(D)) following them; because they were the only hazards advanced forward through the risk screening process and are part of the asset-hazard pairs that received the full risk assessment. For additional details on the Risk Assessment process, see Section 3.0. The following is a description of each of the potential natural hazards that the JVWCD assets are susceptible to.

2.1.1 Avalanche

Avalanches are typically rapid down-slope movement of snow, ice, and debris. They are the result of snow accumulation on a steep slope and can be triggered by ground shaking, sound, wind, animal or a person. The two main factors affecting avalanche activity include weather and terrain – large

frequent storms combined with steep slopes result in avalanche danger. Slope angles between 30 to 45 degrees are optimum for avalanches. Additional factors contributing to slope stability are amount of snow, rate of accumulation, moisture content, snow crystal types, and the wind speed and direction. In Utah, the months of January through April have the highest avalanche risk.

2.1.2 Dam Failure

Dams are structures that store water and diverge and impound water upstream. Most dams have a spillway where the flow of water from the reservoir is controlled. Dam failures result from the breach or overtopping of a manmade water impoundment structure, which often results in catastrophic down grade flooding. Dams owned by JVWCD are all off stream structures and will never likely be overtopped. Failure of these structures would likely be associated with cracking of the embankment through either settlement or ground shaking associated with an earthquake. The severity of a dam or levee failure depends on the area protected by the dam or levee, the volume and velocity of water that breaches the structure, and the structures and population in the protected area. A dam or levee breach will result in flooding of normally protected areas, resulting in impacts similar to those seen in areas that are within the floodplain and not normally protected by a levee. Dams are classified using a National Dam Safety Program hazard classification of the following three Hazard Categories: 1) High, 2) Significant, and 3) Low (see Table below).

Table: CORPS of Engineers Hazard Potential Classification

Hazard Category (a)	**Direct Loss of Life** (b)	**Lifeline Losses** (c)	**Property Losses** (d)	**Environmental Losses** (e)
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	Rural location, only transient or day-use facilities	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required
High	Certain (one or more) extensive residential, commercial, or industrial development	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

a. Categories are assigned to overall projects, not individual structures at a project.
b. Loss of life potential based on inundation mapping of area downstream of the project. Analyses of loss of life potential should take into account the population at risk, time of flood wave travel, and warning time.
c. Indirect threats to life caused by the interruption of lifeline services due to project failure or operational disruption; for example, loss of critical medical facilities or access to them.
d. Damage to project facilities and downstream property and indirect impact due to loss of project services, such as impact due to loss of a dam and navigation pool, or impact due to loss of water or power supply.
e. Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Source: U.S. Army Corps of Engineers, 1995

For additional details on the dam failure hazard see pages 66 - 75 of the 2019 Salt Lake County Multi-jurisdictional HMP.

2.1.3 Debris Flow

Debris flows are water-laden masses of soil and fragmented rock often called mudslides, mudflows, or debris avalanches and usually associated with flooding types of rainfall events or rapidly melting

snowmelt. The debris within a debris flow is typically comprised of soil, rock fragments, and organic material such as trees and other vegetation that are picked up by scouring of rapidly moving water as the flow moves down a confining channel. Debris flow deposits are categorized based on the water to sediment ratio and viscosity of the debris flow. Debris flows may also be generated when a landslide deposit becomes rapidly saturated with water and flows into a channel.

Intense rainfall and rapid snowmelt are generally events that may trigger debris flow movement. Debris flows and floods also occur when heavy rains on recently burned slopes results in higher-than-normal runoff and in turn channel scour. Repeated debris flows and/or flood events deposit sediment at the mouth of canyons, forming an alluvial fan. Flows may travel farther down the fan from the mouth of the canyon if the channel becomes entrenched and the flow is confined.

Debris flows can be viscous and can transport extremely large boulders (greater than 6-foot diameter); debris flows may eventually become muddy flood waters as they deposit their debris. Debris flows tend to move in pulses. Early pulses or previous debris flows can form levees that channel the flow until the levees are breached. The presence of older levees indicates the recurrence and characteristics of debris flows in a particular canyon.

2.1.4 Drought

Drought is a normal recurrent but temporary feature of climate, which results from prolonged periods of below normal precipitation. The severity and frequency of droughts is expected to increase from adverse climate change impacts. Droughts affect the availability of water for M&I, agricultural, recreational, and environmental uses alike. Drought accompanied by higher temperatures also increase the occurrence of algal blooms that have the potential to produce harmful cyanotoxins that render secondary sources unusable. Droughts also heighten the risk of wildfire. The United States Drought Monitor has a map that identifies areas of drought and labels them by intensity. D1 is the least intense level and D4 the most intense. Drought is defined as a moisture deficit bad enough to have social, environmental or economic effects. D0 areas are not in a drought but are experiencing abnormally dry conditions that could turn into drought or are recovering from drought but are not yet back to normal. The five stages of drought from low to high include: D0 Abnormally Dry, D1 Moderate Drought, D2 Severe Drought, D3 Extreme Drought, and D4 Exceptional Drought.

The Palmer Drought Severity Index (PDSI), which has become the "semi-official" drought index as it is standardized across various climates. The index uses zero as normal and assigns a number between 6 and -6, with dry periods having negative numbers and wet periods expressed using positive numbers (NDMC 2006) For additional details on the drought hazard see pages 75-83 of the 2019 Salt Lake County Multi-jurisdictional HMP.

2.1.5 Earthquake

An earthquake is the abrupt shaking of the earth caused by the sudden breaking of rocks when they can no longer withstand the stresses that build up deep beneath the earth's surface. The rocks tend to rupture along weak zones referred to as faults. This sudden release of seismic energy can cause ground shaking, surface fault rupture, and liquefaction.

Ground shaking causes the most impacts during an earthquake because it affects large areas and is the origin of many secondary effects associated with earthquakes. Ground shaking, which generally lasts 10 to 30 seconds in large earthquakes, is caused by the passage of seismic waves generated by earthquakes. Earthquake waves vary in both frequency and amplitude. High frequency low amplitude waves can cause more damage to short stiff structures, whereas low frequency high amplitude waves have a greater effect on tall (high-rise) structures. Ground shaking is measured using Peak Ground Acceleration (PGA). Local geologic conditions such as depth of sediment and

sediment make up affect earthquake waves. Deep valley sediments increase the frequency of seismic waves relative to bedrock.

During a large earthquake fault movement may propagate along a fault plane to the surface, resulting in surface rupture along the fault. Anything built on top of or crossing a fault has a high potential of major damage of fault rupture displacement. Examples of damage include cracked foundations, building structures torn apart, broken up roads, and breaks or ruptures in utility lines, pipelines, or any other utilities. Surface fault rupture does not occur on a single distinct plane; instead, it occurs over a zone often several hundred feet wide known as the zone of deformation.

Soil liquefaction occurs when water-saturated cohesion-less sandy soils are subject to ground shaking. When liquefaction occurs, soils behave more like a viscous liquid (quicksand) and lose their bearing capacity and shear strength. For soils to liquefy, they must be sandy, loose, water-saturated soils typically between 0 and 30 feet below the ground surface and the ground shaking must be strong enough to cause soil to liquefy. The loss of shear strength and bearing capacity due to liquefaction causes buildings to settle or tip and light buoyant structures such as buried storage tanks and empty swimming pools to float upward. Liquefaction can also cause damage through lateral spreading, which is soil displacement of three or more feet accompanied by ground cracking and vertical displacement. Lateral spreading can cause roads, buildings, buried utilities, and other structures to be pulled apart.

2.1.6 Flood

Flooding is a temporary overflow of water onto lands not normally inundated by water. Often, mud/sediment/debris flows happen concurrently with flooding, causing damages sometimes more severe than what flooding alone may have caused. Factors that determine the severity of floods include rainfall intensity, duration of a storm, and rapid snowmelt. A large amount of rainfall over a short time span can result in flash flood conditions. Small amounts of rain can also result in flooding at locations where the soil has been previously saturated or if rain concentrates in an area having impermeable surfaces such as large parking lots, paved roadways, or post-burned areas. Topography and ground cover are also contributing factors for floods. Water runoff is greater in areas with steep slopes and little or no vegetative ground cover. Frequency of flood inundation depends on the climate, soil, and channel slope. Conditions which may exacerbate floods include steeply sloped watersheds, constrictions, obstructions, debris contamination, soil saturation and velocity.

2.1.7 Landslide

Landslides are the downslope movement of rock, debris, or soil. Landslides occur because of either an increase in the driving forces (weight of slope and slope gradient) or a decrease in the resisting forces (friction, or the strength of the material making up a slope). Geology, topography, water content, vegetative cover, and slope aspect are key factors of slope stability.

2.1.8 Lightning

Lightning is a giant spark of electricity that occurs between the positive and negative charges within the atmosphere or between the atmosphere and the ground. During the development of a thunderstorm, rapidly rising air combined with movement of precipitation within a cloud causes electrical charges to build. As negative charges build up near the base of the cloud, the ground beneath the cloud and the area surrounding the cloud become positively charged. When the potential between the positive and negative charges becomes too great, there is a discharge of electricity that we know as lightning.

2.1.9 Problem Soils

Problem soils include collapsible, expansive and undocumented fill soils. Collapsible soils are low density and typically dry soils that decrease in volume when exposed to water. This type of problem soils typically occur in alluvial fan deposits, dry loess or eolian deposits or unconsolidated colluvium deposits. Undocumented fill soils underlying facilities could have the potential for settlement which could result in differential settlement below these facilities. Expansive soils are often associated with high plasticity clays and shale bedrock.

2.1.10 Rockfall

Rockfalls are the fastest moving type of mass movement hazard and predominantly occur in mountains where a rock source exists along and above steep slopes and cliffs that slope greater than 35 degrees. Rockfalls are a result of a loss of support from beneath the rock mass that can be caused by freeze/thaw action, rainfall, weathering and erosion, and/or strong ground shaking resulting from seismic activity. Rockfalls result in the collection of rock fall material, referred to as talus, either on or at the base of the slope. The presence of talus indicates that a rockfall has occurred and the hazard is present at the site.

2.1.11 Severe Wind

Severe wind is most likely the result of a downburst, which is a severe localized wind blasting from a thunderstorm. Downbursts fall into two categories by size – micro-bursts and macro-bursts. Micro-bursts cover an area less than 2.5 miles in diameter. Macro-bursts cover an area with a diameter larger than 2.5 miles.

2.1.12 Severe Winter Weather

Severe winter weather comes in the form of snow and cold temperatures. A severe winter snowstorm deposits at least four inches of snow during a 12-hour period or six inches of snow during a 24-hour period and has winds in excess of 35 mph and temperatures at or below 20° F. A blizzard is a snowstorm with sustained winds of 40 mph or more or gusting winds of at least 50 mph with heavy falling or blowing snow persisting for one hour or more at temperatures of 10° F or colder.

2.1.13 Subsidence

Subsidence is the settling or collapse of the ground. Causes of subsidence include limestone and karst terrain, gypsiferous soil, piping, peat, and mine collapse.

- Karst terrain is characterized by closed depressions, caverns, and streams that abruptly disappear underground. Limestone is susceptible to dissolution by ground water and surface water thus forming karst terrain, which can result in a collapse of the ground surface.
- Gypsiferous deposits, when wetted, are subject to settlement, causing sinkholes similar to those found in karst terrains.
- Piping is a type of subsurface erosion caused by the movement of ground water that removes fine-grained particles creating subsurface voids or channels. These channels increase in size as more and more water is collected until the walls and roof can no longer support the weight above and collapse occurs.
- Peat consists of partially decomposed plant remains that usually accumulate in areas of shallow ground water and near standing water. When water is removed, peat can subside, compress, and settle under pressure.

- Mining removes rock and leaves underground voids that, if not supported, can collapse and cause ground subsidence and sinkholes.

2.1.14 Tornado

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. Tornadoes have high wind speeds and cover large areas. Tornadoes are classified by wind damage using the Fujita Scale, which ranges from F0 at the low end (40-72 mph winds) to F5 at the high end (261-318 mph winds). The damage associated with a tornado can comparatively range from light or minor (tree limbs broken) to devastating damage that destroys structures and carries away large objects.

2.1.15 Wildfire

A wildfire is an uncontrolled fire spreading through vegetative fuel. Wildfires are placed into two classifications – wildland and urban-wildland interface fires. Wildland fires are those occurring in an area where development is essentially nonexistent, except for roads, railroads, or power lines. An urban-wildland interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels. Major ignition sources for wildfires are lightning and human causes such as arson, recreational activities, burning debris, and carelessness with fireworks. Vegetation, topography, and weather are all conditions having an effect on wildfire behavior. The Fire Effects Index (FEI) is the measure used to determine the expected effects if a fire occurs and is based on a rating of suppression difficulty and values impacted, which identifies areas that have important values at risk to wildland fire and/or are costly to suppress. The FEI has two sets of ratings 1) Values Impacted Rating (i.e., Wildland development areas, Drinking water importance areas, Infrastructure assets, Forest assets & Riparian assets) and 2) Suppression Difficulty Rating (i.e., fuel type and topography) The Fire Threat Index (FTI) is a mathematical calculation to estimate the probability of an acre igniting and the expected final fire size. Finally, the Fire Risk Index (FRI) is determined by combining the FEI with the FTI resulting in the overall risk of wildfire. For additional details on the wildfire hazard see pages 160 - 170 of the 2019 Salt Lake County Multi-jurisdictional HMP.

2.2 Previous Hazard Occurrences

Previous natural hazard events affecting the JVWCD service area are discussed below. Information about past occurrences was obtained from interviews with District personnel and also from the 2019 Salt Lake County HMP Annex for the following Cities that are also member agencies within the JVWCD service area and/or receive water from JVWCD: Bluffdale, Draper, Herriman, Midvale, Riverton, Salt Lake City, South Jordan South Salt Lake, Taylorsville, West Jordan.

The District's and its member agencies experience with natural hazards includes incidents related to drought, flood, lightning, landslide, severe wind, severe winter weather, and wildfire. The previous specific hazard occurrences identified by District personnel and those from the 2019 Salt Lake County HMP Annex are summarized in Table 2.1.

Note, while the District has experienced some past flooding occurrences at some of its assets located in or crossing waterways, there are no repetitive loss structures owned and/or operated by the District.

Table 2.1 Previous Hazard Occurrences in the JVWCD Service Area

Hazard	Approx. Year	Occurrence Description

Table 2.1 Previous Hazard Occurrences in the JVWCD Service Area		
Debris Flow	7/21/2009	Debris Flow in Draper
	8/19/2010	Flood and Debris Flow in Draper
Drought	2012 to 2016	Utah Lake fell to levels causing the Utah State Engineer to prohibit diversions of more than 100,000-acre feet of secondary storage rights (junior water right holders) in Utah Lake. This forced early canal closures. The low water levels also intensified a wide-spread algal bloom in Utah Lake prompting public health advisories
Earthquake	2/20/1981	Earthquake magnitude of 4.7 and epicenter in South Jordan
	12/17/1981	Earthquake magnitude 2.2 and epicenter in South Jordan
	5/24/2001	Earthquake magnitude of 2.9 and epicenter in South Jordan
	2/8/2006	An earthquake with a magnitude of 2.1 and epicenter in South Jordan. Ground shaking felt over parts of the Salt Lake Valley
	5/28/2007	An earthquake with a magnitude of 2.3 and epicenter in South Jordan. Ground shaking felt over parts of the Salt Lake Valley
Flood	1983	Rapid melt of an above average snowpack in April caused flooding and super saturated the ground causing a mudflow that breached a Kennecott Copper Mines retention basin flooding contaminated water over several acres that percolated into the aquifer. The result was a contaminated groundwater plume that started migrating toward JVWCD and other community potable water supply wells. The SWGWTP and BCaWTP were constructed to remediate the groundwater plume and produce potable water
	9/6/2002	Flash Flood: A canal above Bluffdale overflowed, sending a wall of water and mud into a subdivision, flooding at least 10 homes. $200,000 property damage
	9/6/2002	Flash Flood in Riverton: Heavy thunderstorm downpours produced localized flash flooding and caused $200,000 in Salt Lake County
	8/3/2007	Flash Flood: Rainfall of 1.1 inches in 30 minutes inundated storm drains and resulted in numerous reports of basement flooding. $45,000 property damage
	6/5/2010	Flash Flood in Midvale: Damage was reported in homes, apartments and businesses. $1,500,000 property damage
	7/26/2011	Flash Flood: In Taylorsville, at least a half dozen homes had flooded basements near the intersection of 5400 South and 3200 West. Water caused a sinkhole to form in the roadway around 6200 South and 2700 West, buckling and collapsing the street. $350,000 in property damage
	7/9/2013	Flash Flood in Midvale: Heavy rain over the Salt Lake Valley flooded six residential properties in Midvale and Sandy. $15,000 property damage
	9/14/2013	Thunderstorms & Flooding: In Herriman, floodwaters entered an apartment complex, impacting about 18 apartment units. $100,000 damages
	9/14/2013	In South Jordan, 11 homes in the Sunstone subdivision experienced basement flooding, with water several inches deep. $100,000 in property damage
Lightning	1993 – 95	Offloading chemical when a near strike took out SCADA at the SERWTP
	7/26/2017	Lightning Strike & Flash Flood in Taylorsville: 2 injured, and $8,750,000 in property damage
	7/26/2017	Lightning 2 injured
Landslide	Aug 1991	900 to 1,000 NTU Flowed into the JVWTP Floc & Sed Basins due to sever rainstorm impacting the Murdock Canal
	4/10/2013	Slope failure: A significant landslide triggered by mining activities occurred just west of South Jordan at the Kennecott Copper Mine
Severe Wind	8/21/2001	Riverton reported a gust to 70 mph (61 kts)
	3/26/2012	63 mph at Bluffdale. $20,000 property damage
	6/12/2013	Thunderstorm/Wind in South Jordan: Multiple large trees were knocked down, including a few that fell on houses and caused damage to roofs. $50,000 in property damage

Table 2.1 Previous Hazard Occurrences in the JVWCD Service Area		
	2/17/2016	In Salt Lake City, scaffolding collapsed on an assisted living center being built; no one was injured, but debris from the incident covered the road and forced the closure of the northbound lanes of Foothill Drive and Parleys Way during the morning. $200,000 property damage
	3/5/2017	68 mph at Draper. 100,000 property damage
	6/12/2017	High Wind in South Salt Lake: widespread power outages. $40,000 in damage
	10/20/2017	High winds knocked down power lines in Midvale, with over 2,000 customers losing power. 5,000 property damage
	7/30/2018	Thunderstorm Wind in South Salt Lake: Thunderstorm winds caused a 20' tree to fall on a 2 story home in South Salt Lake. $10,000 in property damage
Severe Winter Weather	12/19/1998	Winter Storm in South Jordan: Power outages were also noted in portions of South Jordan
	11/21/1999	Heavy Snow: 10 inches at Riverton
	8/8/2008	Draper City - Corner Canyon Fire. 680 acres burned but no homes impacted
	11/28/2010	Winter Storm in West Jordan: 14 inches of snow
	3/22/2013	Lake-Effect Snow in West Jordan: 8 inches of snow
	12/19/2013	Winter Storm in Herriman: 10 inches of snow. $40,000 in property damage
	1/10/2017	Winter Storm in South Salt Lake: 14 inches of snow. $1,000 in property damage
	2/3/2019	Heavy Snow in Taylorsville with 18 inches
	2/3/2019	Heavy Snow in West Jordan: 22 inches of snow
	2/3/2019	Heavy Snow: 22 inches of snow in West Jordan
	3/1/2019	Heavy Snow in South Jordan: Widespread heavy snowfall due to a lake effect snow band
Wildfire	9/19/2010	Machine Gun Fire in Herriman. Wildland Urban Interface Fire
	2012	Pinyon Fire in Herriman. Wildland Urban Interface Fire
	4/15/2015	Wildfire in Salt Lake City: $50,000 property damage
	2018	Herriman - High Country Estates Fire. Wildland Urban Interface Fire
	2018	Herriman - Rose crest Fire. Also, had the 611 acres Rosecrest Fire in June 2012, lost multiple homes in the unincorporated county but all these fires were a direct threat to Herriman residents and infrastructure

2.3 Hazard Significance

Each of these potential natural hazards were evaluated to determine the overall risk they individually pose to the JVWCD system. This evaluation used Worksheet 5.1 from FEMA ' s Local Mitigation Planning Handbook (2013) as its basis and took into account the geographic extent of the hazard within the JVWCD planning area, the probable magnitude of the hazard, and the likelihood of a hazard event.

The **Geographic Area Affected** was estimated for each hazard using the following metrics:

Negligible: affects less than 10% of planning area or isolated single-point occurrence

Limited: affects 10-25% of planning area or limited single-point occurrences

Significant: affects 25-75% of planning area or frequent single-point occurrences

Extensive: affects 75-100% of planning area or consistent single-point occurrences

The **Probable Strength/Magnitude** of each hazard event was estimated based on the following metrics:

Weak: Limited classification on the scientific scale, low speed of onset or short duration of event, resulting in little to no damage

Moderate: Moderate classification on the scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of service for days

Severe: Severe classification on the scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months

Extreme: Extreme classification on the scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions

To estimate the **Probability of a Future Event** for each hazard, the following metrics were used:

Unlikely: less than 1% probability of occurrence in the next year or a recurrence interval of greater than 100 years

Occasional: 1 to 10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years

Likely: 10 to 90% probability of occurrence in the next year or a recurrence interval of 1 to 10 years

Highly Likely: 90 to 100% probability of occurrence in the next year or a recurrence interval of less than 1 year

The summary results of this overall hazard significance rating are presented in Table 2.2. **The Overall Significance Rating** of each hazard to the JVWCD water system was determined by qualitatively combining the three rating criteria as follows:

Low: Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.

Medium: The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.

High: The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

Table 2.2 Hazard Significance Summary				
Hazard	Rating Criteria			Overall Significance Rating
	Geographic Area Affected	Probable Strength/Magnitude	Probability of a Future Event	
Avalanche	Negligible	Moderate	Unlikely	**Low**
Dam Failure	Negligible	Severe	Unlikely	**Low**
Debris Flow	Negligible	Moderate	Occasional	**Medium**
Drought	Extensive	Moderate	Likely	**Medium**
Earthquake - *Ground Shaking (2PE50 & 10PE50)*	Extensive	Severe	Occasional	**Medium**
Earthquake – L*iquefaction*	Significant	Severe	Occasional	**Medium**
Earthquake - *Surface Fault Rupture/Fault Crossings*	Limited	Severe	Occasional	**Medium**
Flood	Limited	Moderate	Occasional	**Medium**
Hail	Limited	Weak	Occasional	**Low**
Landslide *including Rockfall*	Limited	Moderate	Occasional	**Medium**
Lightning	Significant	Weak	Likely	**Medium**
Problem Soils (*including collapsible soils, expansive soils, erosion, & undocumented fills*)	Limited	Moderate	Occasional	**Medium**
Severe Wind	Significant	Weak	Highly likely	**Medium**
Severe Winter Weather	Extensive	Moderate	Highly likely	**Medium**
Subsidence	Negligible	Moderate	Unlikely	**Low**
Tornado	Limited	Weak	Occasional	**Low**
Wildfire	Limited	Moderate	Likely	**Medium**

As can be seen in Table 2.2, all the potential hazards were determined to pose medium risk to the JVWCD system except for avalanche, dam failure, hail, subsidence, and tornado, which have low significance ratings. Therefore, these five hazards rated with low significance were not evaluated further; however, the other 12 natural hazards were evaluated for risk on an asset-by-asset basis. To facilitate the asset-based hazard evaluation assessment of the JVWCD system, the 20 key assets were prioritized based on their criticality to the function of the water system, rated based on their vulnerability to each of the 12 hazards, and classified to establish those assets which would be explicitly evaluated against each hazard (asset-hazard pairs). This Asset Prioritization process is described in Section 2.4 below. This process combined with the Section 2.5 Hazard Rating resulted in the determination of which assets and hazards would be combined into asset-hazard pairs for assessment during the Phase B Risk Assessments (see Section 3.1 and Table 3.1).

2.4 Asset Criticality Ranking

In April 2021, a workshop to determine the criticality ranking of JVWCD's 20 key assets was held using an online Zoom meeting. Attendees included key JVWCD managers and engineers, as well as key ECG Team personnel. The major objective of the workshop was to determine the criticality ranking for the top 20 JVWCD key assets shown in Table 2.3 in the order they were assessed but not by their criticality ranking which is shown in Section 2.4.2 Table 2.5.

Table 2.3 JVWCD Key Critical Assets			
Asset #	Asset Name	Asset #	Asset Name
1	South East Regional Water Treatment Plant (SERWTP)	11	Jordan Narrows Pump Station
2	Jordan Valley Water Treatment Plant (JVWTP)	12	118th South Zone C Pump Station
3	Moniter Drive Well	13	Pump Station serving Zone B North (3200 W. 6200 S.)
4	Newbury Well	14	Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W
5	1443 E. 9400 S. Well	15	Jordan Aqueduct (Reaches 1 – 4)
6	JVWTP 8 MG Reservoir	16	Central Pipeline
7	JVWTP 1 MG Reservoir	17	150th South Pipeline
8	Old Bingham 3 MG Tank	18	24" Cross Valley Pipeline
9	Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete	19	Creek Road Pipeline (24" to 33")
10	Terminal Reservoir 100 MG	20	114th South Pipeline

2.4.1 Pair Wise Comparison

A pair wise comparison method was used to perform the facility ranking. First, the JVWCD mission and values (see Introduction) were used to determine facility comparison criteria, as follow:

Reliability: Consistently delivering water services to customers with priority for indoor demands and maintaining minimum water pressure.

Quality: Meeting all Federal, State and internal water quality standards for drinking water.

Safety: Employee safety, public safety, injury/illness/deaths associated with critical assets. This does not include water quality safety issues. Does not include property damage liability in Value criteria.

Value: Financial Accountability in terms of efficient & cost-effective management of assets (i.e., costs, property, value, employees, customers, etc.).

Pair-Wise comparison of the criteria against one another resulted in criteria weighting factors shown in Table 2.4 and the complete Asset Pair-Wise matrix spreadsheets are provided in Appendix C.

Table 2.4 Criteria Weighting Factors	
Criteria	Weighting Factor
Reliability	13
Safety	11
Quality	8
Value	4

2.4.2 Asset Criticality Tier Ranking Results

Second, the 20 JVWCD assets were compared against each other using the pair-wise comparison approach based on input from the various JVWCD representatives in attendance at the Workshop. This comparison resulted in a total weighted sum (overall asset score) based on the scores for each of the four ranking criteria. The individual asset total scores were then normalized (divided) by the total maximum score possible from the pair-wise comparison. The individual assets were then

grouped into four tiers of five assets per tier based on their overall asset priority score. The assets with the highest scores were grouped into Criticality Tier 1, followed by the second highest scoring individual assets grouped into Tier 2, and so forth. The results of the asset ranking, including overall asset score, priority rank, and tier grouping for each of assets, are shown in Table 2.5. The complete set of Asset Pair-Wise matrix spreadsheets are provided in Appendix C.

Table 2.5 Asset Criticality Ranking

Asset	Overall Asset Score	Rank
Tier 1 Assets		
JVWTP (180 MGD)	3202	1
Jordan Aqueduct Reaches (1-4)	2516	2
SERWTP (25 MGD)	2477	3
JVWTP 1 MG Reservoir	2387	4
Terminal Reservoir (100 MG)	2126	5
Tier 2 Assets		
Central Pipeline	2115	6
150th South Pipeline	2115	7
24" Cross Valley Pipeline	2076	8
Creek Road Pipeline (24" to 33")	2076	9
114th South Pipeline	2076	10
Tier 3 Assets		
118th South Zone C Pump Station	1976	11
Pump Station serving Zone B North (3200 W. 6200 S.)	1976	12
Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W	1820	13
Zone B North Reservoirs	1792	14
1443 E. 9400 S. Well	1781	15
Tier 4 Assets		
Moniter Drive Well	1768	16
Newbury Well	1768	17
Old Bingham 3 MG Tank	1747	18
JVWTP 8 MG Reservoir	1704	19
Jordan Narrows Pump Station	1542	20

2.5 Hazard Rating

In order to prioritize the natural hazard risks, each JVWCD key asset was rated based on its potential risk for each type of natural hazard.

A hazard evaluation for each of the medium-risk and high-risk hazards identified in Section 2.3 was performed on the 20 key assets. The Assets were scored by the project team based on the following scoring definitions:

- High (H): asset completely disabled; utility's mission fully or nearly defeated; deaths, injuries, or other high costs.

- Medium (M): asset partially disabled; utility's mission moderately impacted; moderate amount of other costs.
- Low (L): asset not or only slightly disabled; utility's mission only slightly impacted; low amount of other costs.
- Not Applicable (N/A): given threat cannot be carried out, or otherwise does not apply.

Each applicable hazard was assessed based on that hazard's impact to the Asset. There were 20 Assets that were assessed for 12 natural Hazards resulting in a total of 240 asset-hazard pairs. The results of the ECG Team's preliminary hazard assessment scoring found the following number of asset-hazard pairs for the 20 Assets for each of the four scoring criteria of H, M, L, and not applicable (N/A); results are summarized in Table 2-6.

Table 2.6 Preliminary Hazard Assessment - Scoring

Natural Hazard	High(H)	Medium (M)	Low(L)	N/A	Total # of Assets by Hazard
Debris Flow	1	1	3	15	**20**
Drought	3	4	0	13	**20**
Earthquake - Ground Shaking (2PE50 & 10PE50)	19	1	0	0	**20**
Earthquake – Liquefaction	8	0	0	12	**20**
Earthquake - Surface Fault Rupture/Fault Crossings	2	0	0	18	**20**
Flood	1	1	18	0	**20**
Landslide including Rockfall	2	0	1	17	**20**
Lightning	6	4	4	6	**20**
Problem Soils (including collapsible soils, expansive soils, erosion, & undocumented fills)	0	0	20	0	**20**
Severe Wind	0	4	10	6	**20**
Severe Winter Weather	0	0	20	0	**20**
Wildfire	3	0	12	5	**20**
Total # of Assets by Scoring Criteria	**45**	**15**	**88**	**92**	**240**

This preliminary hazard assessment which found 45 High (H) consequence asset-hazard pairs as shown in the second column of Table 2.6 was reviewed with the District's Planning Team at the Phase B Planning Risk Screening Workshop to screen and select up to 40 asset-hazard pairs for risk assessment. This is covered in greater detail in Section 3.1 Risk Screening under the next Section 3.0, Risk Assessment.

Section 3

Risk Assessment

This section covers risk screening, risk analysis, and risk assessment results for the Hazards and Assets defined in Sections 2.1 and 2.4, respectively.

A hazard evaluation of each of the JVWCD selected 40 asset-hazard pairs from the Risk screening conducted during the Phase B Planning Team Meeting #2 for the 20 critical assets was performed. The results of the assessments of the 40 asset-hazard pairs are discussed below by hazard type.

3.1 Risk Screening

The Phase B Risk Assessment began with a risk screening workshop conducted during the Phase B Planning Team Meeting #2 to review with the District's Planning Team the preliminary hazards assessment performed by the ECG Team discussed in Section 2.5 by reviewing the asset-hazard pair screening worksheet (see Appendix D). The purpose of the Workshop was to verify consequence ratings in the asset-hazard pair screening worksheet and thereby screen all of the applicable hazards against the 20 assets. This screening of the asset-hazard pairs was done by scoring each of the 20 assets against each of the 12 hazards using the same scoring criteria presented in Section 2.5, with the addition of the "Not Selected" criterion:

High (H): asset completely disabled; utility's mission fully or nearly defeated; deaths, injuries, or other high costs.

- Not Selected (N/S): asset initial scoring of H, but not selected by Utility for further assessment due to limited resources.
- Medium (M): asset partially disabled; utility's mission moderately impacted; moderate costs.
- Low (L): asset not or only slightly disabled; utility's mission only slightly impacted; low costs.
- Not Applicable (N/A): given threat cannot be carried out, or otherwise does not apply.

Scores were assigned based on the District's qualitative assessment of the level of consequence that would occur assuming the hazard does occur. The hazard likelihood and vulnerability of the asset are not considered during this screening exercise. Those other two risk variables will be applied later after the asset-hazard pairs have been selected by the District during the next step in the risk assessment process covered in Section 3.2 below. The District reviewed and adjusted several of the asset-hazard scores as discussed below with the complete details provided in the Planning Team Meeting #2 – Risk Screening minutes found in Appendix D. In addition, see Appendix G Geohazards Tech Memo for risk screening which specifically addresses the geohazards of earthquake, landslide and debris flow.

For comparison purposes, Table 3-1 shows the Asset-Hazard Screening and Selection Summary from the Risk Screening Workshop, which when compared to Table 2-6 Preliminary Hazard Assessment Scoring shows that the number of H consequence Asset-Hazard pairs was reduced from 45 to 40 pairs, which is the number of pairs that the risk assessment was performed on for the JVWCD assets in the next section. There were actually 41 pairs determined to have H consequence scoring for the risk screening, but the District's Planning Team was able to determine 1 H consequence Asset-Hazard pair to not select (N/S) for the Debris Flow hazard shown in Table 3.1.

Table 3.1 Asset-Hazard Screening & Selection Summary						
Natural Hazard	High (H)	N/S	Medium (M)	Low (L)	N/A	Total # of Assets by Hazard
Debris Flow	0	1	2	3	14	20
Drought	2	0	1	3	14	20
Earthquake - Ground Shaking (2PE50 & 10PE50)	18	0	2	0	0	20
Earthquake – Liquefaction	8	0	0	0	12	20
Earthquake - Surface Fault Rupture/Fault Crossings	2	0	0	0	18	20
Flood	1	0	6	2	11	20
Landslide including Rockfall	2	0	1	0	17	20
Lightning	5	0	4	11	0	20
Problem Soils (including collapsible soils, expansive soils, erosion, & undocumented fills)	0	0	0	20	0	20
Severe Wind	0	0	0	14	6	20
Severe Winter Weather	0	0	0	20	0	20
Wildfire	2	0	2	2	14	20
Total # of Assets by Scoring Criteria	40	1	18	75	106	240

The 40 High ranking asset-hazard pairs include 19 of the 20 critical assets and 8 of the hazards that advanced from the hazard significance evaluation.

3.2 Risk Analysis

The risk analysis was performed on the 40 selected asset-hazard pairs from the Risk Screening Workshop at Planning Team Meeting #2.

The ECG Team used a Generic Risk Assessment Tool (GRAT) for the risk analysis that assesses the Risk (R) by considering the likelihood of the hazard (T) also referred to as threat likelihood, vulnerability (V) of each segment to the hazard and the consequence (C) of the hazard to each segment if the hazard were to occur. This can be expressed in the following equation:

R = T*V*C

where: R=Risk, T=Likelihood of Hazard (Threat), V=Vulnerability, C= Consequence

The variables in the risk equation were determined as described as follows for each of the 40 asset – hazard pairs: The Likelihood of Hazard or Threat was determined for natural hazards using historical records from NOAA, FEMA flood maps, Seismic report for the Wasatch Front faults, power outage records, etc. The vulnerability against natural hazards was assessed by analyzing each asset's age, material type, condition, etc. against the current IBC codes (i.e., seismic, wind, snow load, etc.). The consequence that would be incurred for each segment if the hazard were to occur was assessed by applying consequence metrics established with the District during the risk assessment planning workshop. A summary of the results for the 19 assets analyzed for the various hazards is presented in Table 3-2 with Asset name, Hazard type, and the relative Risk Rating. There

were five possible relative Risk Ratings of L = Low, ML = Medium Low, M = Medium, MH = Medium High, and H = High.

Table 3.2 Risk Analysis Summary of Results

Asset	Hazard Type	Relative Risk Rating
1 - SERWTP	N(D), N(E-WF)*, N(L), N(W)	ML, MH, M, ML
2 - JVWTP	N(D), N(E-WF)*, N(W)	M, MH, M
3 - Moniter Drive Well	N(E-WF)*	ML
4 - Newbury Well	N(E-WF)*	ML
5 - 1443 E. 9400 S. Well	N(E-WF)*	ML
6 - JVWTP 8 MG Reservoir	N(E-WF)*	M
7 - JVWTP 1 MG Reservoir	N(E-WF)*	M
8 - Old Bingham 3 MG Tank	N(E-WF)*	M
9 - Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete	N(E-WF)**	M, ML
11 - Jordan Narrows Pump Station	N(E-WF)**, N(F), N(L)	M, M, L, M
12 - 118th South Zone C Pump Station	N(E-WF)*, N(L)	L, M
13 - Pump Station serving Zone B North (3200 W. 6200 S.)	N(E-WF)*, N(L)	M, M
14 - Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W	N(L)	ML
15 - Jordan Aqueduct (Reaches 1 – 4)	N(E-WF)***, N(LS)	MH, MH, MH, MH
16 - Central Pipeline	N(E-WF)**, N(LS)	ML, ML, M
17 - 150th South Pipeline	N(E-WF)**	ML, M
18 - 24” Cross Valley Pipeline	N(E-WF)***	M, ML, M
19 - Creek Road Pipeline (24” to 33”)	N(E-WF)**	ML, M
20 - 114th South Pipeline	N(E-WF)**	ML, M

** Earthquake - N(E-WF) - ground shaking.*

***Earthquake - N(E-WF) - ground shaking and liquefaction.*

**** Earthquake - N(E-WF) – ground shaking, liquefaction, and fault rupture.*

A preliminary review of the relative Risk Ratings received by each asset reveals that the highest relative Risk Rating received by any asset was a MH or Medium High risk. This is below the highest possible rating of H or High but is still a concern for the District that should be addressed to lower the risks of the various hazards with M or in some cases even those with ML ratings. The complete Risk Analysis Table with all risk equation variables and their scores in addition to the overall relative risk shown in Table 3-2 is provided in Appendix E Risk Analysis & GRAT Top 5. In the next Section 3.3, the Risk Assessment results are further analyzed including performing a sensitivity analysis to determine those assets with highest relative risk.

3.3 Risk Assessment Results

Next, a consequence workshop was held with the District Planning Team to review the Risk Assessment results from Section 3.2 Risk Analysis and confirm asset rankings using a sensitivity analysis. This was used to establish the risk tolerance of the District for selecting the cutoff point for addressing the highest risk assets based on scoring of their asset-hazard pairs. The sensitivity analysis was performed by assigning scores of 1 to 5 for each of the five relative risk ratings of L, ML, M, MH, and H for each of the assets that were assessed during the Risk Analysis described in Section 3.2 above. The scores for each asset were normalized on a relative risk scoring scale with a maximum of 5.0 points. No projects with 'H'-risk were identified that needed to proceed immediately to "In Progress". The 19 assets assessed scored between 2.0 and 4.0; a score between 4.0 and 5.0 would require immediate attention, so scores between 3.0 and 4.0 are still quite high and should be addressed as soon as practicable depending on District resources.

Scoring for the 19 assets is shown in Table 3-3 where the Top 5 cluster of highest risk assets from the final risk analysis have been identified with yellow highlight as Assets 2, 6, 7, 8, and 15 with scores of 3.3, 3.0, 3.0, 3.0, 3.0, and 4.0, respectively. Figure 3.1 is also presented below to show the relative risk of the 19 Assets analyzed. For additional details on the consequence workshop and risk assessment results see the workshop minutes in Appendix E. In addition, see Appendix G Geohazards Tech Memo for risk results specifically addressing the geohazards of earthquake, landslide and debris flow.

Note that the initial risk assessment effort from the consequence workshop scored the 118th South Zone C Pump Station in the top 3, with a cluster of assets tied with a score of 3.0 for a top 8 rather than a top 5. Further investigation into the 118th S Pump Station's vulnerabilities to seismic and lighting hazards reduced the relative risk score, dropping it out of the top 5. The planning team ranked the tied assets using a qualitative analysis with feedback from District O&M staff on the difficulty to recover from the loss of a particular asset. The top 5 now reflects the assets with the highest risk scores, and those assets that O&M would have the most difficulty replacing.

Table 3.3 Asset Risk Analysis Summary

Asset	Relative Risk Score
1 - SERWTP	2.8
2 - JVWTP	3.3
3 - Moniter Drive Well	2.0
4 - Newbury Well	2.0
5 - 1443 E. 9400 S. Well	2.0
6 - JVWTP 8 MG Reservoir	3.0
7 - JVWTP 1 MG Reservoir	3.0
8 - Old Bingham 3 MG Tank	3.0
9 - Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete	2.5
11 - Jordan Narrows Pump Station	2.5
12 - 118th South Zone C Pump Station	2.0
13 - Pump Station serving Zone B North (3200 W. 6200 S.)	3.0
14 - Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W	2.0

Table 3.3 Asset Risk Analysis Summary	
Asset	Relative Risk Score
15 - Jordan Aqueduct (Reaches 1 – 4)	4.0
16 - Central Pipeline	2.3
17 - 150th South Pipeline	2.5
18 - 24" Cross Valley Pipeline	2.7
19 - Creek Road Pipeline (24" to 33")	2.5
20 - 114th South Pipeline	2.5

The complete details of GRAT Top 5 sensitivity analysis discussed above are included in Appendix E. The mitigation strategies and recommendations for addressing the Top 5 highest risk Assets will be presented next in Section 4 Mitigation Strategies.

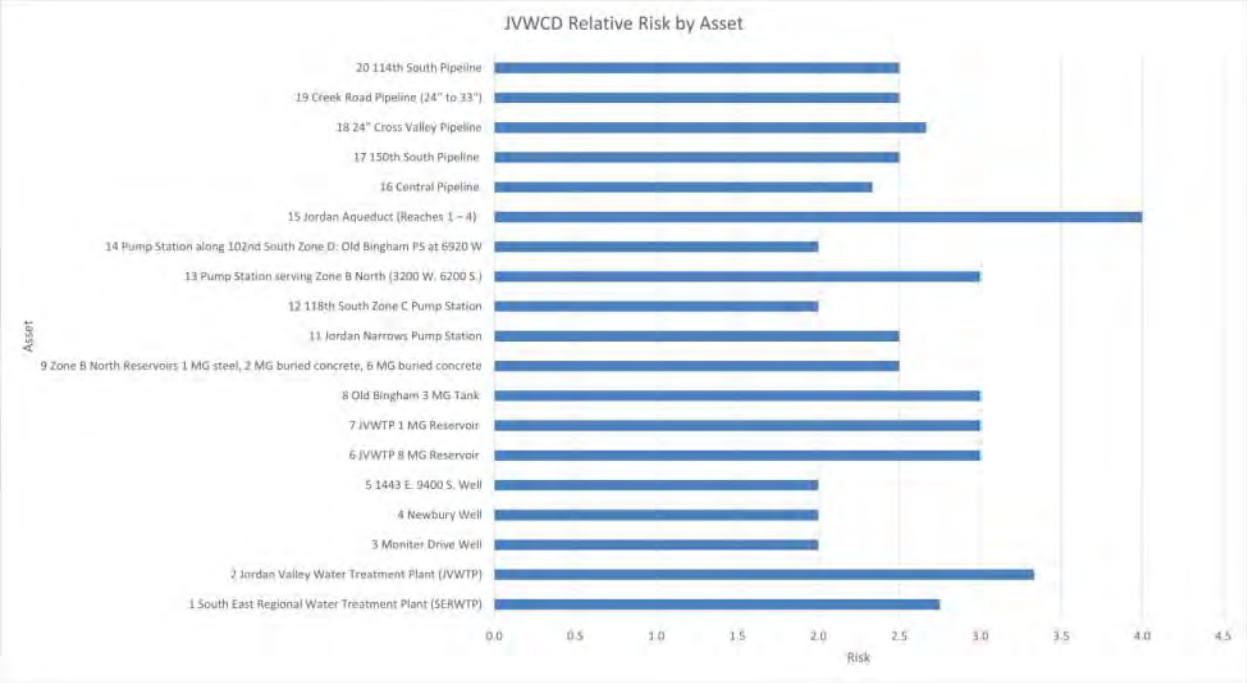


Figure 3.1 Relative Risk by Asset

Section 4

Mitigation Strategy

4.1 District Authorities

JVWCD is the only jurisdiction covered by this Hazard Mitigation Plan. JVWCD's authority falls under the Utah Code Title 17B Limited Purpose Local Government Entities - Local Districts. Title 17B contains Chapter 2a Provisions Applicable to Different Types of Local Districts, which lists the 11 different types of Districts covered by this State Code. JVWCD is recognized as a Water Conservancy District under Part 10 Water Conservancy District Act within Title 17B Chapter 2a.

The above State and District Codes provide JVWCD with the existing authorities and policies to be able to implement the mitigation strategy presented in Section 4 of this Hazard Mitigation Plan. The following are some of the important authorities and policies under Title 17B-1-103 (2) Local district status and powers that JVWCD has for implementing their Mitigation Strategy:

(d) acquire or construct works, facilities, and improvements necessary or convenient to the full exercise of the district's powers, and operate, control, maintain, and use those works, facilities, and improvements;

(e) borrow money and incur indebtedness for any lawful district purpose;

(f) issue bonds, including refunding bonds;

(g) levy and collect property taxes;

(h) as provided in Title 78B, Chapter 6, Part 5, Eminent Domain, acquire by eminent domain property necessary to the exercise of the district's powers;

(i) impose fees or other charges for commodities, services, or facilities provided by the district, to pay some or all of the district's costs of providing the commodities, services, and facilities, including the costs of:

(A) maintaining and operating the district;

(B) acquiring, purchasing, constructing, improving, or enlarging district facilities;

(C) issuing bonds and paying debt service on district bonds; and

(D) providing a reserve established by the board of trustees

(p) construct and maintain works and establish and maintain facilities, including works or facilities:

(i) across or along any public street or highway, subject to Subsection (3) and if the district:

(A) promptly restores the street or highway, as much as practicable, to its former state of usefulness; and

(B) does not use the street or highway in a manner that completely or unnecessarily impairs the usefulness of it;

(ii) in, upon, or over any vacant public lands that are or become the property of the state, including school and institutional trust lands, as defined in Section 53C-1-103, if the director of the School and Institutional Trust Lands Administration, acting under Sections 53C-1- I 02 and 53C-1-303, consents; or

(iii) across any stream of water or watercourse, subject to Section 73-3-29;

The District has been using the above district powers and authorities in implementing some of the mitigation actions from the original JVWCD Hazard Mitigation Strategy, as discussed in the Introduction under the Future Development section. Table 4.1 in Section 4.2, which summarizes the completion status of previous mitigation actions, demonstrates the District's policies, programs, and resources at work to implement mitigation actions. In addition, the District's Mitigation Strategy discussed in Section 4.5, including the mitigation implementation plan provided in Appendix F with its prioritization, funding, and scheduling of mitigation projects, further supports JVWCD's ability and intention to use its authorities, programs, and resources to continue to implement mitigation measures.

4.2 Status of Previous Mitigation Actions

The District's 2004 Hazard Mitigation Strategy identified 19 Mitigation Actions for reducing critical water facilities' risks associated primarily with earthquake, landslide, and flood hazards. The District has implemented (completed or partially completed) several of these mitigation measures and either addressed, eliminated (cancelled), or is in the process of implementing various others. Table 4.1 summarizes the status of each of these previous mitigation actions. Those mitigation actions that are shown as "To Be Scheduled" have been carried forward into this new HMP through the planning process of hazard identification, risk assessment, and mitigation strategies.

Table 4.1 Status of Previous Mitigation Actions (Original 2004 JVWCD Plan)

Orig. Line Number	Mitigation Measure Description	Overall Perceived Risk	Orig. Priority	Orig. Implement. Time Frame	Orig. Estimated Cost (2004 dollars)	Project Status					Comments
						Completed	Addressed	In Progress	To Be Scheduled	Canceled	
1	**Seismic upgrades for the Jordan Valley Water Treatment Plant**: High-rise, Filter Gallery (Bldg. Structures), Upper Raw Water Pond, Screening Bldg., Flocculation Basins, Sedimentation Basins, Filter Basins, Chemical & Control Bldg., 8 MG Reservoir, Washwater Recycle PS #1	H	H1	2005-2008	$6,470,000	X			X		*Completed the following two seismic upgrade mitigation projects at JVWTP: Seismic Retrofit JVWTP 6 Story Bldg. & Renovation – (2006-2008). $2.4M of $8.5M Total Project Cost and $1.79M FEMA Grant.* *Seismic Retrofit JVWTP Filter & Chemical Bldgs. – (2009-2010). $2.2M Project Cost and $1.64M FEMA Grant.* *The new 2021 HMP is also assessing the JVWTP for additional seismic upgrade mitigation actions.*
2	**Seismic upgrades for the Administration Bldgs**. A principal concern is life-safety of District employees and use of facilities after an earthquake.	H	H2	2005-2007	$2,000,000	X					*Completed: Seismic Retrofit JVWCD Headquarters – (2009-2010). $2.7M Project Cost and $2.04M FEMA Grant*
3	**Seismic upgrades for the Southeast Regional Water Treatment Plant**: Filter Operations Bldg. and Filter Basins	H	H3	TBD	$550,000	X			X		*Partially completed: Phase 1 Construction of $55,500 was underway in 2004 and completed in FY2004.* *Other work to be determined (TBD) in next five year HMP update of the new 2021 HMP.*
4	**Seismic upgrades that includes the installation of flexible couplings or relocation of pipe connections at the following reservoirs**: 6200 South 3200 West - 2 MG #1 and 2 MG #2; and 4500 South 4800 West - 1 MG and 2 MG	H	H	TBD	$76,000				X		*Partial alternate mitigation: No seismic mitigation was performed on these reservoirs, with the exception of the installation of automatic shut-off natural gas valves.* *This type mitigation action is being assessed in 2021 HMP for critical Reservoir assets for the earthquake hazard.*
5	**Acquire backup sources of power – portable diesel generator sets for pump stations in the following output capacities**: 800 kW 4160 Volt (3600 West, 10200 South Pump Station) 600 kW 480 Volt (3145 West, 11400 South and 5700 West, 10200 South Pump Stations) 600 kW 2400 Volt (Terminal Reservoir Pump Station) 500 kW 480 Volt (Draper No. 1 and 1300 East, 10700 South Pump Station)	H	M	TBD	TBD	X			X		*Partially completed withe the following: Power outage mitigation – Combination of emergency backup power added for new facilities (PSs & WTPs) and 3 Emergency Gen Sets (portable diesel) designed/purchased for use at 4 PSs (included 3600 West, 10200 South Pump Station) & 3 Wells equipped for alternate use, 2 ten-wheeler trucks to transport Gen Sets during emergency, & purchased 3 new truck bed mounted 150-gallon tanks for refueling Gen Sets.* *The new 2021 HMP will also have a general recommendation for backup power at critical assets under the lightning hazard.*
6	**Perform structural seismic upgrades for the following reservoirs**. There is a concern for localized flooding and damage to property in the vicinity if reservoir contents were released. 2300 East 9800 South- 6 MG 6000 West 4700 South- 6 MG 3600 West 10200 South- 3 MG 5700 West 10200 South- 3 MG	M	M	TBD	800,000		X		X		*Addressed for 3 Reservoirs as follows: 6000 West 4700 South 6-MG Reservoir cannot be retrofit, and no mitigation actions have been taken for the 3-MG at 3600 West 10200 South and 3-MG at 5700 West 10200 South.* *This type mitigation action is being assessed in new 2021 HMP for critical Reservoir assets for the earthquake hazard.*
7	A raw water or treated water aqueduct may catastrophically fail. Acquire repair segments to reduce the delay in repairing.	M	H	TBD	Small			X	X		*In progress as follows: There are 4 pipe segments at the JVWTP location which can be used along the aqueduct, but the quantity is very limited and the District is planning on acquiring additional pipeline segments and constructing storage location(s) strategically located across the service area.* *The new 2021 HMP will also have a general recommendation for stockpiling of pipeline materials for critical assets.*
8	Install a parallel pipeline (potentially a 33" line) to either the 4500 South or 6600 South crossing of the Jordan River / liquefaction zone with a seismic-resistant pipeline design.	M	M	TBD	Project-dependent				X		*This type of mitigation action is being assessed in 2021 HMP for critical assets and also general recommendations for the earthquake hazard.*
9	Perform seismic upgrades for well house structures.	M	M	TBD	$330,000				X		*No action taken.* *This type mitigation action is being assessed in the new 2021 HMP for critical Well assets for earthquake hazard.*
10	**Booster pump station seismic upgrades** – There are no pump stations that would be expected to be non-functional in a 475-yr earthquake (10% in 50 years) for which no redundant flow path exists, with the potential exception of the finished water pumps at Jordan Valley Water Treatment Plant that pumps water from the 8 MG reservoir to Bluffdale City's 6 MG reservoir (mainly rural/agricultural area with limited number of industrial customers).	L-M	M	TBD	$200,000				X		*No action taken.* *This type mitigation action is being assessed in the new 2021 HMP for critical Pump Station assets for earthquake hazard.*

Table 4.1 Status of Previous Mitigation Actions (Original 2004 JVWCD Plan)

Orig. Line Number	Mitigation Measure Description	Overall Perceived Risk	Orig. Priority	Orig. Implement. Time Frame	Orig. Estimated Cost (2004 dollars)	Project Status					Comments
						Completed	Addressed	In Progress	To Be Scheduled	Canceled	
11	Develop the capability to provide temporary disinfection of groundwater from the wells. Some wells already have this capability and thus more research is necessary to more concretely define this mitigation action. 9 of 27 equipped, 2 portable stations.	L	M	TBD	Small					X	*No additional action taken. This mitigation action was cancelled and not carried forward into the new 2021 HMP.*
12	Ensure adequate procedures and training are in place for minimizing the risks for fire and flooding	H	H	TBD	Small	X			X		*Annual training on fire hazard is performed by use of risk and tailgate talks. This type of general mitigation measure is being carried forward into the new 2021 HMP under the wildfire hazard.*
13	There is concern that a landslide could damage the Salt Lake Aqueduct or the Olmsted Aqueduct. Such damage results in the loss of the District's raw water supply but would be the responsibility of others.	H	N/A	NA	NA		X				*No recommended mitigation actions were identified, so addressed and remove from mitigation actions.*
14	Such damage could result in loss of the District's raw water supply but would be the responsibility of others to repair.	H	N/A	N/A	N/A					X	*Duplicate of #13 mitigation action for other hazards but same end result, so remove from mitigation actions list.*
15	Consider obtaining emergency electrical generators as noted above.	H	M	TBD	TBD					X	*Duplicate of #5 mitigation action for other hazards, so remove from mitigation actions list.*
16	**The operations and maintenance complex may be flooded during a 100-year or 500-year event, resulting in potential loss of SCADA, as well as access to maintenance shops, repair equipment and the emergency operations center.** Consider making provisions to have a temporary SCADA system for use at an alternate location. Practice yearly SCADA-free operation for a day. Make provisions to move equipment and vehicles temporarily if flooding threatens. Make provisions for a temporary location for the emergency operations center.	H	H	TBD	Small		X				*No additional mitigation measures have been taken on this item to protect against flood damage. As part of the Utah Shakeout Exercise held every year in April, the District runs the system without the SCADA.* *There were 2 Flood hazard project actions have been addressed in 2021 HMP and found to be Low relative risk, so no further specific mitigation action or general mitigation measures recommended for the flood hazard.*
17	Loss of more than one river-crossing pipeline is unlikely in any flood event. Recommended actions noted above for installing a parallel pipeline to either the 4500 South or 6400 South crossing would further enhance redundancy.	M	M	TBD	Project-dependent					X	*Duplicate of #8 mitigation action for other hazards, so remove from mitigation actions list.*
18	Reduce flooding vulnerability of bridge/road to allow access to complex and passage of District vehicles.	M	L	TBD	Project-dependent		X				*The installation of an enlarged culvert is schedule for January at the unnamed stream crossing Beckstead Ln.. No mitigation measures have been planned for the bridge over the North Jordan Canal*
19	Flooding of the Jordan Narrows Pump Station may require replacement of the electrical control equipment on the floor of the station.	L	N/A	N/A	N/A		X				*N/A since no mitigation project was identified, but assessed again in 2021 HMP where found to be Low relative risk so no further action recommended*

4.3 Mitigation Goals

Mitigation Goals:

The mitigation goals established in this plan are based upon the mission of the District to "Deliver quality water and services every day." From this mission statement and the District's vision and values, the four mission criteria of Reliability, Safety, Quality, and Value were developed to prioritize water system assets and thereby mitigation goals (see Section 2.3.1 and Appendix C for Pair-Wise Comparison discussion and results). The District also considered the mitigation goals in the 2019 Salt Lake County HMP for developing the following general mitigation goals for this mitigation plan:

- Protect the lives, health, and safety of District employees and the public before, during, and after a disaster.
- Protect and eliminate and/or reduce damages and disruptions to the District's critical facilities, structures, and infrastructure during disasters
- Enhance and protect the communication and warning/notification systems of the District, its member agencies, and emergency responders within Salt Lake County.
- Promote education and awareness programs, campaigns, and efforts designed to encourage District employees, member agencies, retail customers, and the public to mitigate and become more resilient to disasters.
- Advocate, support, and promote the continued coordination and integration of disaster planning efforts between the District, its member agencies, partner agencies, and other stakeholders.
- Advocate, support, and promote the use of laws and local regulations and ordinances (i.e., building codes and standards) aimed to mitigate hazards and to enhance resiliency.

Some additional more specific District mitigation goals to reduce and/or avoid natural hazard vulnerabilities include:

- Retrofitting and/or constructing building structures for life safety and damage reduction
- Retrofitting and/or constructing nonstructural items for continued operation of the water system
- Performing geotechnical/geological soil strengthening to prevent structural damage and water system loss of operation
- Preventing loss of electrical power to critical water system facilities

Development of mitigation measures (general and specific) was based on avoiding the anticipated post-hazard event damage states or deficiencies identified in Section 4.4 Mitigation Actions/Measures which are expected to enable the District to meet its performance objectives listed below.

Performance Objectives:

The District's performance objectives for their water system assets subsequent to the occurrence of a natural hazard are as follows:

- Provide potable water service (fully treated water normally delivered) to all wholesale and retail customers:
  - At 100% of indoor demand (winter demand rates) within 7 days following a natural hazard event

  - At 100% of peak daily demand rates within 30 days following a natural hazard event
- Maintain adequate emergency finished water storage to serve 2/3rds of average daily demand
- Provide raw water delivery to Welby-Jacob canal for secondary water use within 30 days following a natural hazard event for summer demands
- Maintain life safety at all manned/occupied District buildings/facilities (i.e., offices) during a natural hazard event

4.4 Mitigation Actions/Measures

Mitigation measures are discussed in two categories. The general mitigation measures include actions for JVWCD to integrate to it standard practices and the specific asset mitigation measures are projects that should be completed to mitigate hazards to specific critical assets.

4.4.1 General Mitigation Measures

General measures are presented below for the 6 hazards with the highest potential to impact JVWCD facilities.

4.4.1.1 Drought Mitigation

The Diversity of the Districts water supply portfolio provides significant drought resiliency. No single source provides more than 50% of the total water supply. Central Utah Project, Provo River Project, and Salt Lake Valley high quality groundwater supply make up approximately 73% of the source water with the remaining 27% coming from a combination of 6 other sources. The most significant vulnerabilities identified in the Drought Contingency Plan (DCP) include; climate change impacts reducing snowpack and creating earlier spring runoff which ultimately reduces stream flows during the peak usage season, water quality events in Utah Lake that shut down secondary supplies and subsequently increase demand on potable systems, and significant dependence on the Provo River watershed.

The following are general mitigation measures applicable to JVWCD facilities with risk to the drought hazard:

- Plan for drought and implement drought mitigation measures
  - Complete Drought Contingency Plan that is currently under development and will include a list of priority action items that are both proactive and reactive to drought conditions. The proactive mitigation measures include 15 mitigation projects to be implemented prior to a drought and the reactive mitigation measures include 14 response actions that are used to adapt to the available water supply level during a drought.
  - Implement Drought Contingency Plan mitigation measures and response actions, which include continued conservation activities and treatment plant improvements to handle impaired raw water quality, in accordance with their priorities after the DCP is completed. Maintain the DCP and the action items including drought management mitigation measures and guidelines.
  - Actively manage water sources during drought conditions by utilizing JVWCD's Supply, Demand, and Major Conveyance Study that includes a system-wide model. This Study provides provisions on backing up almost every JVWCD source identifies alternate sources that will be useful for JVWCD, and evaluates the effect of variable water supply scenarios, including drought, on its ability to meet the contractual water demands of its customers.

- Monitor drought conditions at least monthly and make an official declaration prior to peak season each year
  - JVWCD coordinates with CUWCD to monitor water supply conditions for its Provo River Project and Central Utah Project rights through regular updates from the National Weather Service's Salt Lake Office, NOAA's Colorado River Forecast Center, and NRCS's Utah Snow Survey Office. Drought conditions and stream flow are also closely monitored from NOAA and USGS websites.
  - Each March a drought committee, consisting of JVWCD staff and a representative from each member agency, convenes to review water supply forecast information and develop a preliminary recommended the water supply availability level for the remainder of the year.
  - The preliminary recommendation is then verified at the annual Member Agency Meeting held every April and taken to the JVWCD board for consideration and approval in May.

4.4.1.2 Earthquake Mitigation

The following are general mitigation measures applicable to all pipelines identified as having seismic ground shaking, faulting, and/or liquefaction hazard vulnerabilities associated:

- Material Stockpiling
  - Stockpile representative sizes of steel repair sleeves, steel plate patch material, pipe replacement segments, valves, and other spare parts/materials for immediate access after a seismic event. Wherever possible, storage of stockpiled material should be provided near the location where the material will be used. Note that for larger pipe diameters, this is a less effective method.
  - Stockpile repair segments and clamps of each size of existing pipe within high liquefaction zones for immediate access to perform repairs following a damaging seismic event.
  - Pipe Supply Contract - JVWCD should develop priority supply contract(s) with pipe suppliers such that replacement segments can be procured expeditiously after a damaging seismic event.
  - Training- JVWCD should incorporate response to seismic events, including pipeline repair and restoration, as part of its emergency training for employees.
  - Post-earthquake event inspections (i.e., CCTV inside pipe or in-person inspections where large enough) should be conducted for critical pipelines.
- Seismic upgrades of pipelines (hardening)
  - Large diameter pipe and joint replacement
  - Redundant pipelines
  - Flex couplings at building connections near faulting areas
  - Supporting pipelines with deep foundations (e.g., piles, driven piles, stone columns) through liquefaction zones
- Nonstructural bracing and/or anchoring of pipe, equipment, etc. for critical assets
- Geological investigation/evaluation for further study and identification of mitigation actions
- Structures at risk of earthquake-related damages include the 8MG and 1MG tanks at JVWTP, Old Bingham Tank, and the original sedimentation basins at the JVWTP, which would severely cripple JVWCD's ability to meet summer demands. Details on how these risks should be addressed are provided in Section 4.4.2 and until those specific measures can be implemented the District

should include special provisions in their continuity of operations plan to operate the system if any of these structures were to fail.

4.4.1.3 Flood Mitigation

There was only a single asset (Jordan Narrows Pump Station) assessed for the flood hazard, which was determined to have a relative risk level of Low. Therefore, there were no JVWCD assets identified with significant flood vulnerabilities, and there are no recommended mitigation measures for this hazard.

4.4.1.4 Landslide Mitigation

General recommendations for mitigating the identified landslide concerns associated with the evaluated JVWCD pipelines are listed below:

- Material Stockpiling - It is recommended that JVWCD stockpile representative sizes and types of repair sleeves, steel plate patches, and/or pipe replacement segments for immediate access after a seismic event. Wherein it is possible, storage of stockpiled material should be provided near the location where the material will be used. Note that for larger pipe diameters, this is a less effective method.
- Upgrades of pipelines (hardening)
  - Large-diameter pipe and joint replacement
  - Redundant pipelines
  - Flex couplings at building connections near landslide areas
  - Pipe Supply Contract - JVWCD should develop priority supply contract(s) with pipe suppliers such that replacement segments can be procured expeditiously after a damaging landslide event.
- Training - JVWCD should incorporate pipeline repair and restoration response to landslide events into its emergency training for employees.
- Geological investigation/evaluation for further study and identification of mitigation actions

The Jordan Aqueduct system crosses several landslide areas, and requires further investigation to determine the preferred approach to harden this important lifeline, which is covered in greater detail in Section 4.4.2.1.

4.4.1.5 Lightning Mitigation

General recommendations for mitigating the identified lightning hazard vulnerabilities for the evaluated JVWCD facilities are outlined below.

- Perform lightning protection system assessments for critical assets to determine protection needs.
- Add lightning protection systems to buildings and structures starting with highest priority structures that do not include them
- Add surge protection at each service entrance (i.e., power, communications, and antenna systems) and critical equipment
- Add uninterrupted power supply (UPS) to electrical/controls
- Provide backup power supply with lightning protection to critical assets [i.e., emergency transfer power equipment, onsite generator/purchase portable generator(s), line up rental generator(s)]

4.4.1.6 Wildfire Mitigation

General recommendations for mitigating potential wildfire hazard concerns associated with JVWCD and its customer's facilities are listed below.

- Pipelines:
  - Monitor burned areas for erosion, debris flows, and landslides after a burn event.
- Structure and Infrastructure Projects:
  - Protect propane tanks and external fuels
  - Create defensible space around structures and infrastructure (i.e., fire barrier, fire break road)
  - Conduct maintenance to reduce risk (i.e., remove vegetation & other fuel sources)
- Natural Systems Protection:
  - Implement a Fuels Management Program
- Education and Awareness Programs:
  - Increase wildfire risk awareness
  - Educate about wildfire mitigation techniques
- Secondary impact mitigation measures for wildfire:
  - Work with watershed agencies and other stakeholders (Forest Service, NRCS, Soil Conservation Service, State Forestry & Lands, counties, cities, etc.) to perform erosion control after a wildfire
  - Monitoring at raw water entry points into JVWCD raw water collection system

There were no assets identified with significant direct wildfire vulnerabilities; however, the watersheds that supply the JVWTP and SERWTP are constantly at risk of a wildfire, which would adversely affect water quality at both plants. The specific mitigation measure described in Section 4.4.2.2 addresses this issue for the JVWTP.

4.4.2 Specific Asset Mitigation Actions

Projects to mitigate risks for the five assets with the top relative risk scores (see Section 3.3) are described below.

4.4.2.1 Jordan Aqueduct (JA) Reaches 1, 3 & 4 Project Scoping

Asset Description

The JA system consists of four distinct reaches:

- JA-1 is 17,716 linear feet (LF) of 78-inch steel pipe with gasketed (not welded) joints and reinforced concrete pipe (RCP) with bell-and-spigot joints. Reach 1 conveys raw water from the Provo River Aqueduct to the JVWTP. It was constructed in the early 1970s.
- JA-2 is 62,981 LF of 78-inch steel pipe with gasketed (not welded) joints and RCP with bell-and-spigot joints. Reach 2 conveys finished water from the JVWTP to the Terminal Reservoir, and does not have major geological hazards. It was constructed in the early 1970s.
- JA-3 is 29,540 LF of steel pipe ranging in size from 66-inches to 48-inches. Reach 3 conveys finished water north from the Terminal Reservoir to the end of JVWCD's service area near 2100 S. It was constructed in the early 1970s.

- JA-4 is 89,840 LF of steel pipe with gasketed (not welded) joints and RCP with bell-and-spigot joints. It ranges in size from 72-inches to 66-inches. Reach 4 conveys raw water from CUWCD's Alpine Aqueduct north to the JVWTP. It was constructed in the late 1970s.

Deficiency

Three of the four reaches encounter geologic hazards along their alignment, and need to be addressed through further study to better identify and quantify the hazards. The affected segments will then be prioritized by developing an implementation plan.

Liquefaction and associated lateral spread can cause significant damage to a portion of Reach 1 located near the Jordan River.

Reach 3 and Reach 4 intercept surface fault special study zones related to the Granger segment of the West Valley fault zone and the Provo segment of the Wasatch Fault zone, respectively. Surface fault rupture special study zones are designated in areas where surface faulting could occur.

Landslide deposits and areas that are identified as having a potential for landslides are identified as intercepting Reach 4 in several areas which can cause significant damage to portions of Reach 4.

Damage Scenario Description

During a seismic event, if liquefaction under Reach 1 occurs, it will lead to settlement of up to 3 to 4 inches or more. Factoring in lateral spread, lateral movements of several feet could occur in the same area, which would pull the unrestrained joints apart.

If fault splays are identified as trending through portions of Reach 3 and Reach 4, a surface fault rupture event along those splays would cause offset of Reach 3 and Reach 4. The amount of offset could be on the order of several feet.

If instability of a hillside or slope occurs, a landslide, through portions of Reach 4, displacement on the order of several feet could occur in the same area.

Any of the above events will lead to separation of the unrestrained joints, causing leaks that lead to flooding and significant property damage with the potential for loss of life in addition to significant loss of service.

Mitigation Measure

Site specific liquefaction studies will need to be completed to assess the likelihood of liquefaction occurring at a given location, and to define the magnitude of settlement/lateral movement that could occur. In accordance with the typical standard of care for assessing surface fault rupture hazards, trenches should be excavated to pass through the pipeline and 50 feet beyond either side in areas where the pipeline is located in a surface fault rupture special study zone. In areas where trenching is not feasible, geophysical surveying should be completed. Landslide assessments can be staged with an initial site reconnaissance to define the limits of the landslide deposit. If required, further study would include trenching and boring into the landslide mass along with laboratory testing and slope stability modeling to define the potential for movement of the landslide mass.

Data from this study will be used to design specific mitigation measures for the aqueduct, which may include realignment to avoid the hazard(s) where possible, harden the aqueduct to survive the event, and/or prepare mitigation measures like emergency shutoff valves and provisions for bypass piping to quickly restore service.

4.4.2.2 JVWTP Sed Basins 1&2 Seismic, Drought, and Wildfire Resilience Upgrade

Asset Description

The JVWTP is the District's key water treatment facility, accounting for 80% of the District's water treatment capabilities and the majority of the District's potable water supply. It was designed in 1971 and constructed from 1971-1974. It was expanded in 1987. The original construction included two flocculation/sedimentation basins (basins 1&2) with circular clarifier mechanisms for solids removal. Basin 1&2 have three circular mechanisms over sloped concrete floors. There is an unreinforced expansion joint in each section of sloped floor between each circular mechanism. The expansion included four flocculation/sedimentation basins, basins 3&4 on the north side of basin 1&2, and basins 5&6 on the south side of basins 1&2. Figure 4.1 is a site plan for the JVWTP.

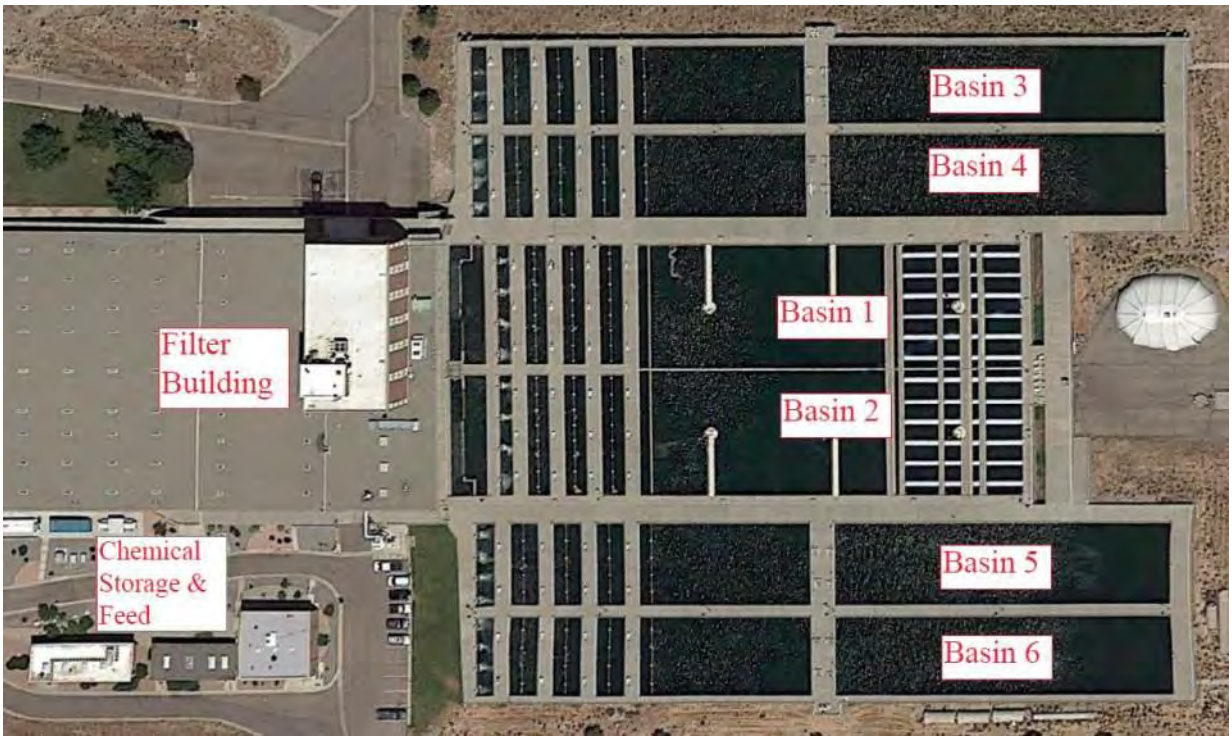


Figure 4.1. JVWTP Site Plan

Deficiency

Feedwater for the JVWTP originates from the Provo River. Diversions occur at either the Olmsted Diversion or the Murdock Diversion, but both are run-of-the-river diversions that are directly affected by river water quality. Seismic activity, wildfire, and drought present water quality hazards within the geologically active canyon. The landslides would result in high amounts of sediment in the river which would be difficult to treat with the existing sedimentation basins. Similar risks exist for winter season avalanches that are common after deep snow storms within the canyon, and as rainstorms occur after a wildfire. The steep side walls of the Provo River Watershed will result in significant debris/sediment flows to the diversion point. This hazard has occurred in the past after wildfire events. A significant amount of fire debris and ash will be transported via the diversions to the JVWTP, increasing chemical dosing and sediment loads.

The circular mechanisms must be plumb at the center column for the rake arm to travel efficiently through a full revolution. The unreinforced expansion joints create, in effect, floating slabs that are susceptible to differential settlement from ground shaking. See Figures 4.2 and 4.3.

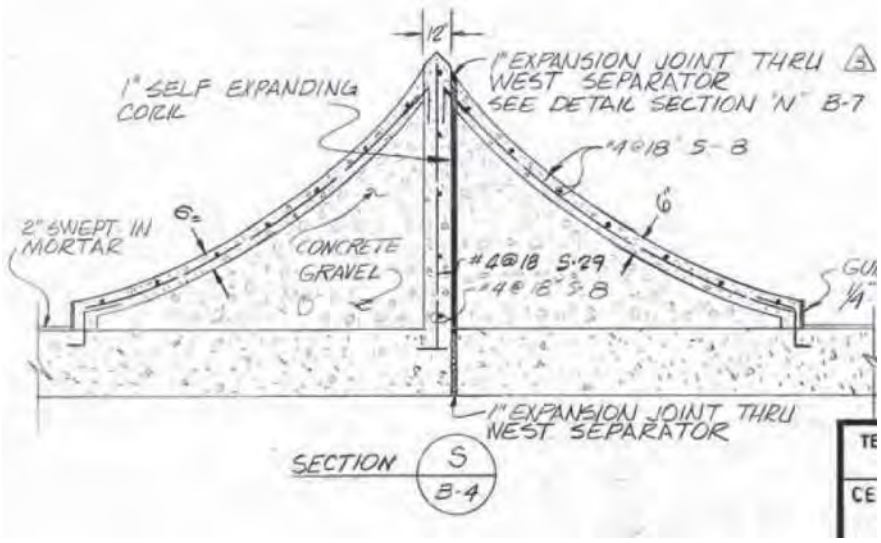


Figure 4.2. Unreinforced Expansion Joint, Drawing 10-B-5 from 1971 Drawings

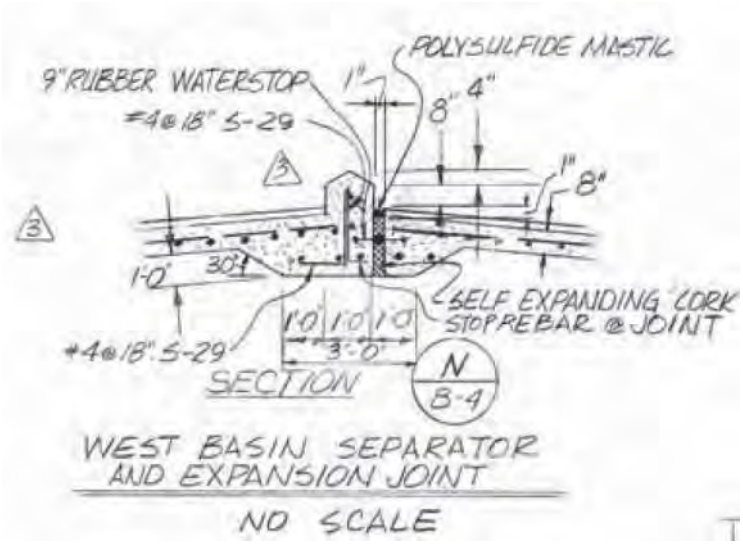


Figure 4.3. Unreinforced Expansion Joint, Drawing 10-B-7 from 1971 Drawings

Damage Scenario Description

A seismic event with ground shaking that leads to differential settlement will create leaks in basins 1 & 2, and knock the mechanisms out of level. This would prevent the basins from removing solids, knocking them offline for several years while they are rebuilt. The initial damage state would take JVWTP offline for 7 days while the shared settled water channels are repaired and isolated so the outer basins (3, 4, 5, and 6) can be brought back online. This will impact a population of approximately 624,000 before basins 3-6 are returned to service with the plant back online at a reduced capacity. The District would have to perform workarounds for the two summers it would take to reconstruct basins 1 & 2, which would impact a population of approximately 54,337 for 39 days during peak demand each year for 2 years, or 78 days total. The combination of the Initial Damages & Workarounds was combined to determine the B/C ratio.

Mitigation Measure

As shown in the figures above, the original design does not allow for simple retrofit options like a carbon-fiber overlay to tie the adjacent slabs together. A topping slab could be placed over the existing floors if the conical bottoms were filled in, but the basins only have a 10-ft water depth. The topping slab would reduce water depth and significantly impair settling.

The sloped floors under each circular mechanism need to be removed, and a new double-mat foundation placed at a lower elevation to improve settling characteristics for future wildfire and drought conditions that bring more turbidity and TOC to the plant, requiring higher coagulant doses to treat and remove accumulating solids.

This project will seismically upgrade sedimentation basins 1 and 2 by replacing under-slab unrestrained cast-iron soil pipe with seismically resilient piping, replacing the basins' shallow conically-sloped bottoms with deeper flat bottoms, constructing sister walls around the perimeter and divider walls, and installing a dowelled connection between flocculation & sedimentation. The project team will design and administer the construction contract to upgrade the two original sedimentation basins to mitigate ground shaking hazard and improve process resilience against water quality degradation from drought and fires.

4.4.2.3 JVWTP 1 MG Reservoir Seismic Upgrade

Asset Description

The 1 MG Reservoir is a conventionally reinforced circular concrete tank. It sits on a hill immediately south of the JVWTP, on the south side of the Mountain View Corridor. Its primary purpose is to provide pressure and storage for the plant's utility and process water systems. For example, the process water is used to generate chlorine dioxide onsite for pre-oxidation and some disinfection credit; it also supplies water to several other chemical systems as well as seal water for pumps.

Deficiency

This tank was part of the original design and construction in the early 1970s. The seismic accelerations for this area qualify as a region of High Seismicity per the ASCE 41-17 Seismic Evaluation Standard. The tank floor design, with several unreinforced expansion joints, was found to be deficient because the joints compromise the lateral load carrying capability of the diaphragm, see Figure 4.4.

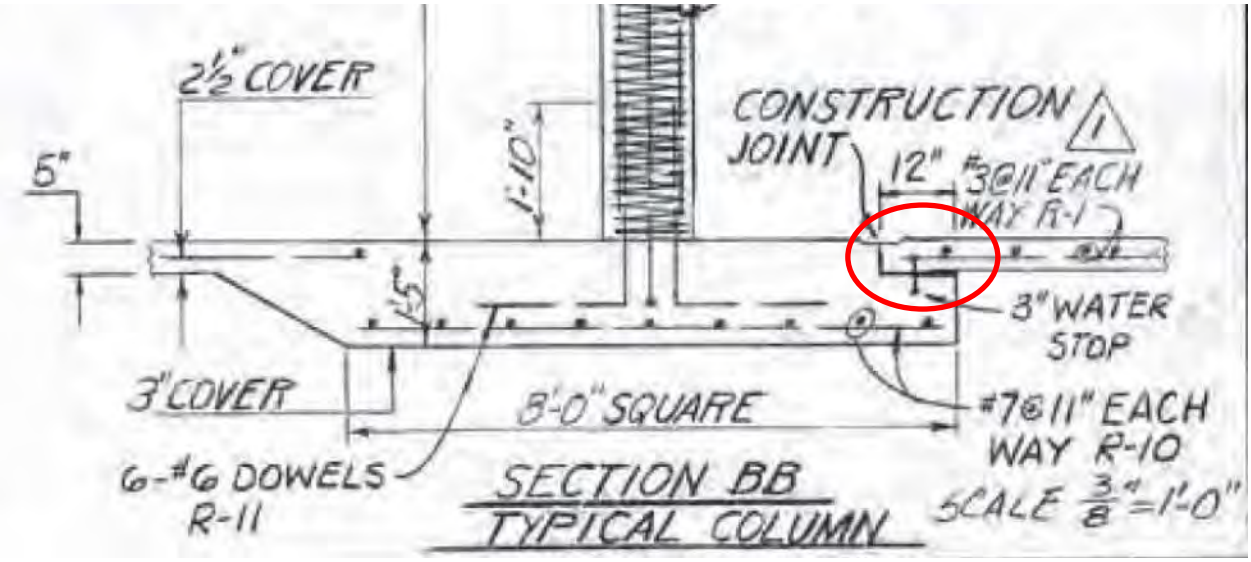


Figure 4.4. Unreinforced Expansion Joint, Drawing 10-S-10 from 1971 Drawings

This tank was also examined with respect to other current building codes and standards for tanks, such as the ACI 350 Building Code and the ACI 350.3 Seismic Design Standard. This tank was found to have insufficient freeboard for sloshing waves during a seismic event (4-¾"). For reference, tanks in this area typically require freeboard of around 12" for sloshing to prevent uplift of the roof slab in a seismic event.

This tank no longer meets many other criteria included in the ACI 350 Building Code, such as the concrete cover requirements to the reinforcing steel for durability. Upgrading this tank to current standards is not practical and replacement of the structure should be considered.

Piping connections to the tank are rigid and subject to failure with ground shaking, and should be replaced with seismically-resilient piping when the tank is replaced.

Damage Scenario Description

A seismic event with ground shaking that leads to differential settlement will create leaks in all floor joints and piping connections. The saturated hillside below the tank may cause the tank to fail catastrophically if the downhill side gives way causing debris flow over Mountain View Corridor. The JVWTP would then have no process water for its chemical systems, leading to the entire JVWTP shutting down for at least 7-days while a workaround is implemented. The temporary workaround is expected to fail intermittently (assume 1-day per month) until a more permanent workaround is designed/installed approximately 9 months later.

Mitigation Measure

Construct a new two-celled process-water tank to eliminate the single point of failure in the existing deficient tank. Install flexible connections for all piping. Remove the existing tank from service after the new tank is online and demolish the existing tank.

4.4.2.4 Old Bingham 3 MG Reservoir Seismic Upgrade

Asset Description

The 3 MG Reservoir at Old Bingham Highway is a distribution system reservoir that provides operational and emergency storage to its service area. It was constructed in 1976 as a prestressed tank reinforced with post-tensioning tendons in the floor, wall, and roof. This tank was constructed before the first publication of the AWWA D115 tank Standard, but it can be loosely characterized as an AWWA D115 style tank.

Deficiency

The original drawings could not be located, so the project team evaluated drawings from other comparable tanks of similar age and design. The cracking this tank exhibits, circumferentially in the wall and around the perimeter of the roof slab, is indicative of the construction detailing used by Atlas Prestressing in the late 70's and early 80's, as is the sloping closure strip connecting the base of the wall to the floor slab.

The seismic accelerations for this area qualify as a region of High Seismicity per the ASCE 41-17 Seismic Evaluation Standard. The tank does not meet many of the modern requirements of ACI 350 Building Code for tanks, the ACI 350.3 Seismic Design Standard, or the AWWA D115 Standard for Tendon Prestressed Tanks. Examples include minimum concrete cover requirements for reinforcing steel and corrosion protection requirements for post-tensioned tendons. Previous inspections and observations by JVWCD staff indicate that one or more post-tensioned tendons in the roof have failed.

Damage Scenario Description

Failure of post-tensioned tendons could cause the roof to collapse, damaging columns, walls, and the foundation, leading to a complete failure of the tank. The service area would experience a loss of supply for a short time (assume 3-days) while distribution system modifications are made to isolate the tank and provide backup supply with the correct pressure for the zone. The temporary workaround is expected to require increased maintenance with brief intermittent shutdowns (assume 1-day per quarter) until a new tank is designed/installed approximately 18 months later.

Cast iron piping without flexible connections will also likely break, contributing to tank failure.

Mitigation Measure

If further study determines that tendons in the roof have failed, the roof could be selectively demolished to preserve the walls and columns. The roof could then be replaced, while placing a coating on the tank interior to mitigate corrosion on the columns, walls, and floor.

Yard piping, including all tank connections, should be replaced with seismically-resilient piping with flexible connections.

4.4.2.5 JVWTP 8 MG Reservoir Seismic, Wildfire, and Water Quality Improvements Project

Asset Description

The 8 MG Reservoir is a conventionally reinforced rectangular concrete tank. It sits on a slight bench immediately north of the JVWTP, just uphill from the Welby-Jacobs Canal and a residential subdivision. Its primary purpose is to provide volume to meet regulatory disinfection requirements using free chlorine, volume for plant operations such as backwashes, volume to meet distribution system peak-hour demands without affecting plant operations, and volume for emergency shutdowns. The tank also provides pressure for system demands downstream of the JVWTP.

Deficiency

This tank was part of the original design and construction in the early 1970s. The seismic accelerations for this area qualify as a region of High Seismicity per the ASCE 41-17 Seismic Evaluation Standard. The tank design, with several unreinforced expansion joints that pass through the floor, walls, and roof, was found to be deficient because the joints compromise the lateral load carrying capability of the diaphragm, see Figure 4.5. There are five of these joints that effectively divide the tank into 6 sections with no reinforcement tying them together.

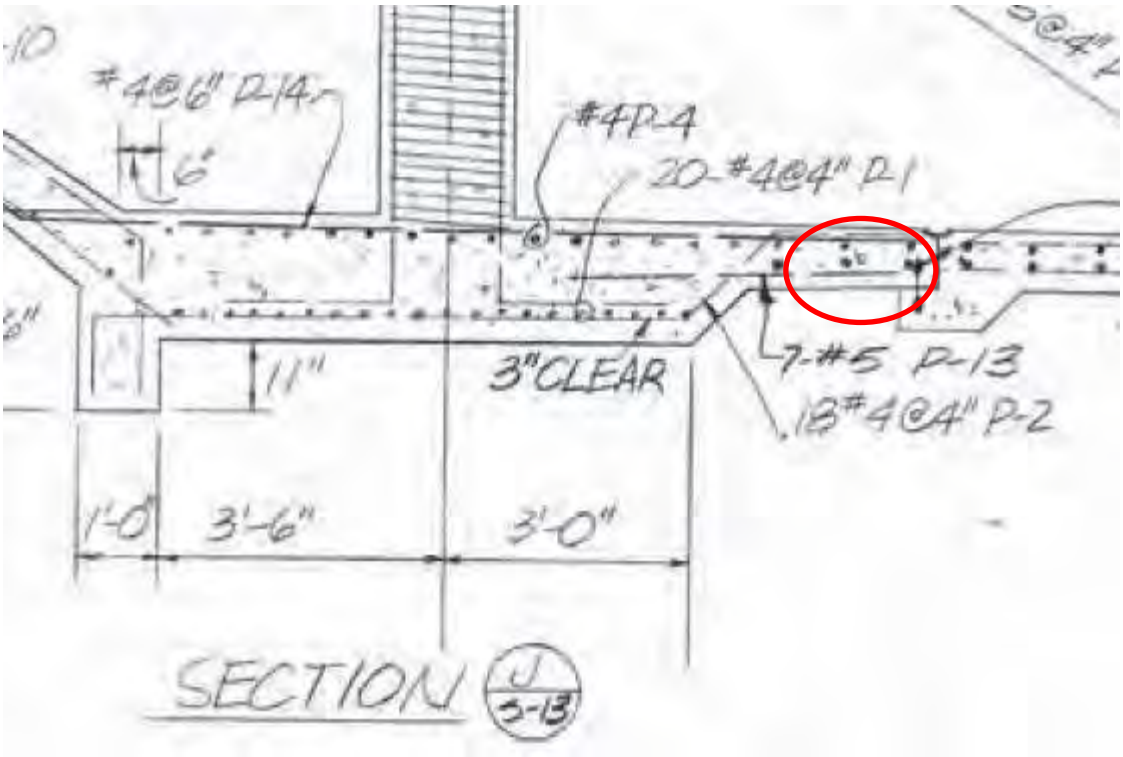


Figure 4.5. Unreinforced Expansion Joint, Drawing 10-S-14 from 1971 Drawings

This tank no longer meets many other criteria included in the ACI 350 Building Code, such as the concrete cover requirements to the reinforcing steel for durability. Upgrading this tank to current standards is not practical and replacement of the structure should be considered.

Piping connections to the tank are unrestrained and subject to failure with ground shaking.

Damage Scenario Description

A seismic event with ground shaking that leads to differential settlement will create leaks in all of the unreinforced expansion joints and piping connections. The tank will develop slow leaks in the separated floor and wall joints with the downhill side eventually giving way, causing a debris flow and flood surge into the nearby Welby-Jacob Canal. The finished water line will fill with contaminated water before it can be isolated, causing a boil order and estimated minimum of a 5-day shutdown to drain, flush, and refill the lines. The JVWTP capacity will be reduced for lack of disinfection volume, and/or the plant will need to feed higher chlorine dose than is otherwise needed until the replacement tank is designed and installed approximately 18 months later.

Mitigation Measure

Replace the existing deficient tank with a new larger 12.5 MG tank to maximize storage in the footprint currently occupied by the 8 MG Reservoir. The new tank will be designed to modern standards, reducing, or eliminating a post-event outage entirely, and it will provide additional finished water storage for wildfire-related plant disruptions that may require temporarily shutting down the JVWTP's raw water intake. The new tank should be highly baffled to improve water quality by reducing chlorine use to meet required disinfection credits.

4.4.2.6 JA Reaches 1, 3, & 4 Mitigation Project(s)

Asset Description

See Section 4.4.2.1

Deficiency

See Section 4.4.2.1 for the base deficiencies that will be further examined and determined in more specific and greater detail with the completion of the JA 1, 3, 4 Scoping Project.

Damage Scenario Description

See Section 4.4.2.1 for the base damage scenario description that will be further examined and determined in more specific and greater detail with the completion of the JA 1, 3, 4 Scoping Project (Mitigation Action 1).

Mitigation Measure

Design and construct recommended mitigation measures for hardening JA Reaches 1, 3, and 4 based on the results of Mitigation Action 1, once completed.

4.5 Mitigation Implementation

In order to facilitate development of an implementation plan for the specific mitigation measures/actions delineated in Section 4.4.2 above, the measures were combined into projects (mitigation actions), cost estimates were prepared for the Top 5 Assets' high priority projects, and the projects were prioritized and scheduled. This implementation development process is described in corresponding subsections below.

4.5.1 Packaging of Mitigation Measures

The first step in developing the mitigation implementation plan was to define mitigation projects that combine individual measures into larger, standalone projects that are more practical for execution. The mitigation projects were created based on the top 5 assets determined through Section 3 Risk Assessment and identified in Section 3.3 Risk Assessment Results as shown in Table 3.3 and Figure 3.1. The specific asset mitigation actions that were developed into mitigation projects are described in Section 4.4.2 above. The funding sources (i.e., Operation & Maintenance (O&M), FEMA grants, and Capital Improvement Plan (CIP)) were also considered in determining the packaging of mitigation measures. The various mitigation projects are listed in Table 4.2 below along with their total estimated mitigation costs.

4.5.2 Mitigation Project Cost Estimate

Planning level estimated costs are provided in Table 4.2 for those mitigation projects that were determined by the District to be high priority. Detailed breakdowns of the estimates can be found in Appendix H. Costs are rough order of magnitude estimates which reflect approximate construction costs in Second Quarter 2021 dollars. An Order of Magnitude estimate is defined as a Conceptual Level or Project Viability Estimate. Typically, engineering is from 0 to 2 percent complete. Order of Magnitude estimates are used to prepare planning level cost scopes or evaluation of alternative schemes, long range capital outlay planning. Expected accuracy for Order of Magnitude estimates typically ranges from -50 to +100 percent, depending on the technological complexity of the project, appropriate reference information and the inclusion of an appropriate contingency determination. In unusual circumstances, ranges could exceed those shown.

The estimates include the fees directly related to labor and materials for physical implementation of mitigation measures, consultant design and/or analysis fees, construction management and administration fees, as well as estimated allowances for contractor overhead and profit. Additional design and in-depth analysis work are required to fully quantify the cost associated with

implementing the mitigation measures. The intent of this estimate is to provide a basis from which the future work may begin.

Table 4.2 Mitigation Project Estimated Costs

	Mitigation Project	Total Estimated Mitigation Cost**
1	Jordan Aqueduct (JA) Reaches 1, 3 & 4 Project Scoping	$302,300
2	JVWTP Sedimentation Basins 1&2 Seismic, Drought, and Wildfire Resilience Upgrade	$30,400,00
3	JVWTP 1 MG Reservoir Seismic Upgrade	$1,610,000
4	Old Bingham 3 MG Reservoir Seismic Upgrade	$2,000,000
5	JVWTP 8 MG Reservoir Seismic, Wildfire, and Water Quality Improvements Project	$16,310,000
6	Jordan Aqueduct (JA) Reaches 1, 3 & 4 Mitigation	TBD*

** To Be Determined (TBD) upon completion of Mitigation Action 1*

***This cost opinion of probable costs of construction is made on the basis of the experience, qualifications and judgement of the cost estimators. Brown and Caldwell cannot and does not guarantee that proposals, bid or actual construction costs will not vary from this, or subsequent estimates prepared by Brown and Caldwell*

Items that are not in these planning level cost estimates include, but are not limited to:

1. Relocation of owner's equipment to permit construction access
2. Hazard abatement or remediation

Items that may change the estimated costs include, but are not limited to:

1. Modifications to conceptual scope of work in estimate
2. Special phasing requirements not known at this time
3. Unforeseen conditions
4. *Force Majeure* conditions (e.g., COVID-19 pandemic)

Since the cost of labor, materials, and equipment, the contractor's method of determining prices, or over competitive bidding cannot be controlled or accurately anticipated, the opinion of construction cost provided for herein is made on the basis of professional experience. There is no guarantee that actual project proposals, bids, or construction costs will not vary from the estimated costs. Because the mitigation measures described within this Plan are conceptual and the costs herein are rough order of magnitude estimates, there is no guarantee that the actual project costs will not exceed the estimates and/or the established project budgets.

Factors that should be considered in developing an accurate project cost at the time the mitigation project is implemented include: escalation, construction phasing, and non-business work hours. Prices included herein should be escalated at a minimum of 3% to 4% annually (based on the CPI), with a base date of June 2021, to account for implementation schedule. If any of the projects are implemented as phased construction, phasing costs will need to be included in the cost estimate and should be added to the total project budget to cover the cost of temporary shutdowns and work-arounds, multiple mobilizations, and additional labor for work done outside of normal working hours. Any cost for excessive overtime to meet stringent milestone dates will also need to be added to the planning level cost estimates.

4.5.3 Mitigation Project Prioritization, Funding, and Scheduling

The final step in preparing an implementation plan for the mitigation measures was to identify the priority, potential funding, and proposed implementation schedule for the mitigation projects found in Section 4.5.1. The mitigation projects were prioritized based on the criticality ranking (see Table

2.6) of the assets within each mitigation project and the results of the benefit cost analysis (see Section 4.6). The potential funding was determined based on discussions with District management concerning O&M funds and CIP funds and on eligibility requirements for FEMA grant funds. The results of the mitigation project prioritization, funding, and scheduling is shown in tabular form in Appendix F.

A summary of each of the 6 mitigation projects found in Appendix F, Table F. l is presented below. The Mitigation Action number corresponds to the mitigation package's priority. All of these Mitigation Actions are considered High priority since they pertain to the District's top 5 highest ranked assets by risk for the combined natural hazard risk and consequence of failure.

The summary of each Mitigation Action includes the hazard to be mitigated, mitigation objective, priority of the action, estimated cost, estimated implementation time frame, and potential funding source(s). Also shown is the responsible jurisdiction, which in all cases is solely JVWCD.

Mitigation Action 1 - Jordan Aqueduct (JA) Reaches 1, 3 & 4 Project Scoping

Hazards:	Earthquake, Landslide
Objective:	Study earthquake (fault rupture & liquefaction), liquefaction, and landslide impacts on JA Reaches 1, 3, and 4 for preparation of detailed plan to harden the JA system.
Priority:	HIGH
Time Frame:	Based on funding, estimated in Years 2-3
Funding:	Local and Federal
Estimated Cost:	$302,300
Jurisdiction:	JVWCD

Mitigation Action 2 – JVWTP Sed Basins 1&2 Seismic, Drought, and Wildfire Resilience Upgrade

Hazard:	Earthquake, Drought, and Wildfire
Objective:	Design and administer the construction contract for a seismic upgrade of the two, original deficient sedimentation basins to mitigate ground shaking hazard and improve process resilience against water quality degradation from drought and wildfires.
Priority:	HIGH
Time Frame:	Based on funding, estimated in Years 1-4
Funding:	Local and Federal
Estimated Cost:	$30,400,000
Jurisdiction:	JVWCD

Mitigation Action 3 – JVWTP 1 MG Reservoir Seismic Upgrade

Hazard:	Earthquake
Objective:	Construct a new two-celled process-water tank to eliminate the single point of failure in the existing seismic deficient tank. Remove the existing tank from service after the new tank is online, and demolish the existing tank.
Priority:	HIGH
Time Frame:	Based on funding, estimated in Years 3-4
Funding:	Local and Federal
Estimated Cost:	$1,610,000
Jurisdiction:	JVWCD

Mitigation Action 4– Old Bingham 3 MG Reservoir Seismic Upgrade

Hazard:	Earthquake (Ground Shaking and Liquefaction)
Objective:	Remove the roof with failing post-tensioned tendons; place a coating on the tank interior to mitigate corrosion; construct a new roof; install flexible connections on all yard-piping connections to the tank.
Priority:	HIGH
Time Frame:	Based on funding, estimated in Year 5
Funding:	Local and Federal
Estimated Cost:	$2,000,000
Jurisdiction:	JVWCD

<u>Mitigation Action 5</u> – JVWTP 8 MG Reservoir Seismic, Wildfire, and Water Quality Improvement Project

Hazards:	Earthquake, Wildfire
Objective:	Replace the existing seismic deficient tank with a new larger tank to provide additional storage for wildfire-related plant disruptions; improve tank baffling to improve water quality by reducing chlorine use.
Priority:	HIGH
Time Frame:	Based on funding, estimated in Years 3-4
Funding:	Local
Estimated Cost:	$16,310,000
Jurisdiction:	JVWCD

<u>Mitigation Action 6</u> – Jordan Aqueduct (JA) Reaches 1, 3 & 4 Mitigation

Hazards:	Earthquake and Landslide
Objective:	Design and construct recommended mitigation measures for hardening JA Reaches 1, 3, and 4 (see Mitigation Action 1)
Priority:	HIGH
Time Frame:	Based on funding, estimated in Years 4-5
Funding:	Local and Federal
Estimated Cost:	To Be Determined upon completion of Mitigation Action 1
Jurisdiction:	JVWCD

NOTE: The District does not participate in the NFIP and has no repetitive loss structures. However, the District will review all mitigation projects to evaluate their impact to any NFIP identified regulatory floodplain prior to implementing the mitigation action. Should the project impact an identified regulatory floodplain, the District will coordinate and obtain required floodplain development permits from local floodplain administrators or discuss the potential development with the State NFIP Coordinator, in accordance with Part 60.3 of the National Flood Insurance Act of 1968 and the Disaster Mitigation Act of 2000.

4.6 Benefit Cost Evaluation

A benefit cost analysis was performed for the mitigation projects identified above which consist of physical retrofit measures. FEMA' s BCA Reference Guide (2009) and What is A Benefit? (2001) documents were used as the basis of the benefit cost evaluation. The benefit cost evaluation performed is in accordance with the basics of the FEMA Benefit Cost Analysis (BCA) methodology used in the Building Resilient Infrastructure and Communities (BRIC) program for federal disaster grant funding applications to determine the cost-effectiveness of utility improvement measures. It should be noted, however, that the FEMA BCA modules were not run for any of the mitigation projects, and therefore benefit-cost ratios shown herein may not be equivalent to those obtained from the modules. A benefit cost analysis using the appropriate BCA modules will need to be completed when submitting a FEMA grant application.

Two categories of "Avoided Damage" were used to determine the benefits portion of the benefit cost analysis: l) avoided physical damages, and 2) avoided loss-of-function impacts (i.e., economic impact of loss of water services). Benefits for avoided casualties and injuries were not accounted for because they are considered to be relatively minor for typical utility systems compared to physical

damage and loss-of- function impacts and in some cases are not applicable. The benefits were calculated using the difference between baseline conditions and upgraded conditions.

Avoided physical damage was determined based on the expected performance of the assets and the estimated structure, pipeline segment, nonstructural item, or equipment replacement value. Based on the assessment results for each hazard event, an estimate of the damage state (e.g., severe, moderate, light, etc.) was defined for each deficient asset's baseline and upgraded condition. The physical loss estimate was then expressed as a percentage of the replacement value, which was linked to each estimated damage level. The avoided physical damage benefit was calculated in dollars as the difference in the expected baseline damage and the anticipated damage after upgrades have been implemented.

Avoided loss-of-function impacts (i.e., economic impacts of loss of water service) were determined in accordance with the FEMA BCA standard utility loss of service values and Sections 6.3 and 6.4.2 of FEMA's What is a Benefit? document. The economic impacts of loss of water service are estimated based on complete loss of potable water service, which is currently valued by FEMA in their BCA tool at $114 per person per day. Based on the hazard assessment results, scenario damage descriptions were defined for individual assets. Using these damage descriptions, the District estimated the functional downtime of the JVWCD water system facilities/assets (in days of complete loss of service) both for the baseline condition and the upgraded condition assuming only the individual asset under consideration is damaged. The District also determined the number of customers served by each asset in terms of population. The total economic impact of the loss of service was determined for the baseline and upgraded conditions using FEMA's current 2021 standard economic impact value of $114 per person per day of loss of potable water service. The FEMA standard value accounts for the effects of reduced regional economic activity, direct impacts on customers, and disruption of customer's normal activities. The avoided loss-of-function benefit was calculated as the difference in the expected baseline impacts and the upgraded impacts.

The total hazard scenario benefits for each asset are the sum of the avoided damage benefit and the avoided loss-of-function benefit. To account for the useful project lifetime of the mitigation work and the time value of money, the "expected annual benefits" are converted to a "present value of annual benefits" using the FEMA-mandated discount rate of 7% and a standard project useful lifetime value of 50 years for utility projects. The benefit-cost ratio is determined by dividing this " present value of annual benefits" by the estimated project mitigation cost.

The benefit cost ratios for each mitigation project were determined using a sum of the avoided physical damage benefits for each asset included in the project and a system-wide determination of the avoided loss-of-function benefits considering the combined contribution of each individual asset within that project. Table 4.3 shows a summary of the benefit cost results for each mitigation project.

Table 4.3 Benefit Cost Summary

	Mitigation Project	Total Annualized Present Value Benefits	Total Mitigation Costs	Benefit Cost Ratio
1	Jordan Aqueduct (JA) Reaches 1, 3 & 4 Project Scoping	NA	$302,300	NA
2	JVWTP –Sed Basins 1&2 (Earthquake, Drought, Wildfire)	$104,940,000	$30,400,000	3.5
3	JVWTP – 1 MG Reservoir (Earthquake)	$125,211,000	$1,610,000	80.2
4	Old Bingham 3 MG Tank (Earthquake)	$2,868,000	$2,000,000	1.6
5	JVWTP – 8 MG Reservoir (Earthquake, Wildfire)	$54,446,000	$16,310,000	3.4

Table 4.3 Benefit Cost Summary				
	Mitigation Project	Total Annualized Present Value Benefits	Total Mitigation Costs	Benefit Cost Ratio
6	Jordan Aqueduct (JA) Reaches 1, 3 & 4 Mitigation Project	N/A	TBD	N/A

Section 5

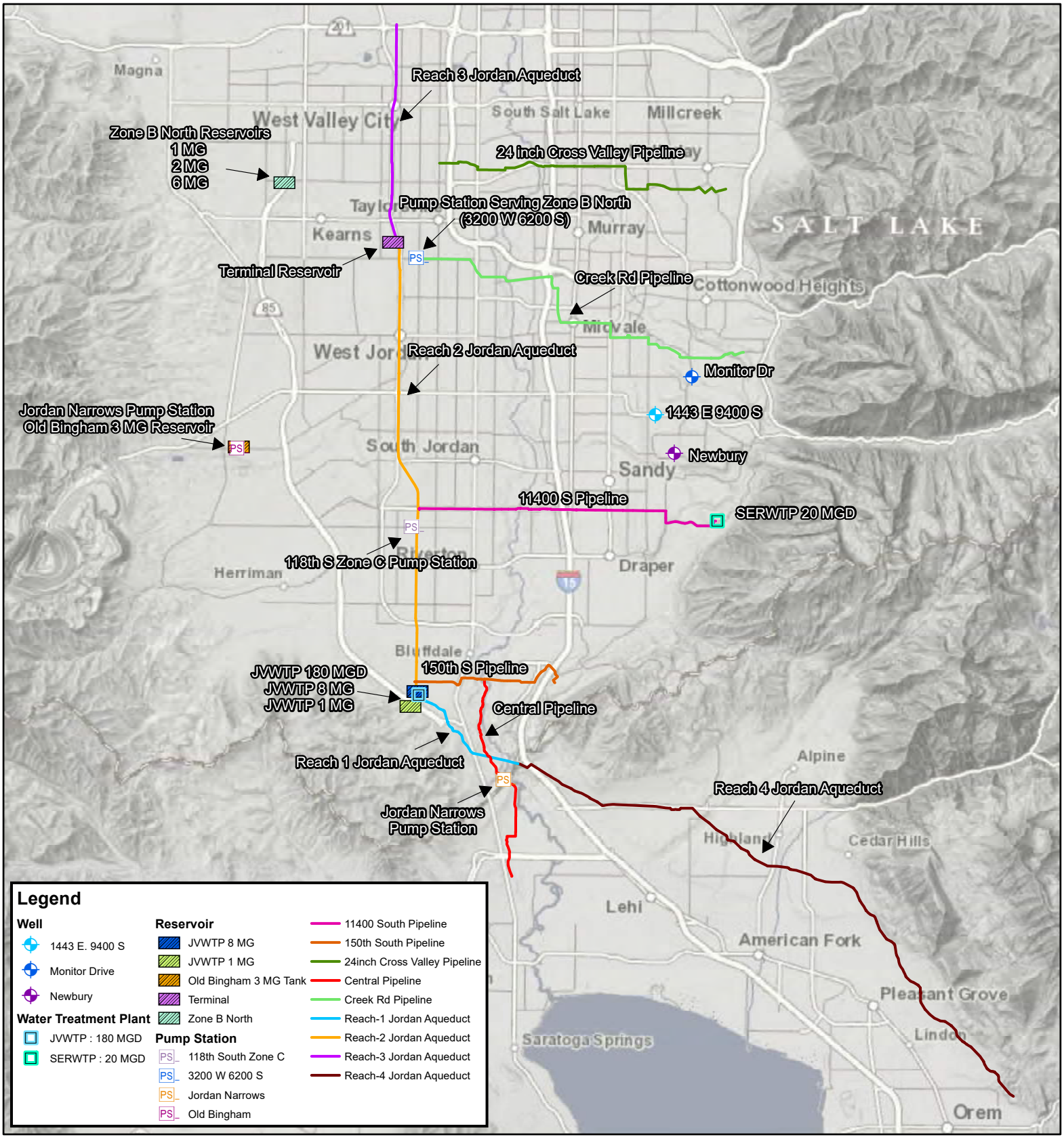
Plan Maintenance

The District plans on monitoring and evaluating the JVWCD Hazard Mitigation Plan yearly as it correlates to the District's annual Capital Improvement Plan updates. In addition, the District plans on monitoring and evaluating the Plan in conjunction with updates to the State Plan that include the District's water system. The regional plans covering the District's facilities include Salt Lake County and Mountainland Association of Governments (MAG). The District is considering submitting portions of their Plan to Salt Lake County and MAG, for inclusion in their regional plans for future updates. The District intends on updating their natural hazard mitigation plan at least once every five years, either through State and/or Regional Plan updates or through an actual update to their own Plan. The District will continue to provide its stakeholders with updates to the JVWCD Plan and encompassing State/Regional Plans in order to solicit public involvement and comments.

Appendix A: Asset Location and Hazard Maps

All Hazard Maps_2021 0713
- Asset Location Map
- Debris Flow Hazard
- Ground Shaking Hazard
- Liquefaction Potential
- Surface Fault Rupture Hazard
- Collapsible Soil and Rock
- Expansive Soil and Rock
- Landslide Hazard

Flood Maps_2021 0428
- 1_SERWTP
- 2_JVWTP
- 3_Monitor Dr Well
- 4_Newbury Well
- 5_1443E 9400S Well
- 6_8MG Tank
- 7_1MG JVWTP Culinary Tank
- 8_Old Bingham Tank
- 9_Zone B North Tanks
- 10_Terminal Reservoir
- 11_Jordan Narrows PS
- 12_11800 S Zone C Pump Station
- 13_3200 W 6200 S Pump Station
- 14_Old Bingham Pump Station
- 15a_JA-4
- 15b_JA-4
- 15c_JA-4
- 15d_JA-4
- 15e_JA-1
- 15f_JA-2
- 15g_JA-2
- 15h_JA-2
- 15i_JA-2
- 15j_JA-2
- 15k_JA-2
- 16_Central
- 17a_150th South Pipeline
- 17b_150th South Pipeline
- 18a_Cross Valley Pipeline
- 18b_Cross Valley Pipeline
- 18c_Cross Valley Pipeline
- 19a_Creek Road Pipeline
- 19b_Creek Road Pipeline
- 20a_114th South Pipeline
- 20b_114th South Pipeline

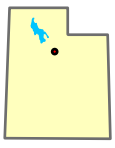


0 7,500 15,000 30,000 45,000 Feet

1:215,000

Basemap:
Basemap and Geologic Hazard Data provided by the State of Utah AGRC. Assets provided by the Client.

N

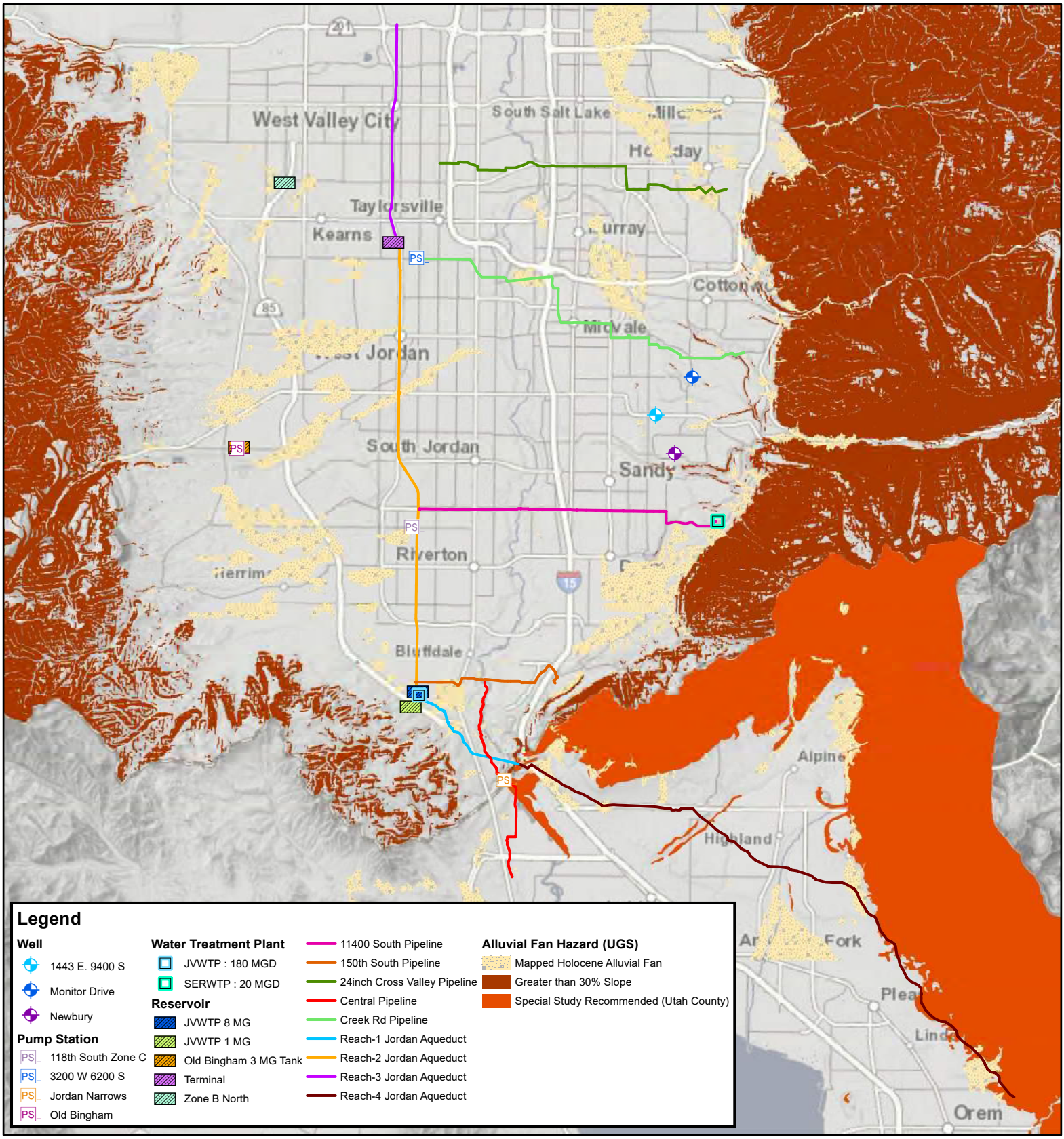


GeoStrata

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Asset Location Map

Plate 1



Legend

Well
- 1443 E. 9400 S
- Monitor Drive
- Newbury

Pump Station
- PS 118th South Zone C
- PS 3200 W 6200 S
- PS Jordan Narrows
- PS Old Bingham

Water Treatment Plant
- JVWTP : 180 MGD
- SERWTP : 20 MGD

Reservoir
- JVWTP 8 MG
- JVWTP 1 MG
- Old Bingham 3 MG Tank
- Terminal
- Zone B North

- 11400 South Pipeline
- 150th South Pipeline
- 24inch Cross Valley Pipeline
- Central Pipeline
- Creek Rd Pipeline
- Reach-1 Jordan Aqueduct
- Reach-2 Jordan Aqueduct
- Reach-3 Jordan Aqueduct
- Reach-4 Jordan Aqueduct

Alluvial Fan Hazard (UGS)
- Mapped Holocene Alluvial Fan
- Greater than 30% Slope
- Special Study Recommended (Utah County)

0 5,500 11,000 22,000 33,000 44,000 Feet

1:215,000

N

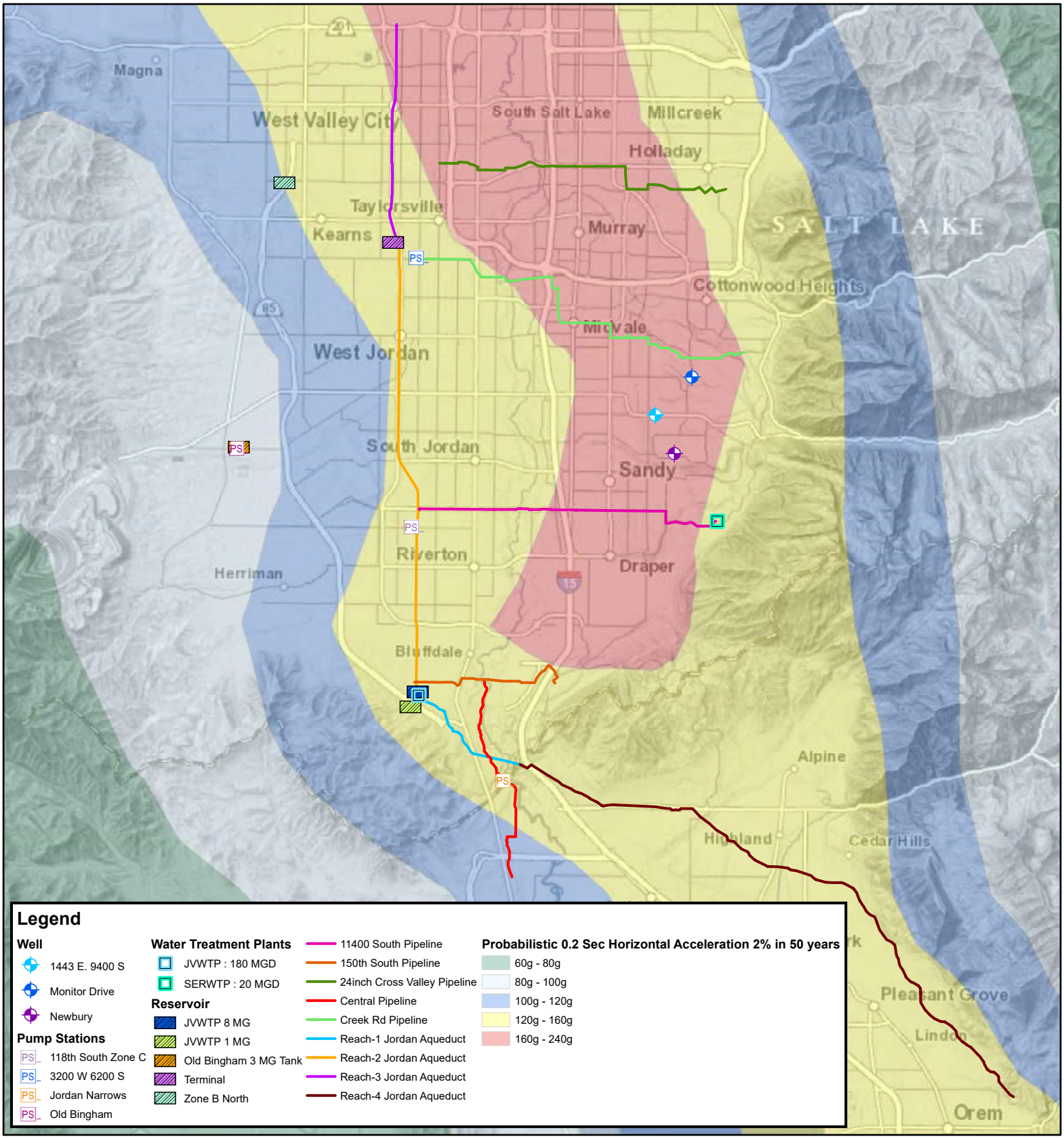
Basemap:
2018 1m NAIP aerial imagery and Geologic Hazard Data provided by the State of Utah AGRC. Assets provided by the Client.

GeoStrata

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Debris Flow Hazard

Plate 2



0 7,500 15,000 30,000 45,000 Feet

1:215,000

Basemap:
Basemap and Geologic Hazard Data provided by the State of Utah AGRC.

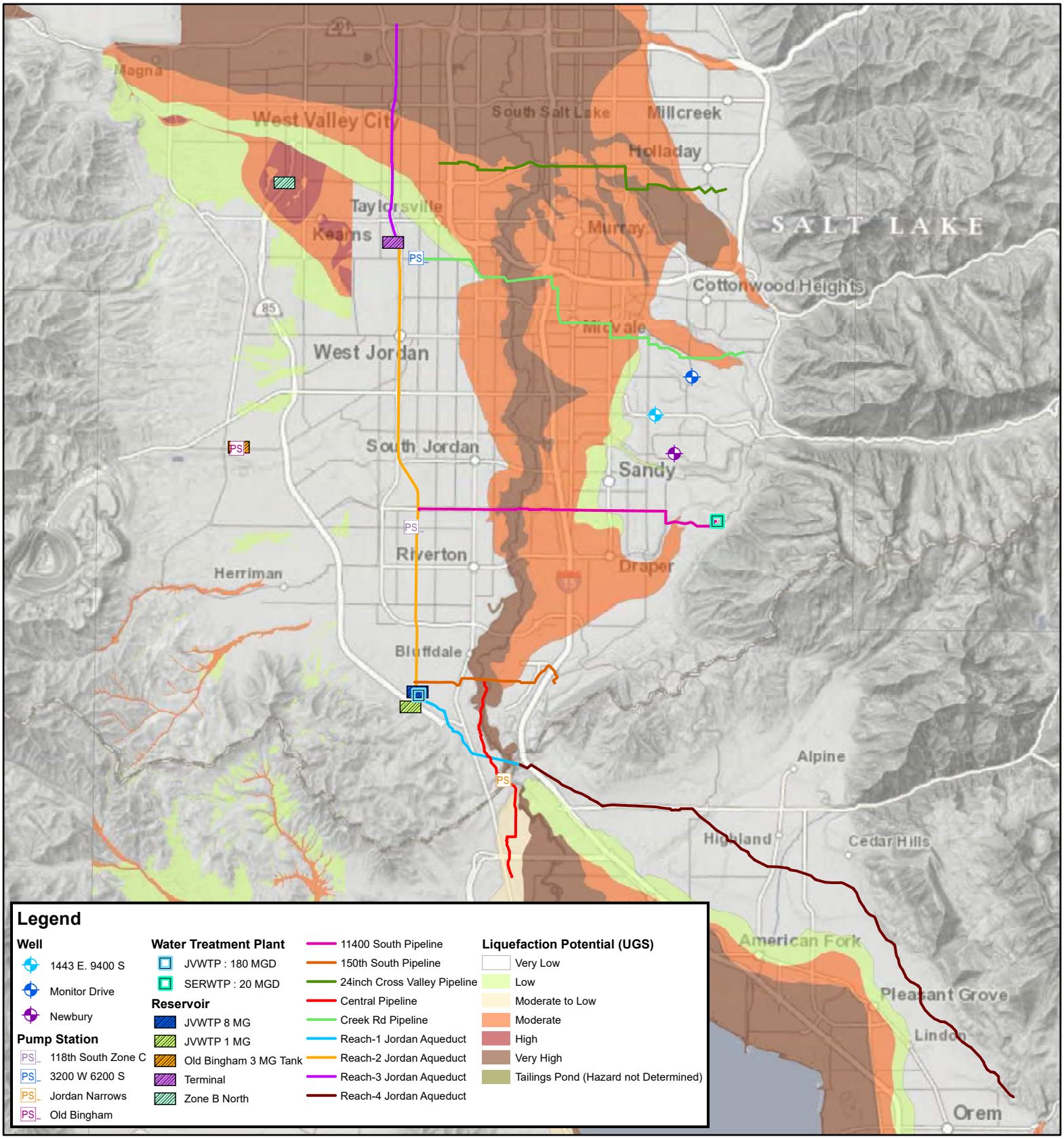
N

GeoStrata

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Ground Shaking Hazard
Probablistic 0.2 Second Horizontal Acceleration 2% in 50 yrs

Plate 3



0 7,500 15,000 30,000 45,000 Feet

1:215,000

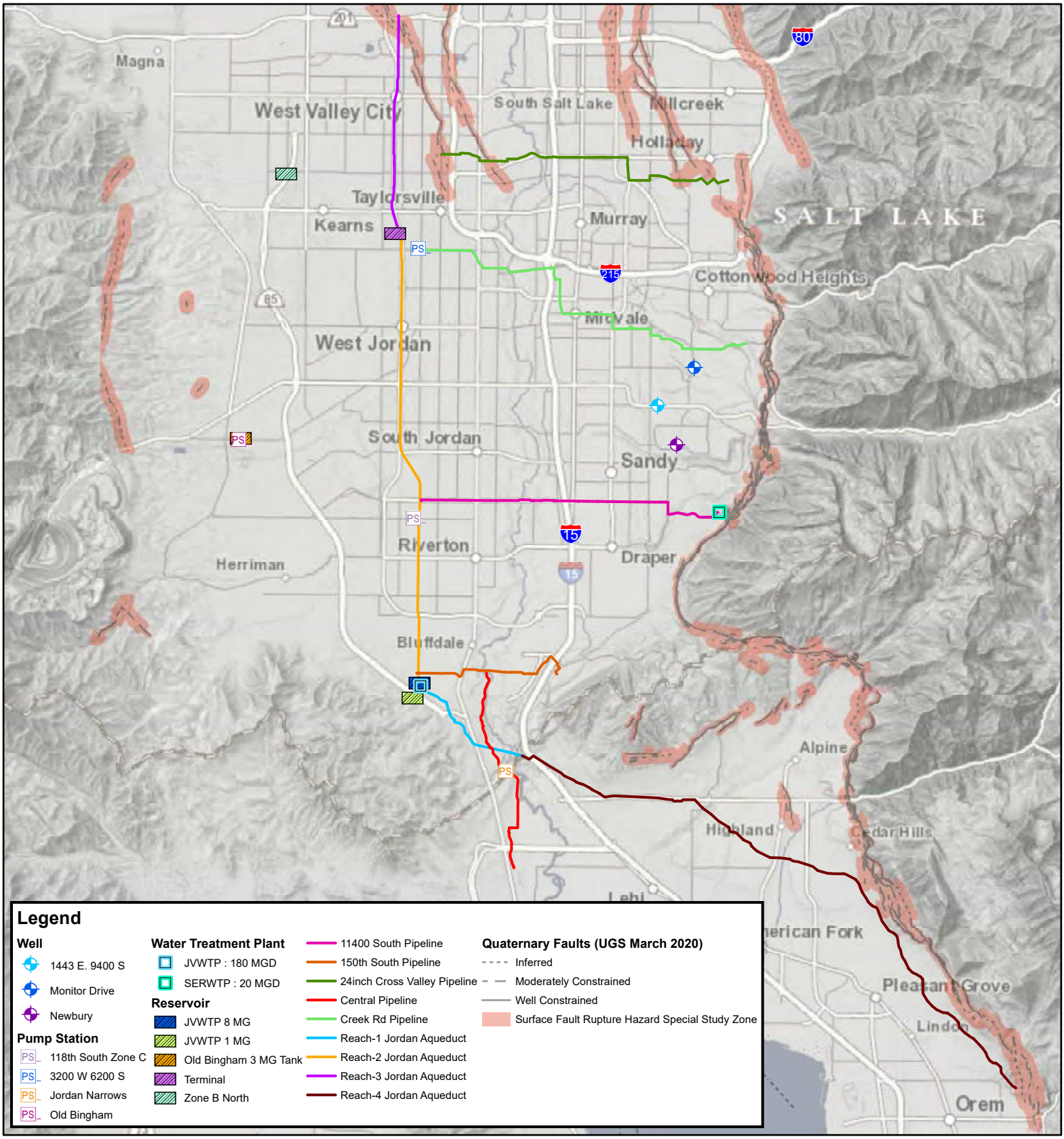
Basemap:
Basemap and Geologic Hazard Data provided by the State of Utah AGRC. Assets provided by the Client.

N

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Liquefaction Potential

Plate 4



Legend

Well
- 1443 E. 9400 S
- Monitor Drive
- Newbury

Pump Station
- PS 118th South Zone C
- PS 3200 W 6200 S
- PS Jordan Narrows
- PS Old Bingham

Water Treatment Plant
- JVWTP : 180 MGD
- SERWTP : 20 MGD

Reservoir
- JVWTP 8 MG
- JVWTP 1 MG
- Old Bingham 3 MG Tank
- Terminal
- Zone B North

- 11400 South Pipeline
- 150th South Pipeline
- 24inch Cross Valley Pipeline
- Central Pipeline
- Creek Rd Pipeline
- Reach-1 Jordan Aqueduct
- Reach-2 Jordan Aqueduct
- Reach-3 Jordan Aqueduct
- Reach-4 Jordan Aqueduct

Quaternary Faults (UGS March 2020)
- Inferred
- Moderately Constrained
- Well Constrained
- Surface Fault Rupture Hazard Special Study Zone

0 7,500 15,000 30,000 45,000 Feet

1:215,000

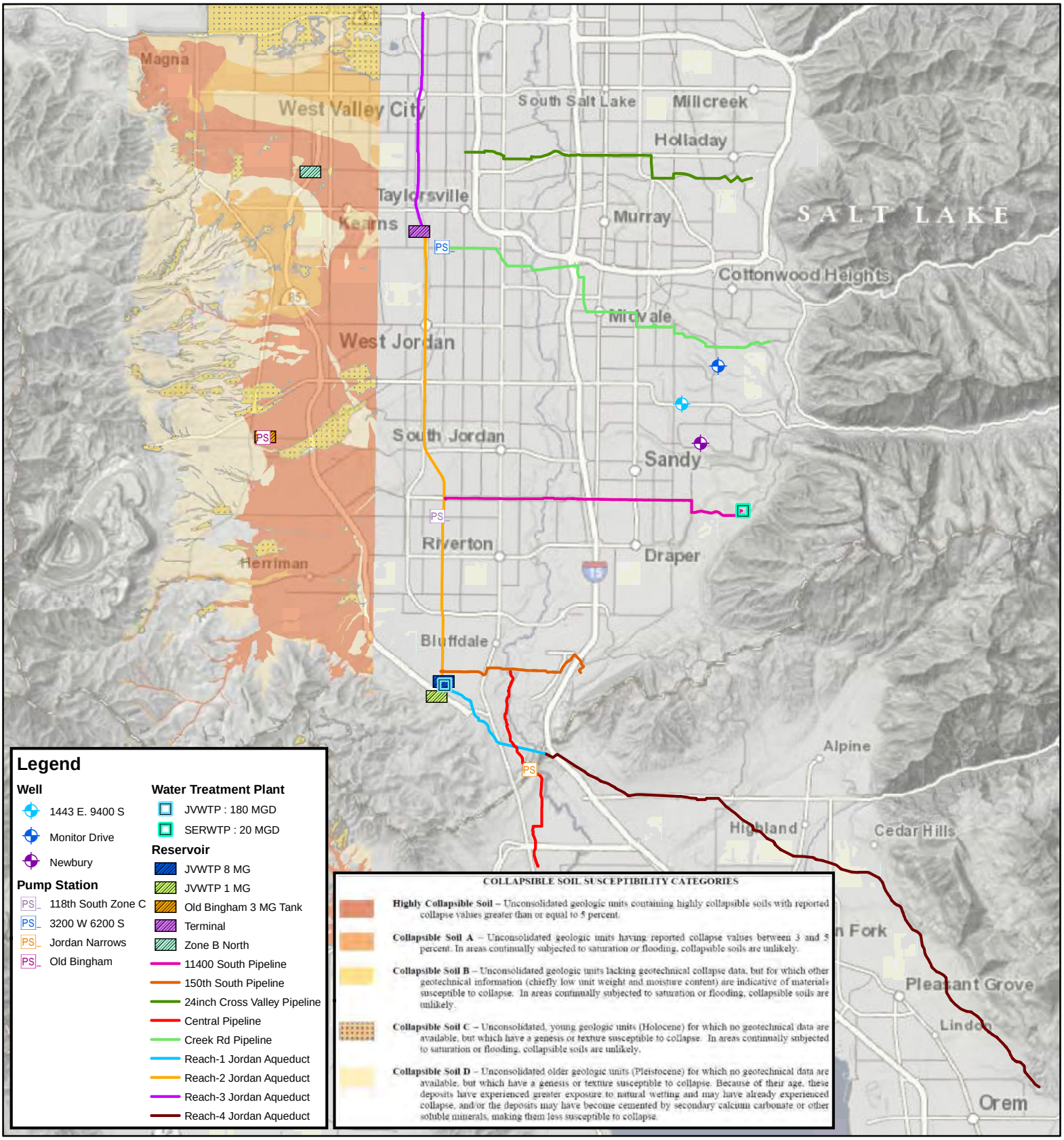
Basemap:
Basemap and Geologic Hazard Data provided by the State of Utah AGRC. Assets provided by the Client.

N

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Surface Fault Rupture Hazard

Plate 5



0 5,500 11,000 22,000 33,000 44,000 Feet

1:215,000

N

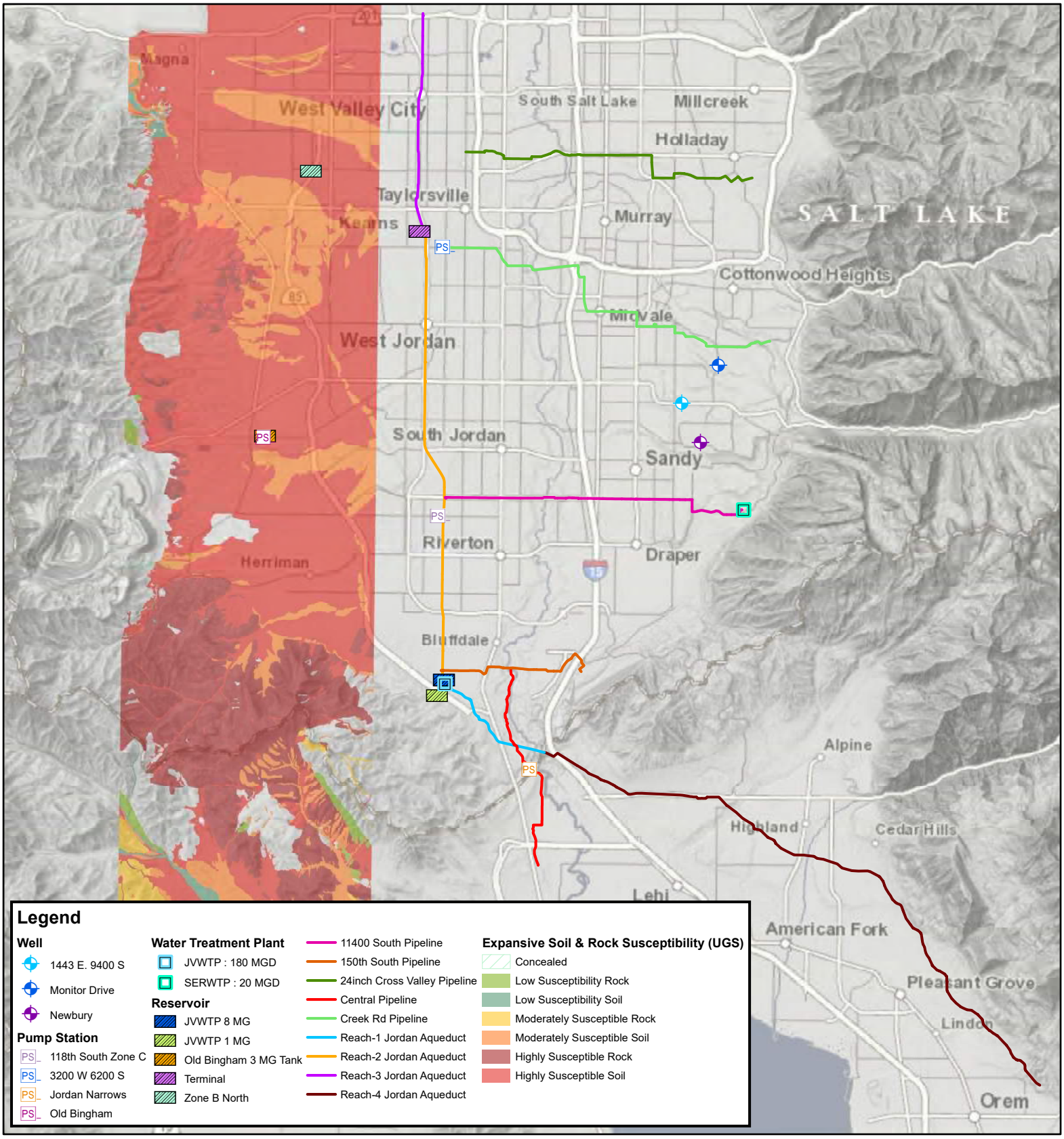
Basemap:
2018 1m NAIP aerial imagery and Geologic Hazard Data provided by the State of Utah AGRC. Assets provided by the Client.

GeoStrata

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Collapsible Soil and Rock

Plate 6



Feet
0 5,500 11,000 22,000 33,000 44,000

1:215,000

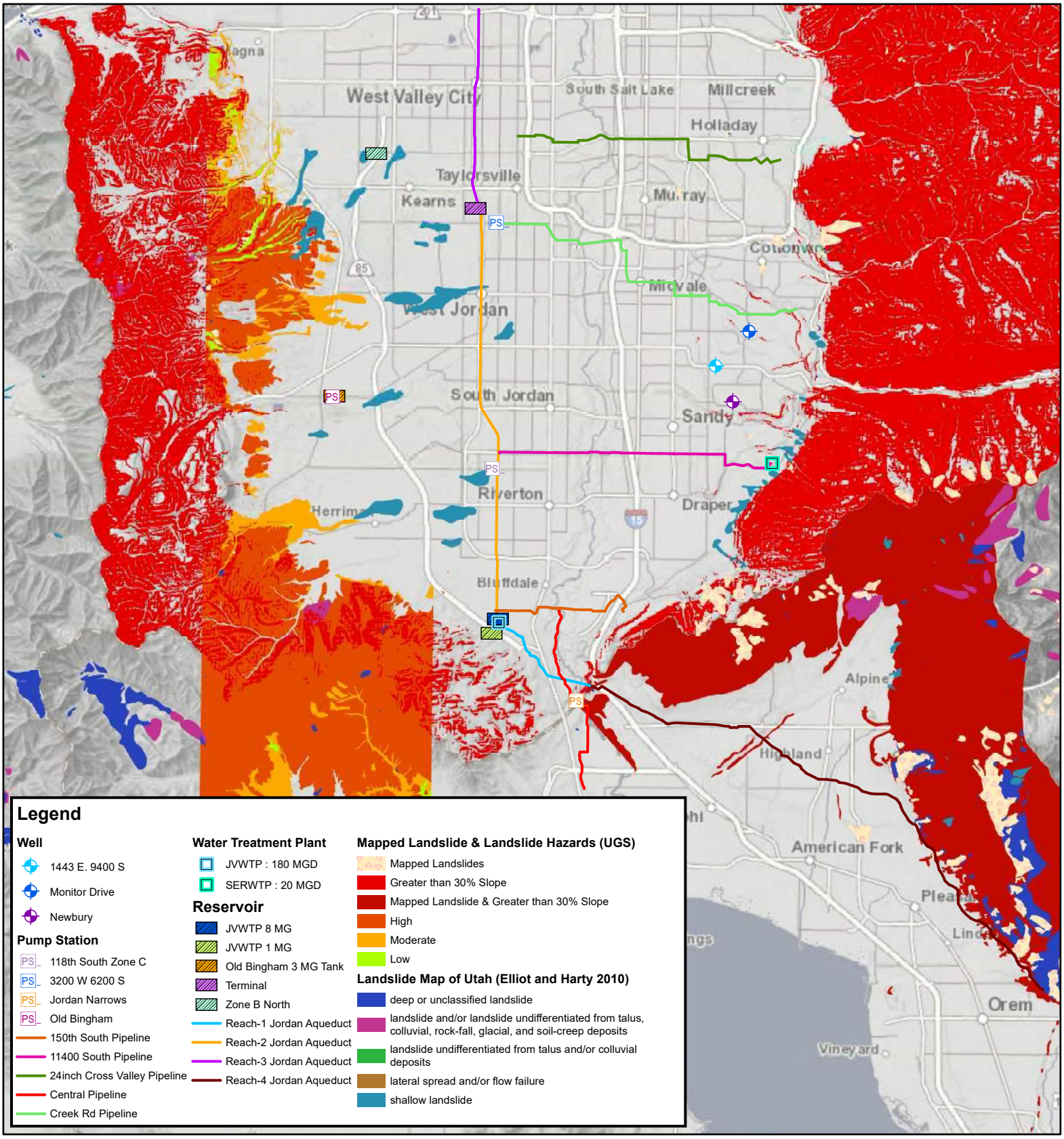
Basemap:
2018 1m NAIP aerial imagery and Geologic Hazard Data provided by the State of Utah AGRC. Assets provided by the Client.

N

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Expansive Soil and Rock

Plate 7



0 1,000 2,000 4,000 6,000 Feet

1:28,079

Basemap:
Basemap and Geologic Hazard Data provided by the State of Utah AGRC. Assets provided by the Client.

N

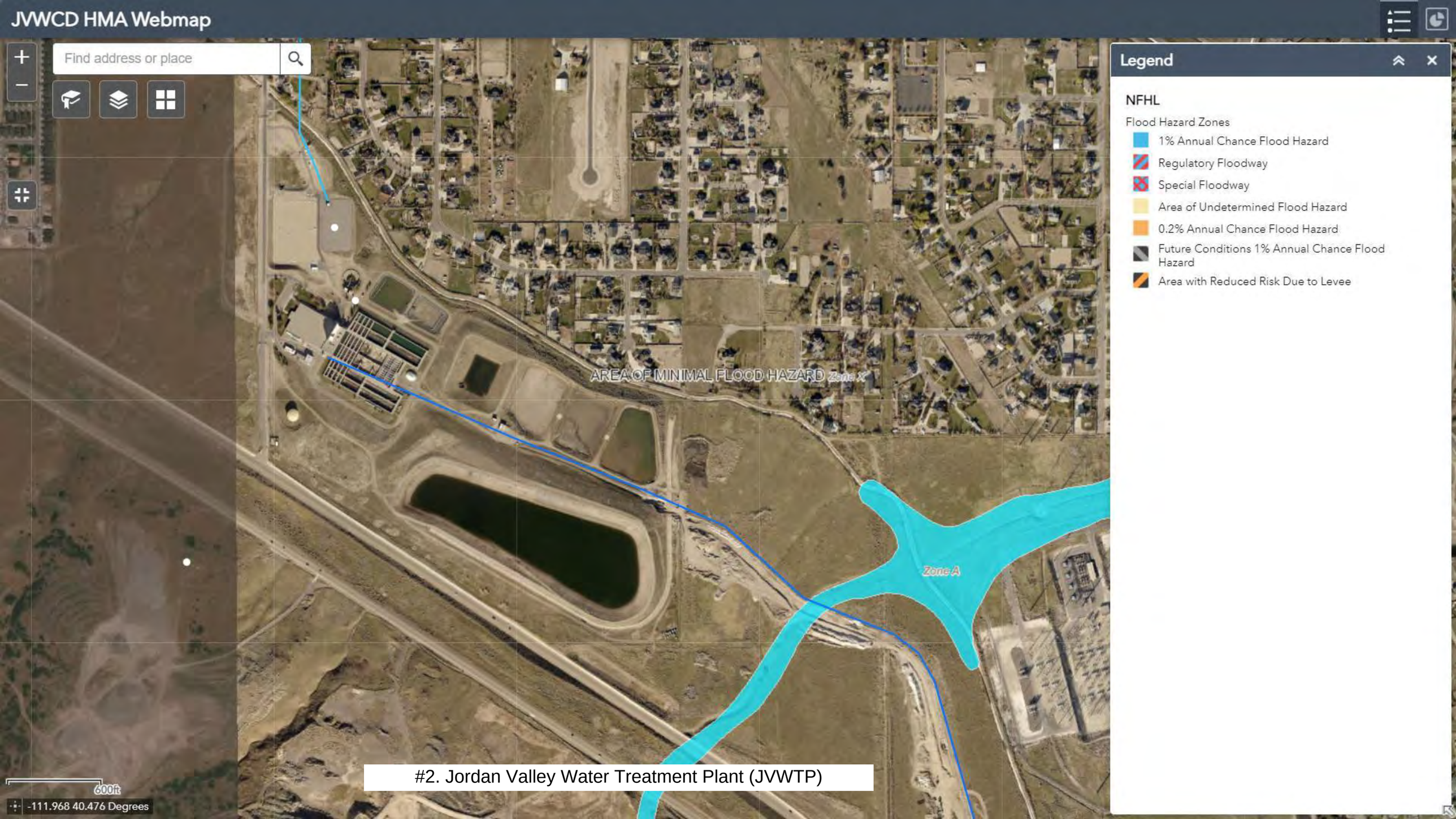
GeoStrata

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

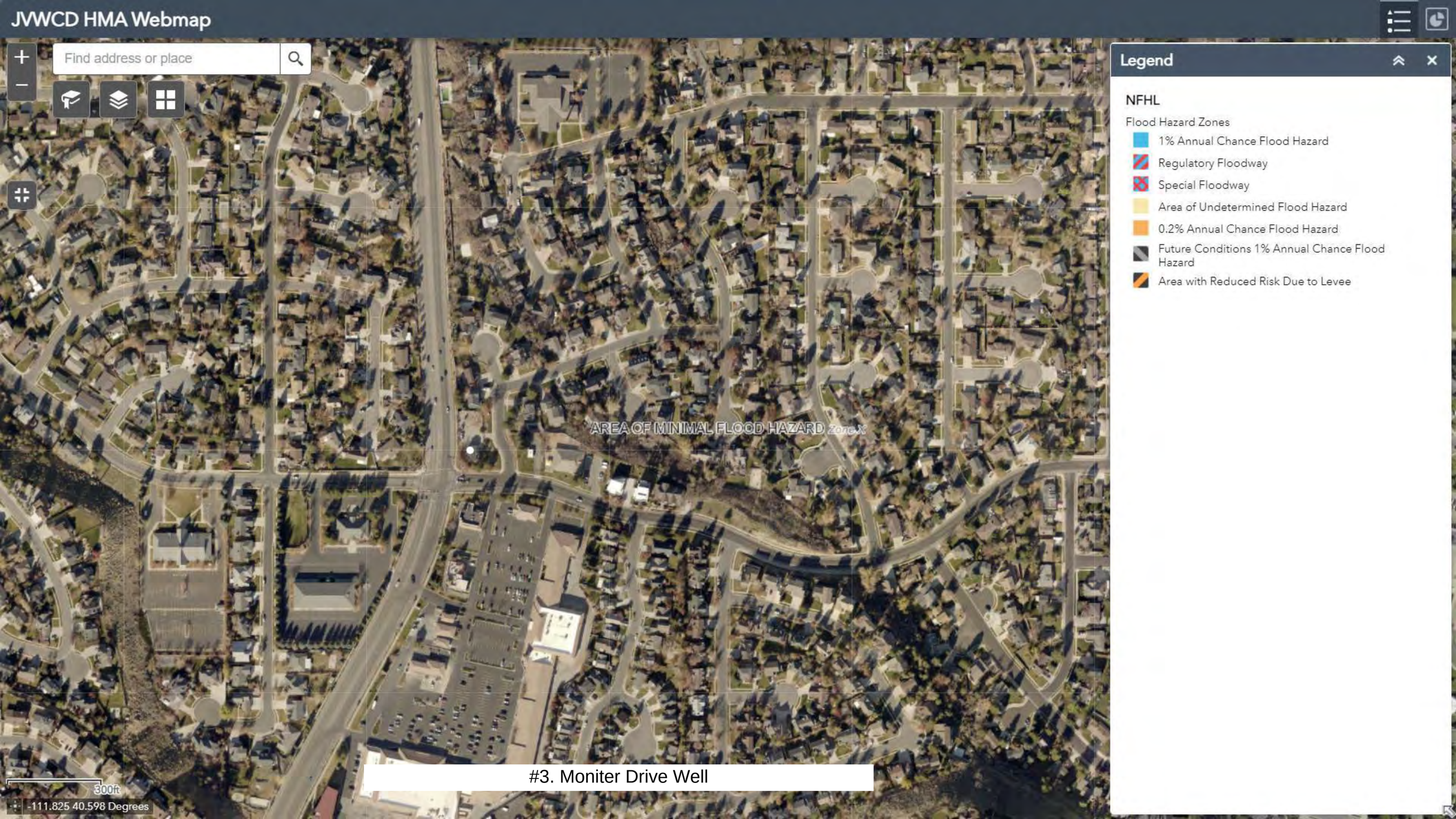
Landslide Hazard

Plate 8

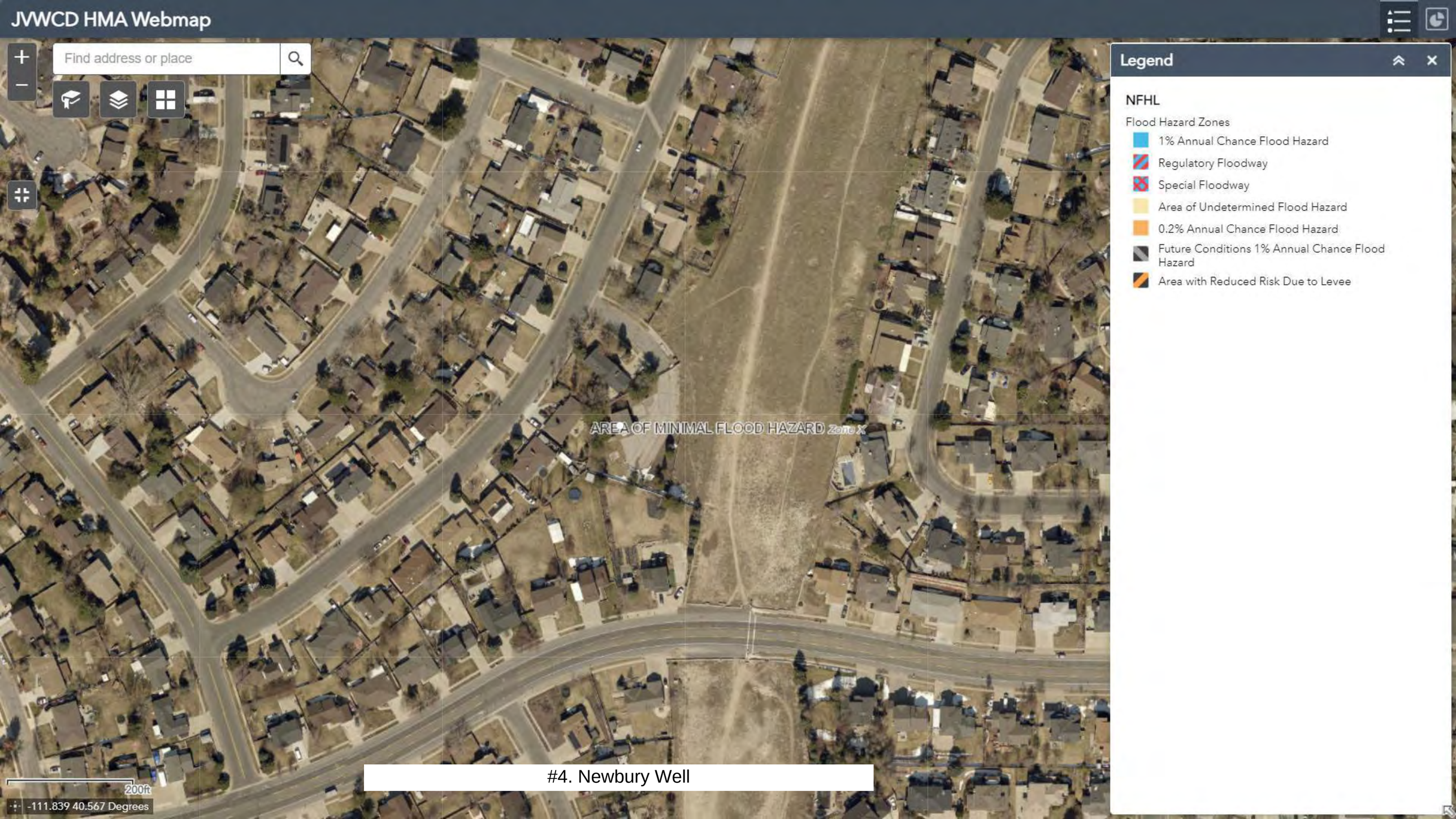
#1. Southeast Regional Water Treatment Plant (SERWTP)



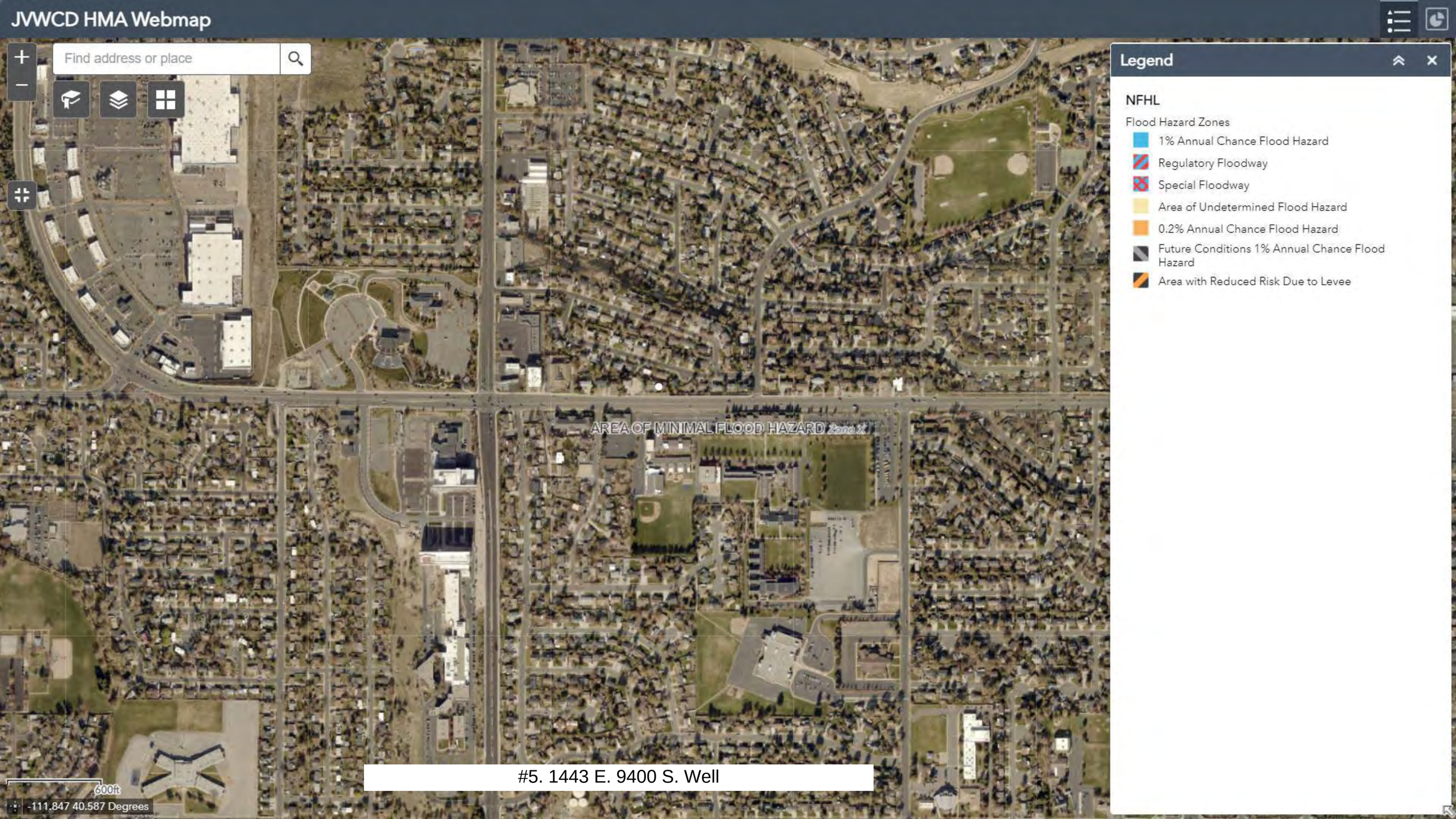
#2. Jordan Valley Water Treatment Plant (JVWTP)



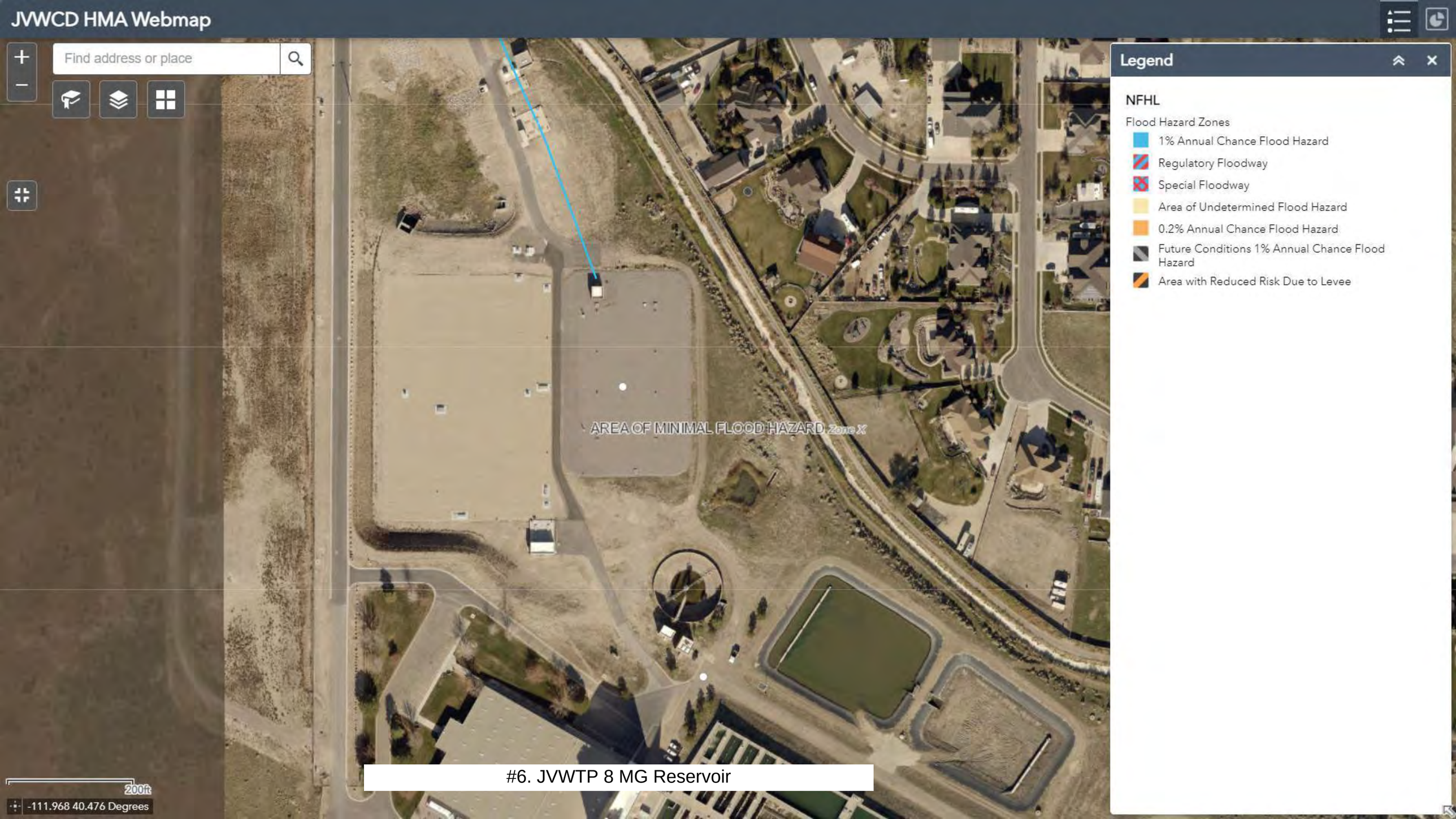
#3. Moniter Drive Well



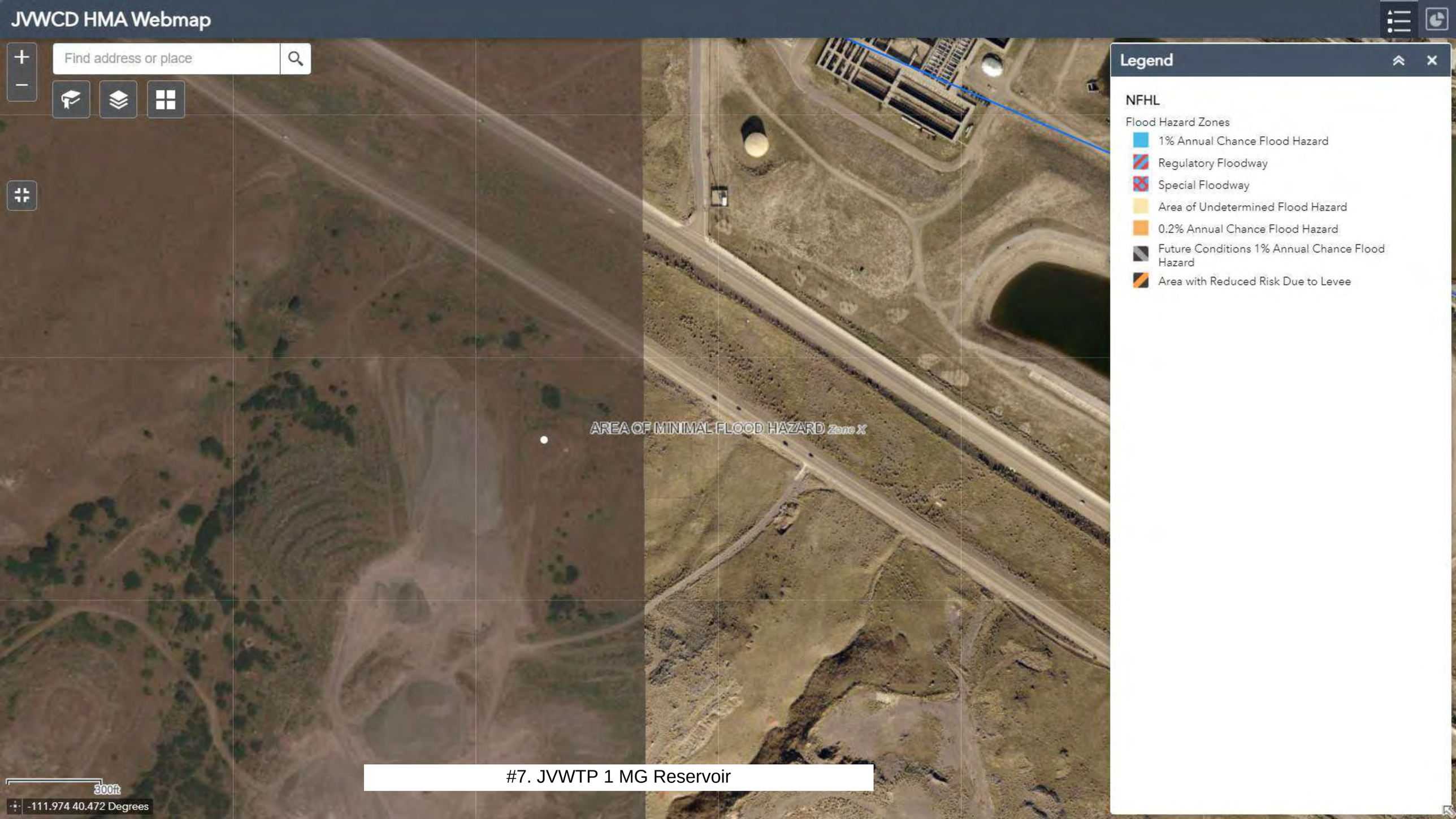
#4. Newbury Well



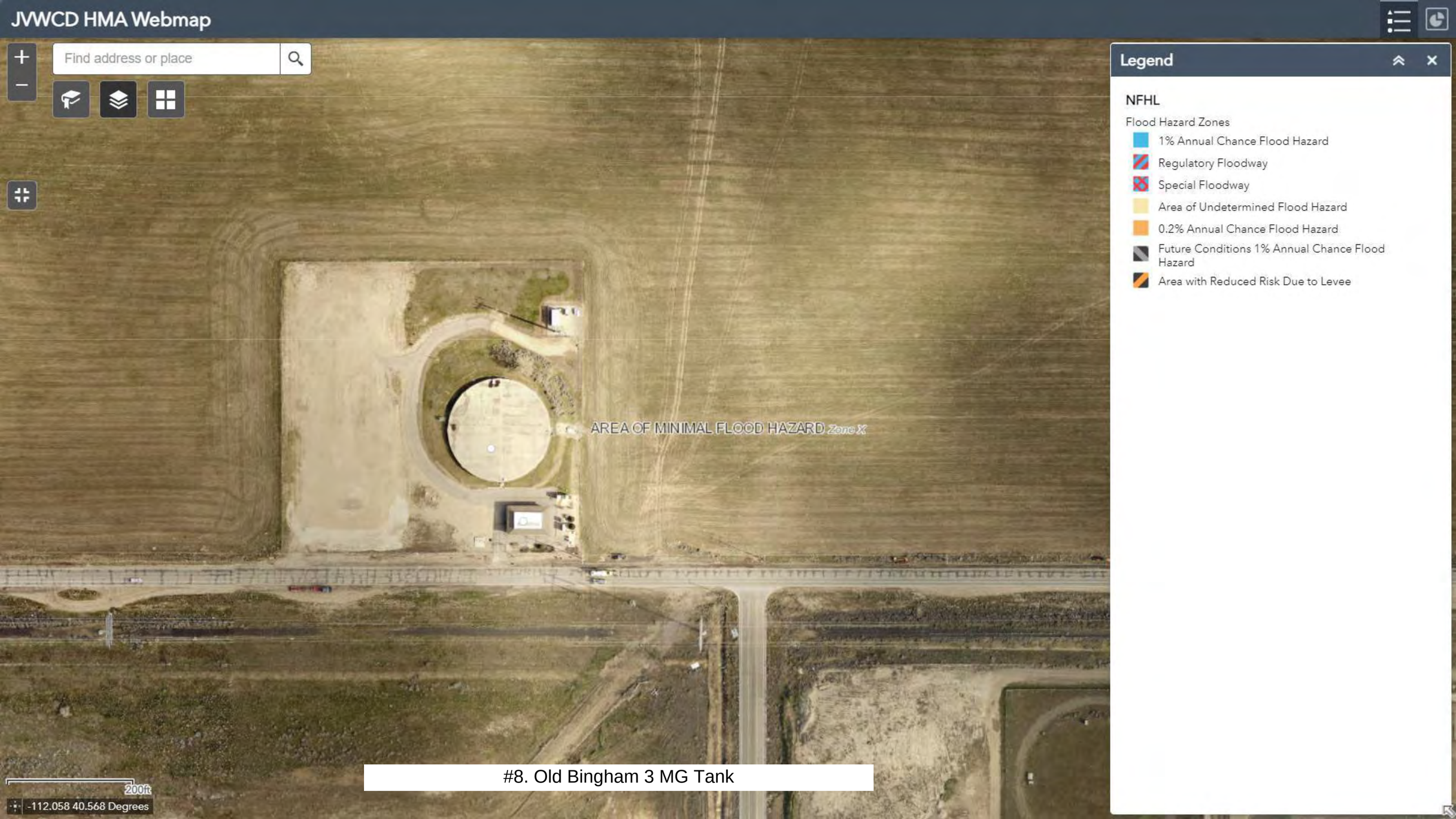
#5. 1443 E. 9400 S. Well



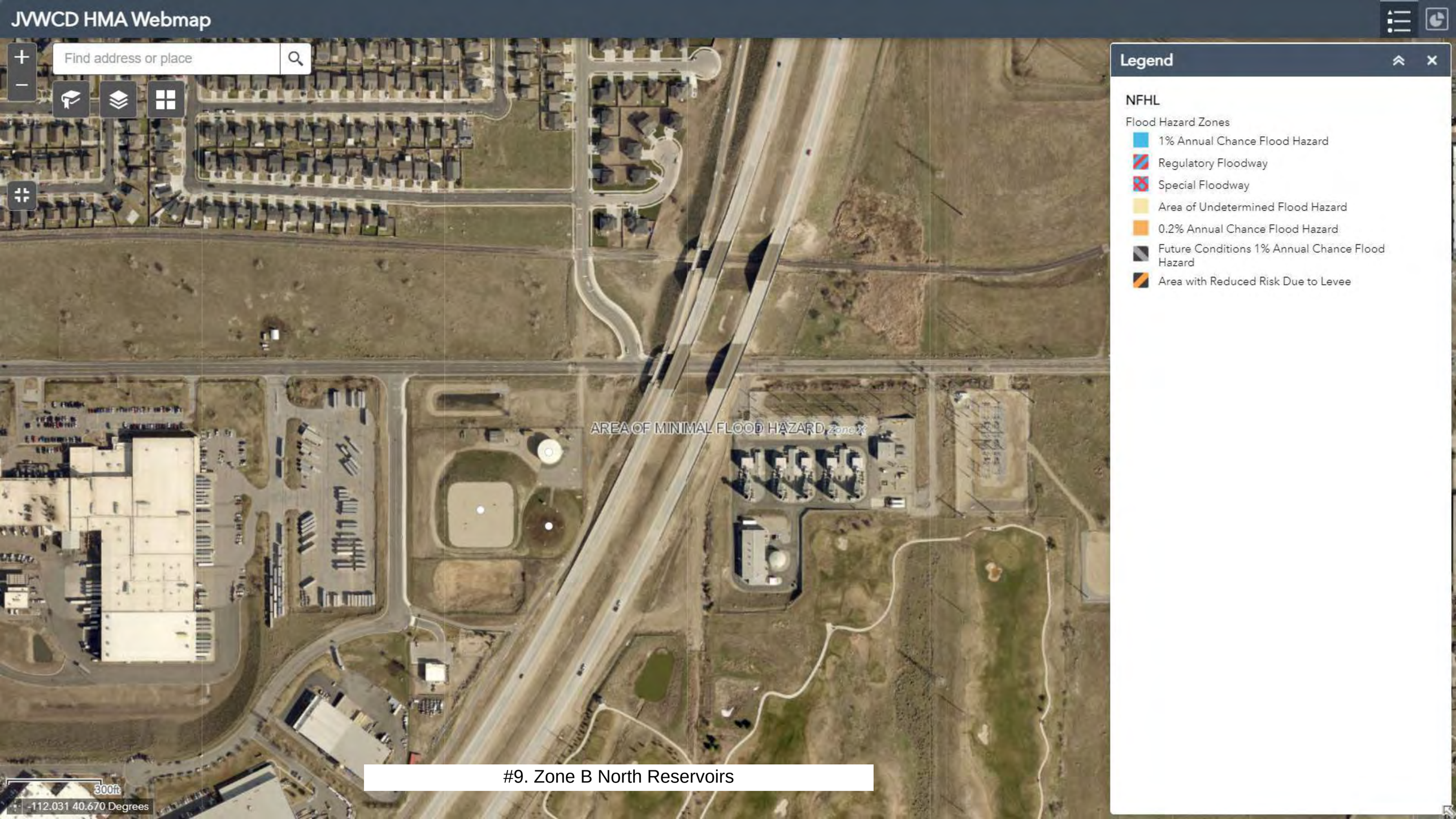
#6. JVWTP 8 MG Reservoir



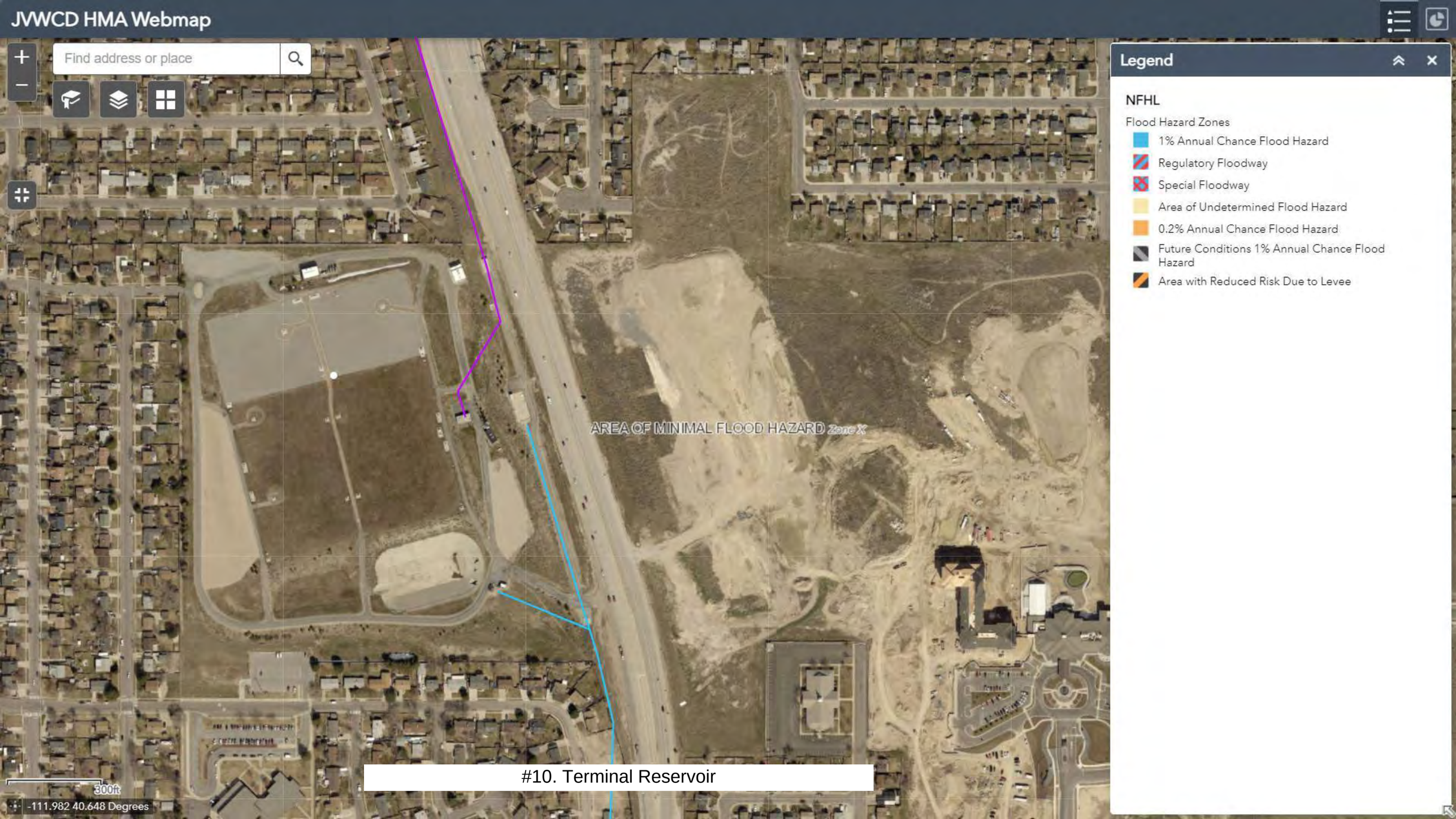
#7. JVWTP 1 MG Reservoir



#8. Old Bingham 3 MG Tank

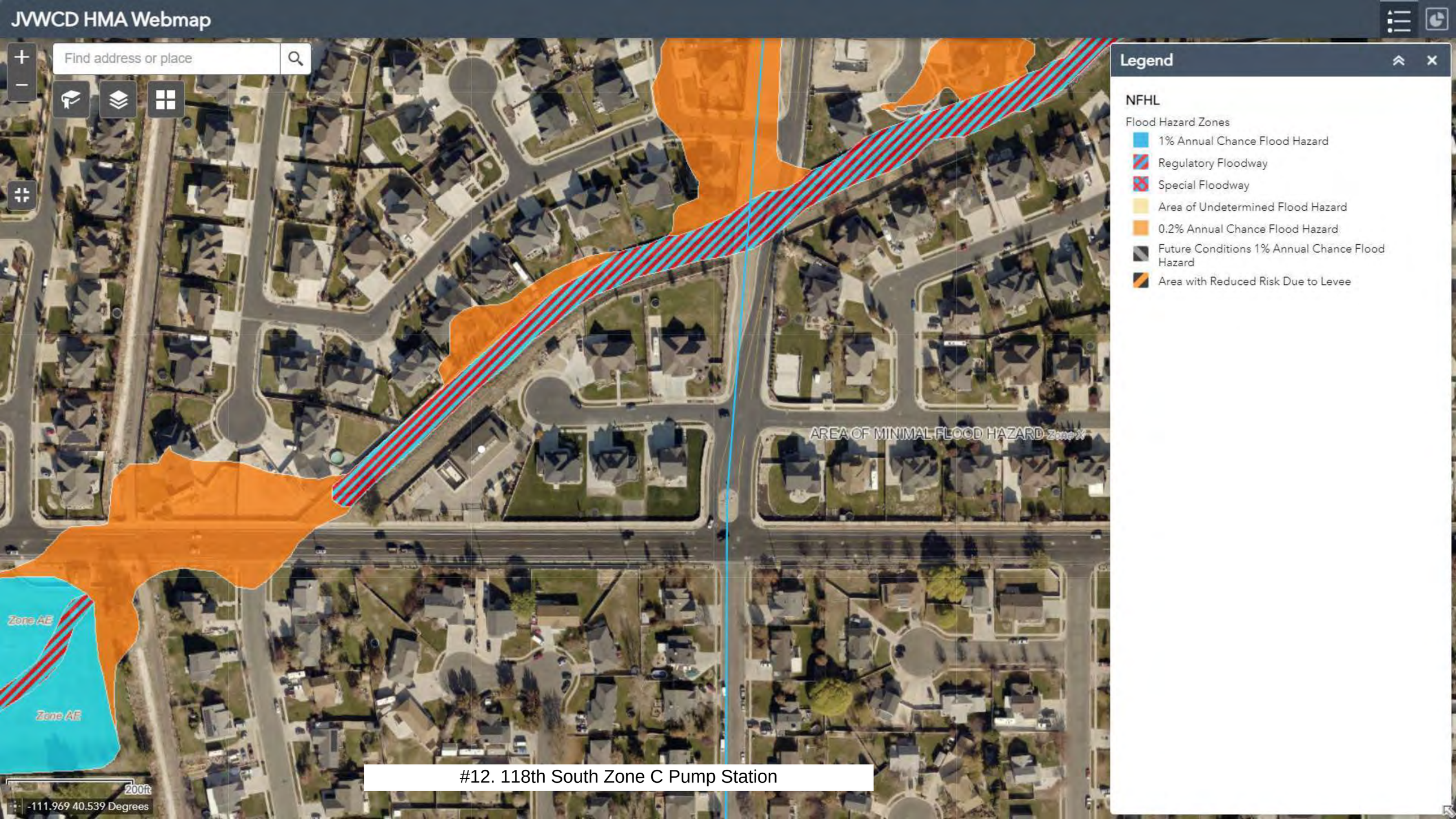


#9. Zone B North Reservoirs



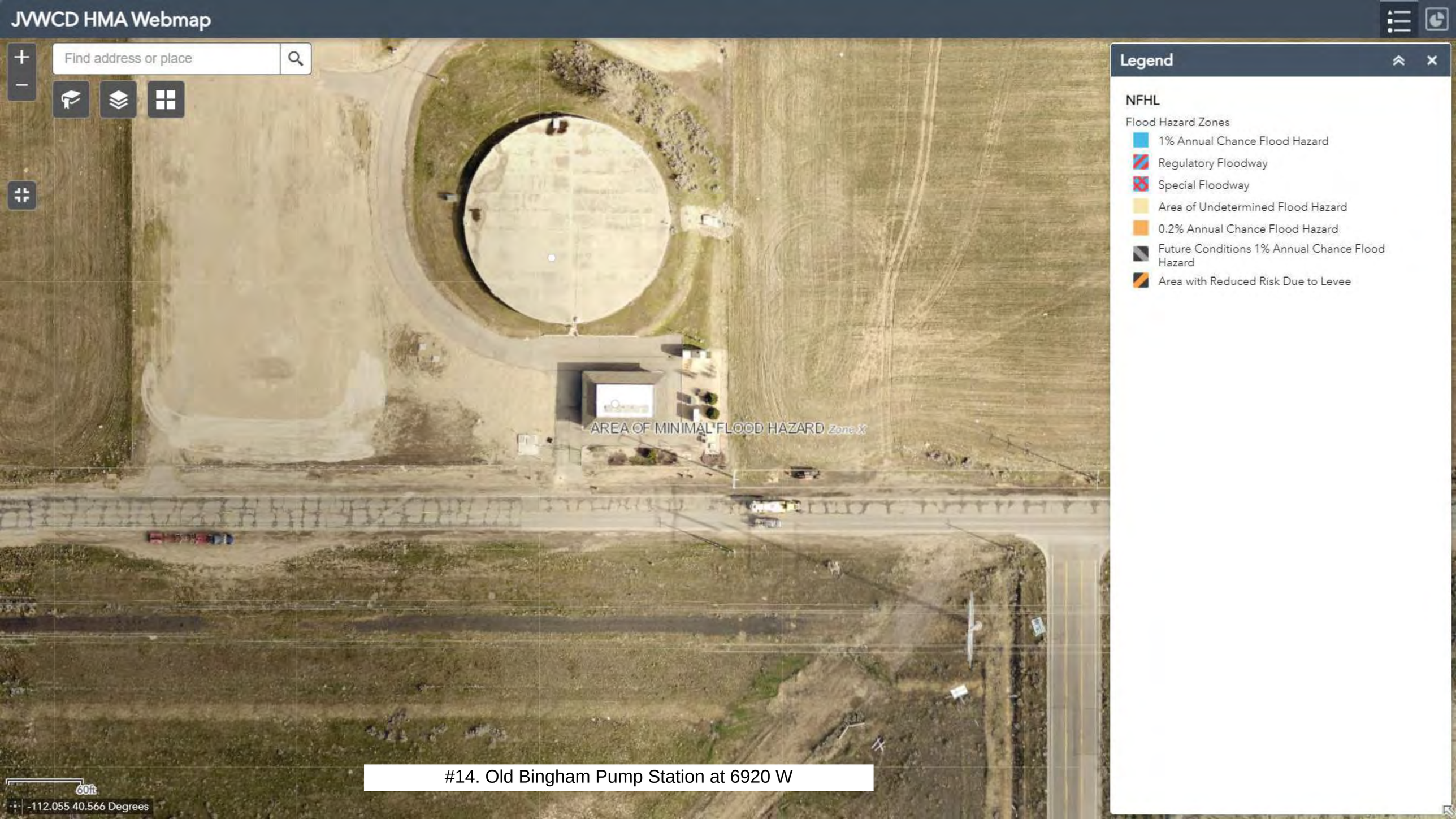
#10. Terminal Reservoir

#11. Jordan Narrows Pump Station

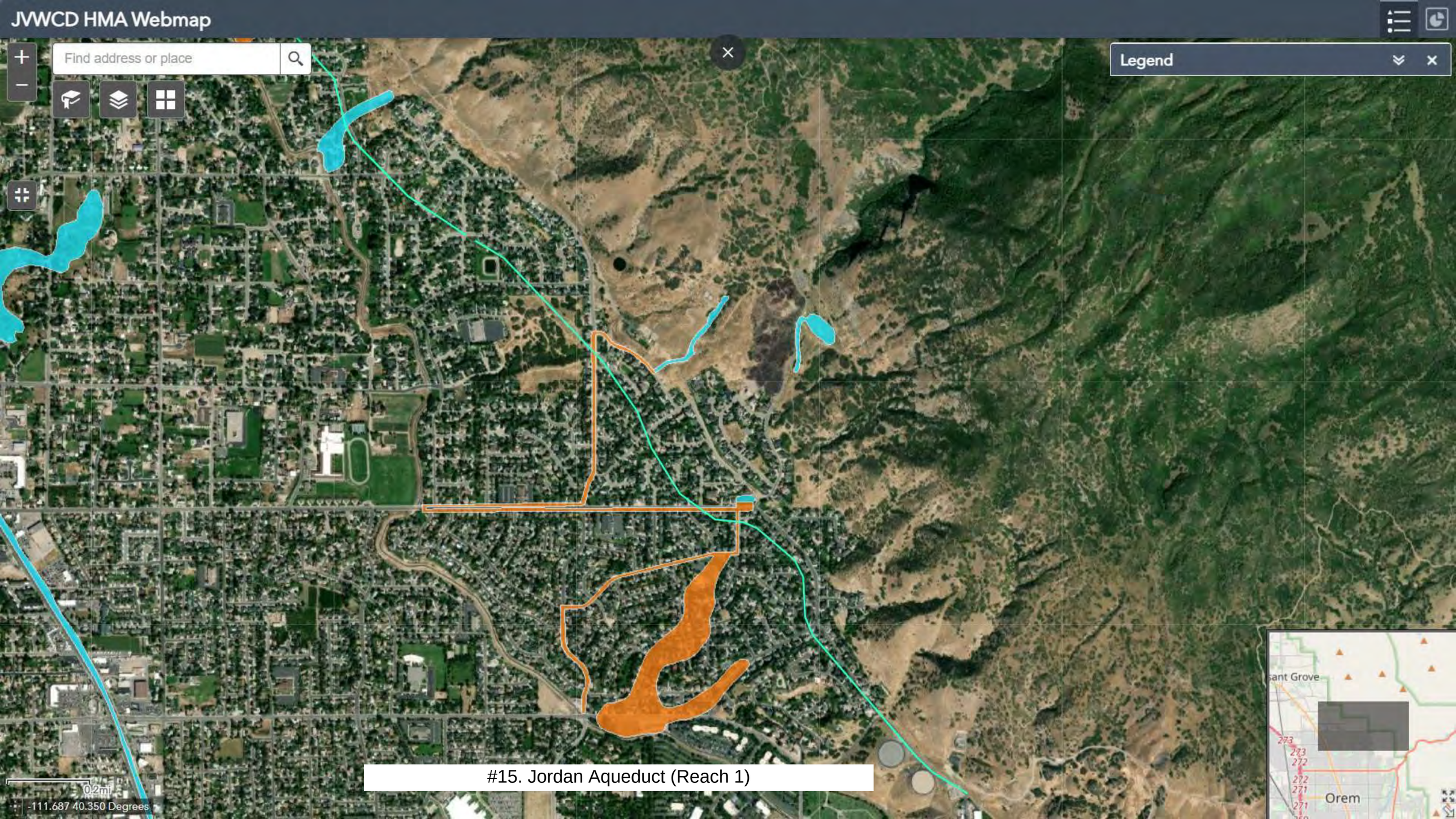


#12. 118th South Zone C Pump Station

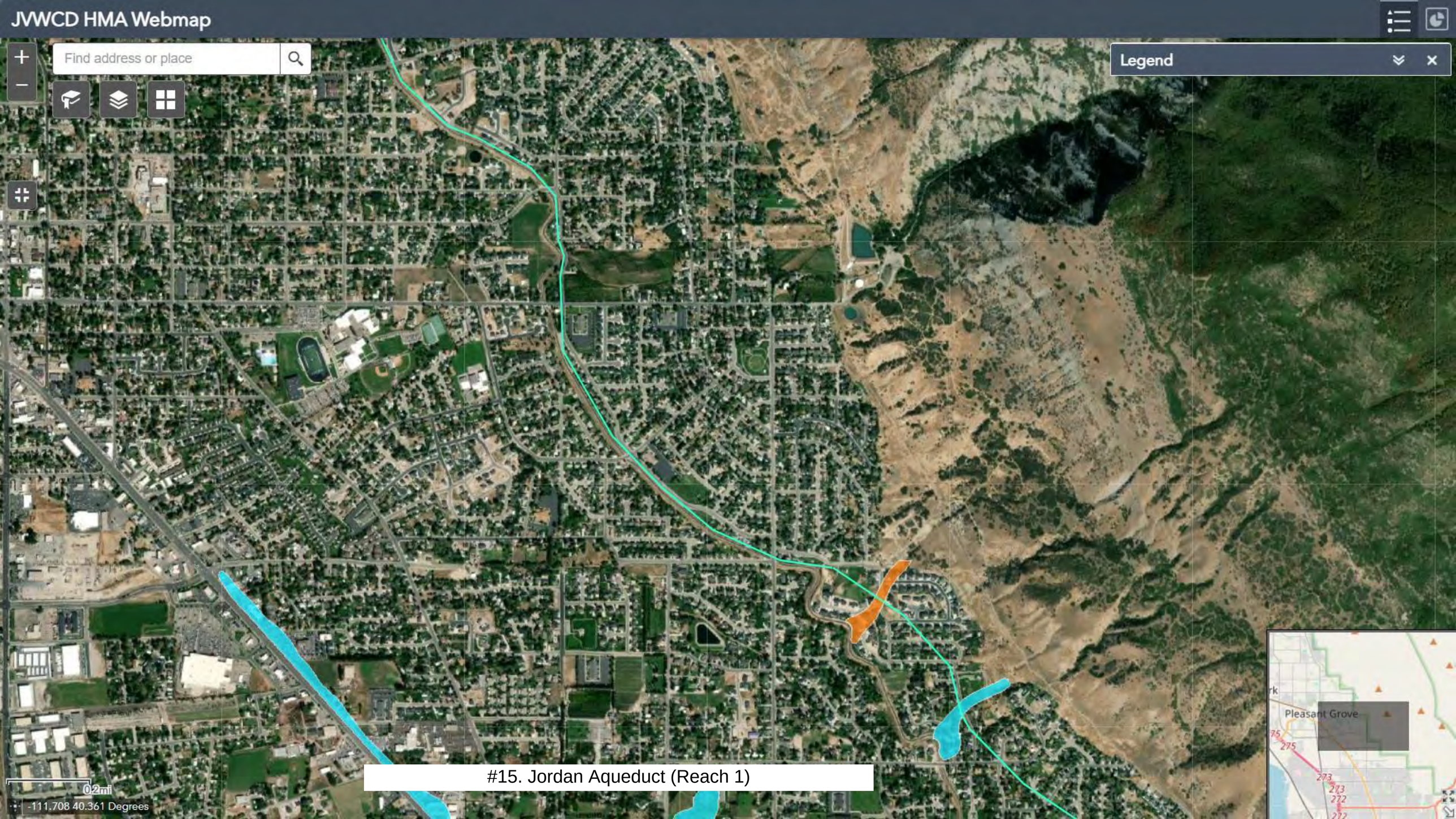
#13. Pump Station serving Zone B North (3200 W. 6200 S.)



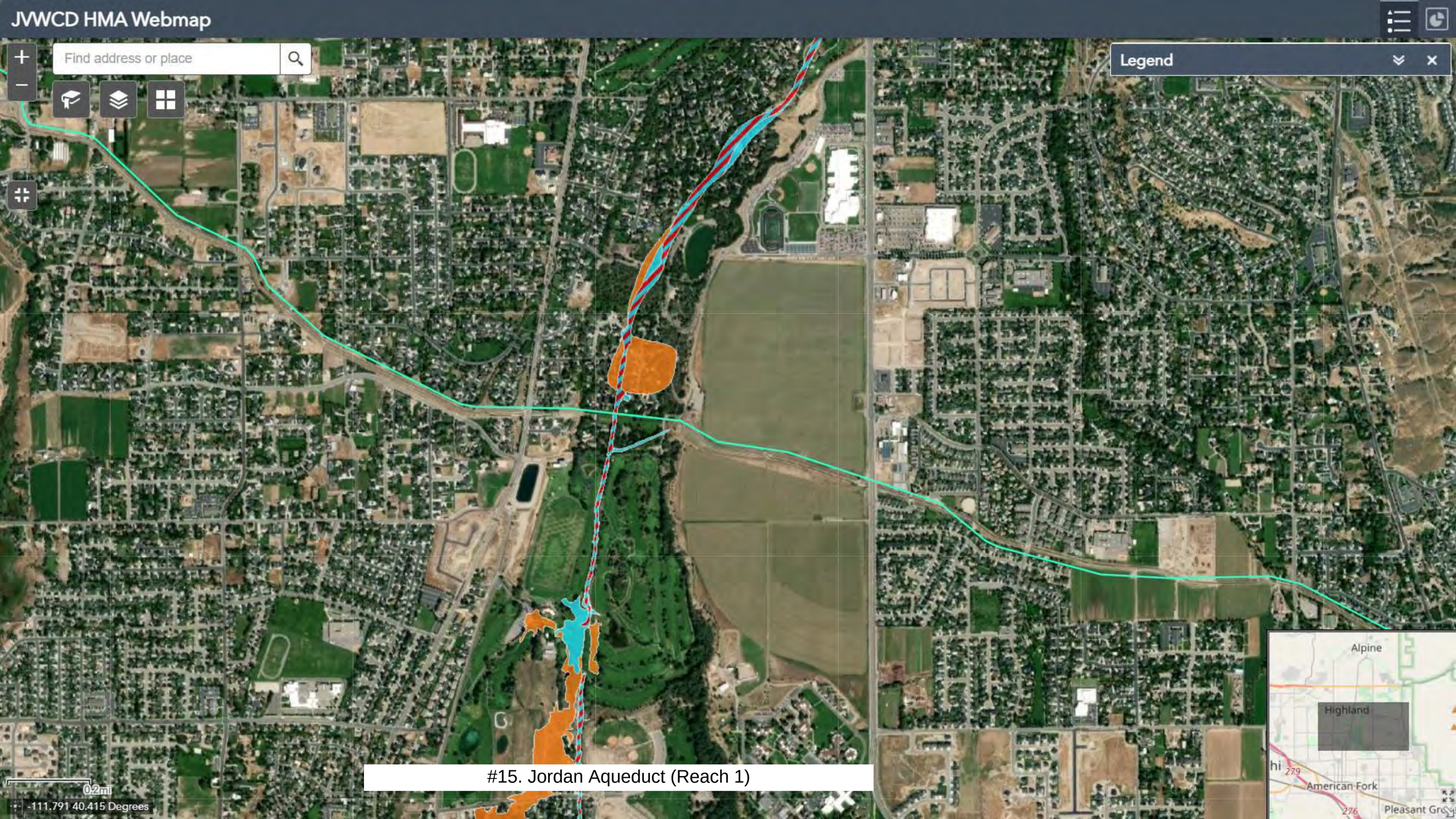
#14. Old Bingham Pump Station at 6920 W



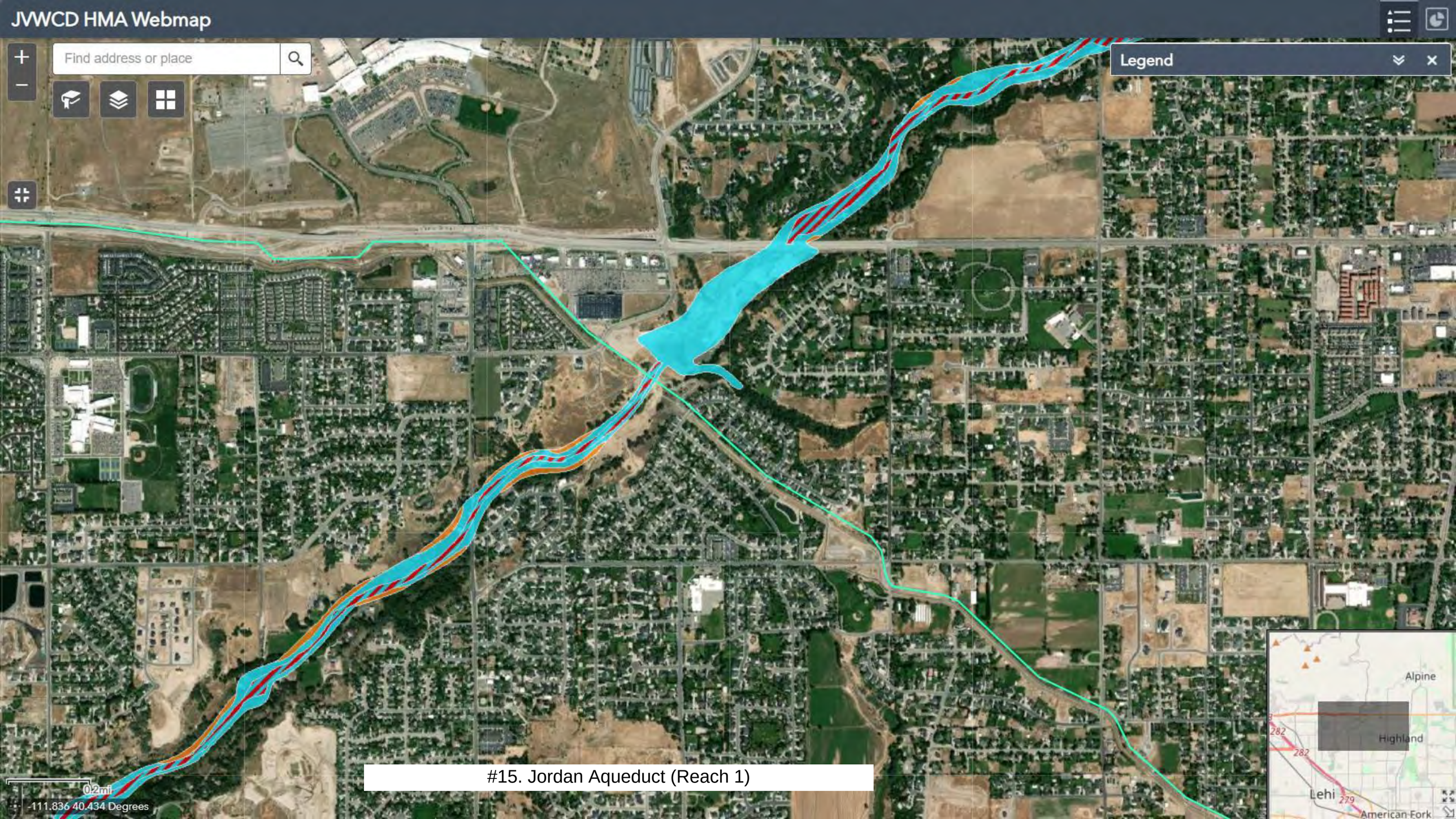
#15. Jordan Aqueduct (Reach 1)



#15. Jordan Aqueduct (Reach 1)

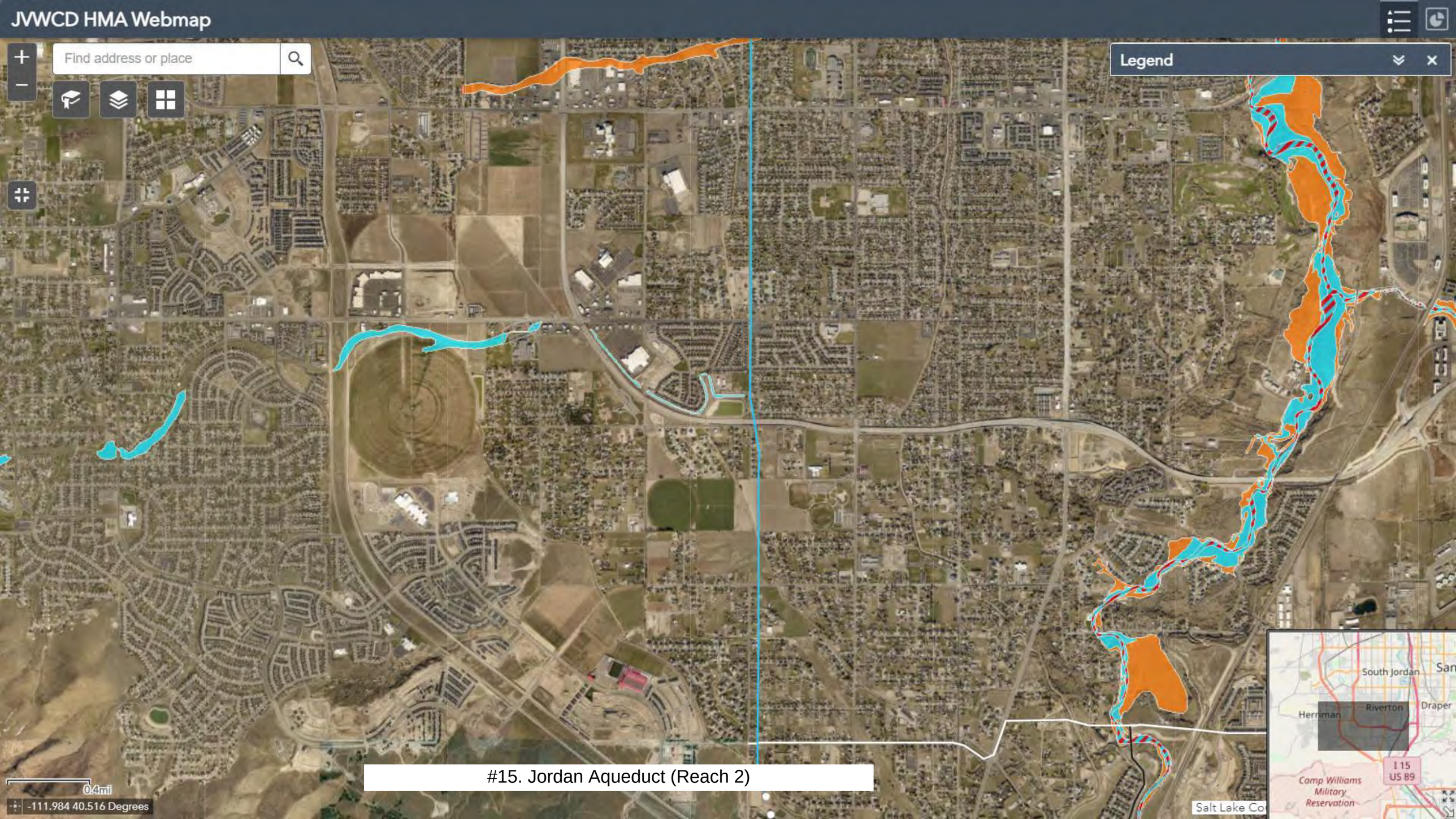


#15. Jordan Aqueduct (Reach 1)

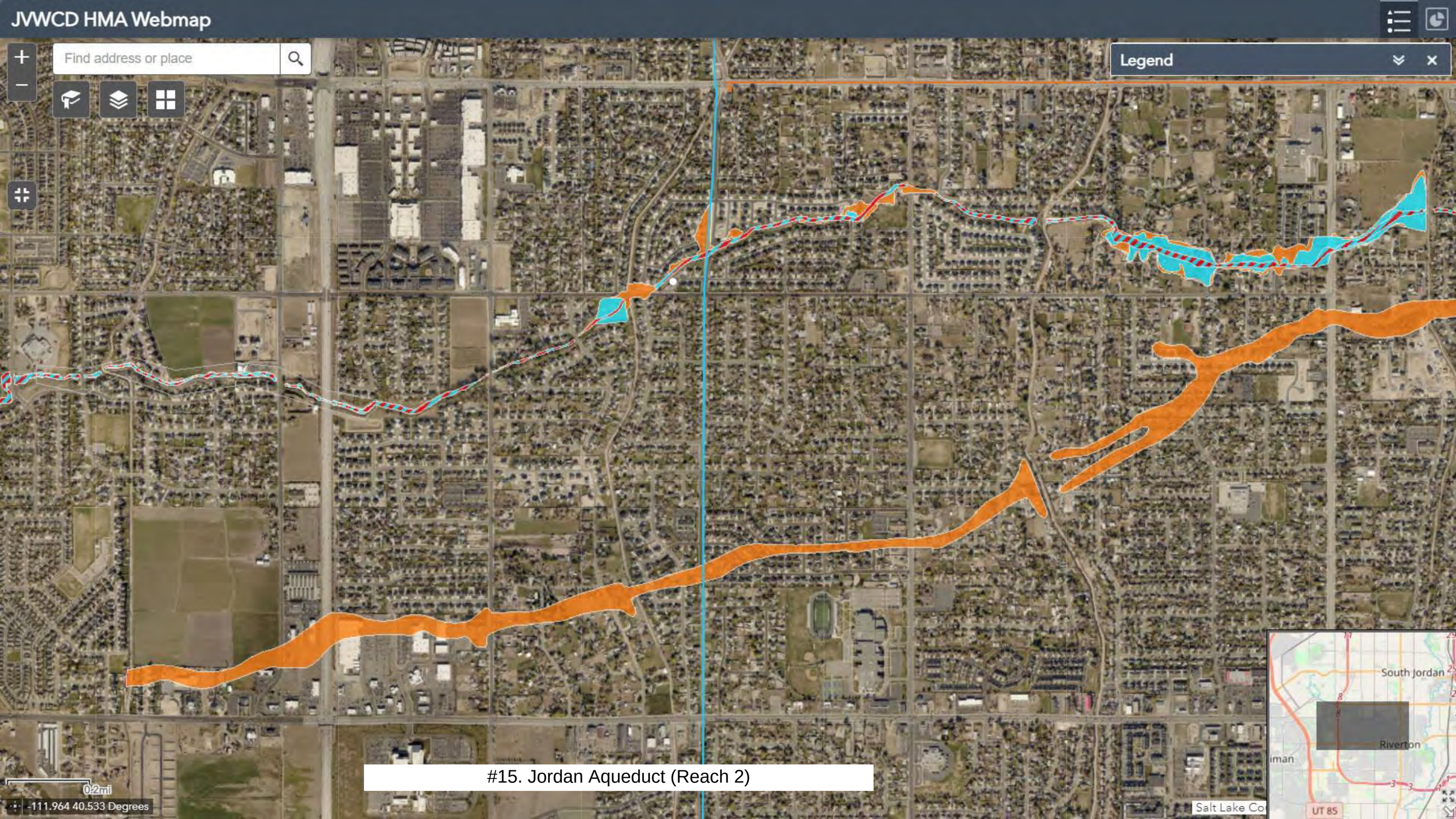


#15. Jordan Aqueduct (Reach 1)

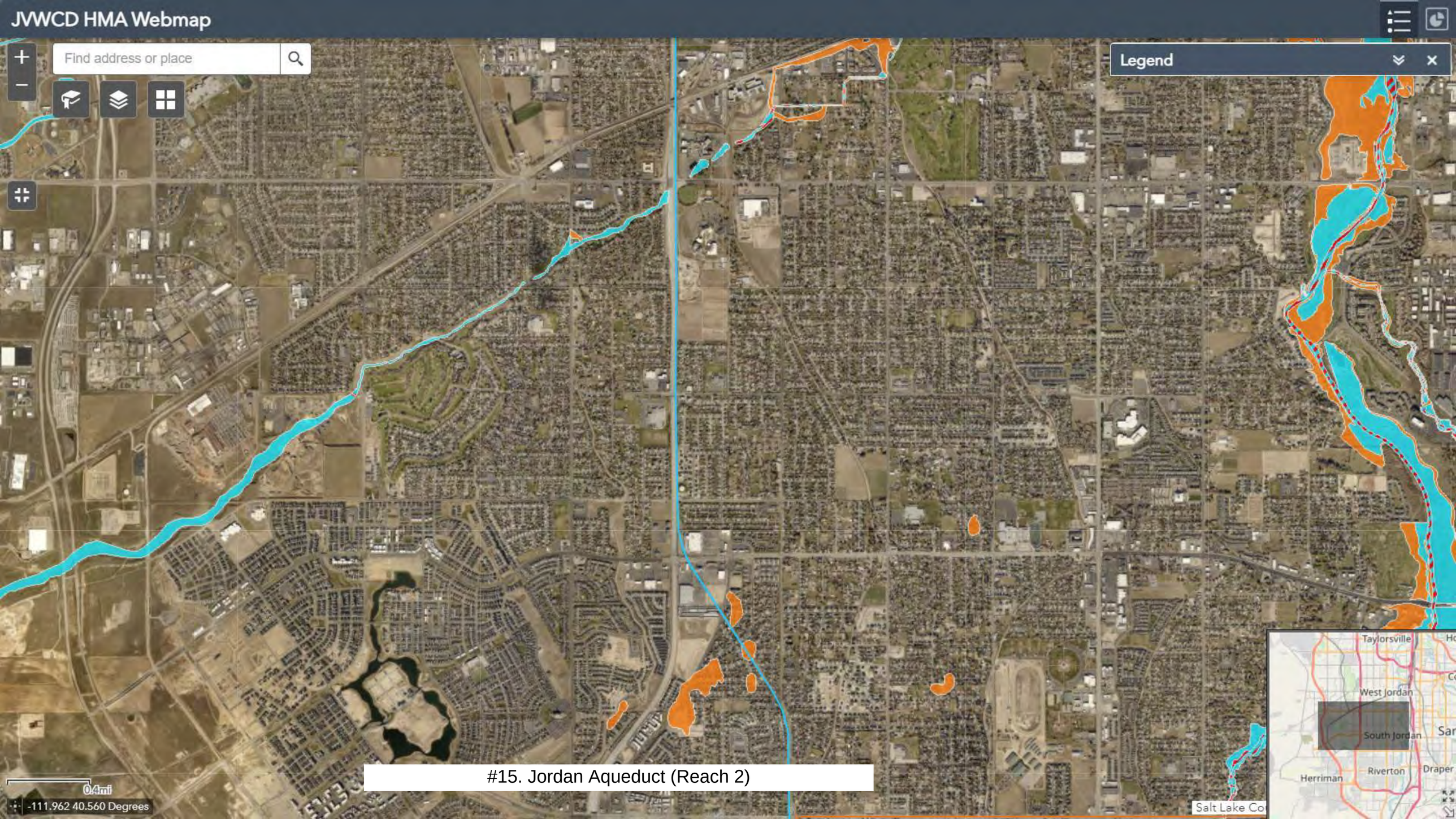
#15. Jordan Aqueduct (Reach 4)



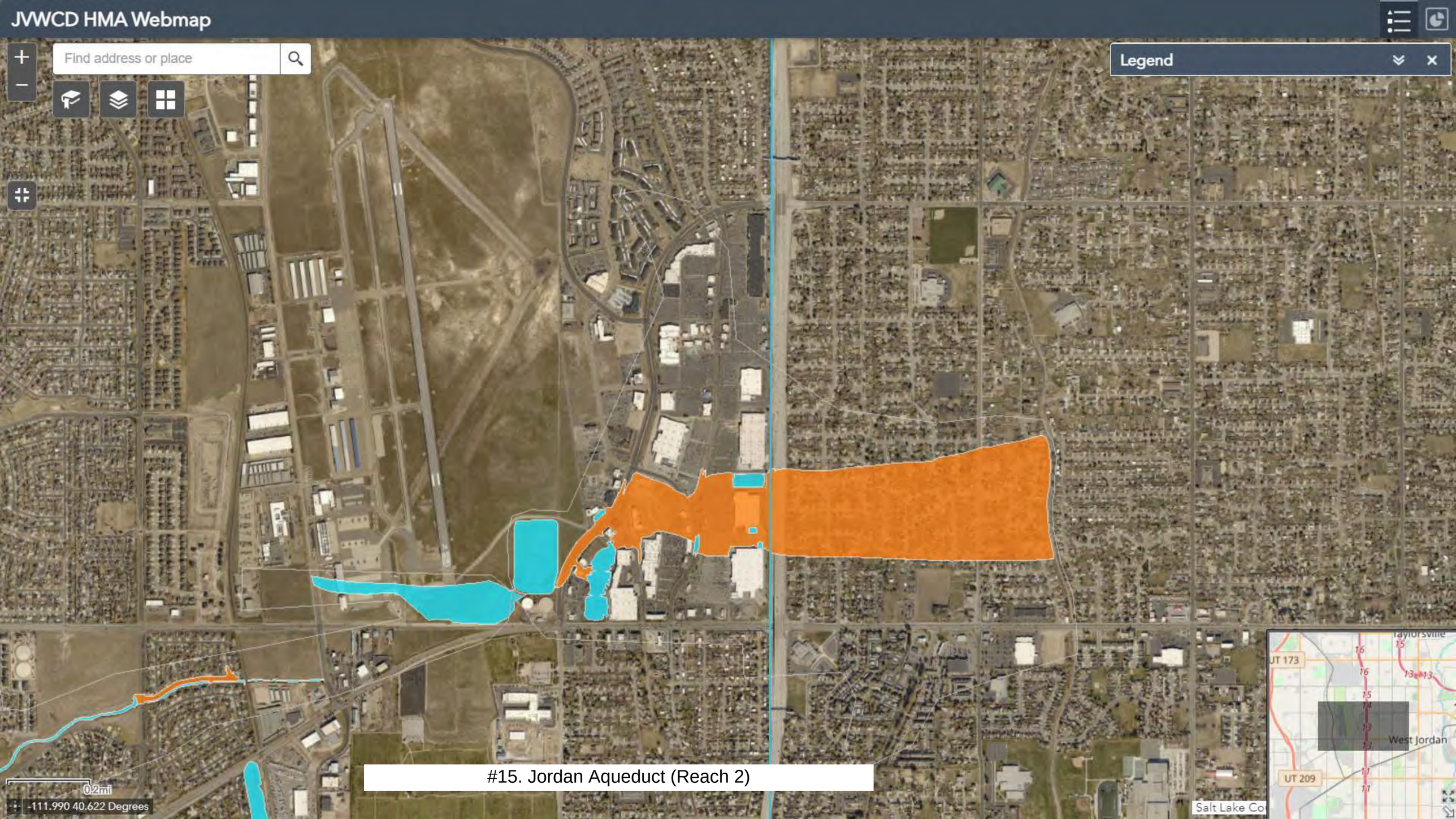
#15. Jordan Aqueduct (Reach 2)



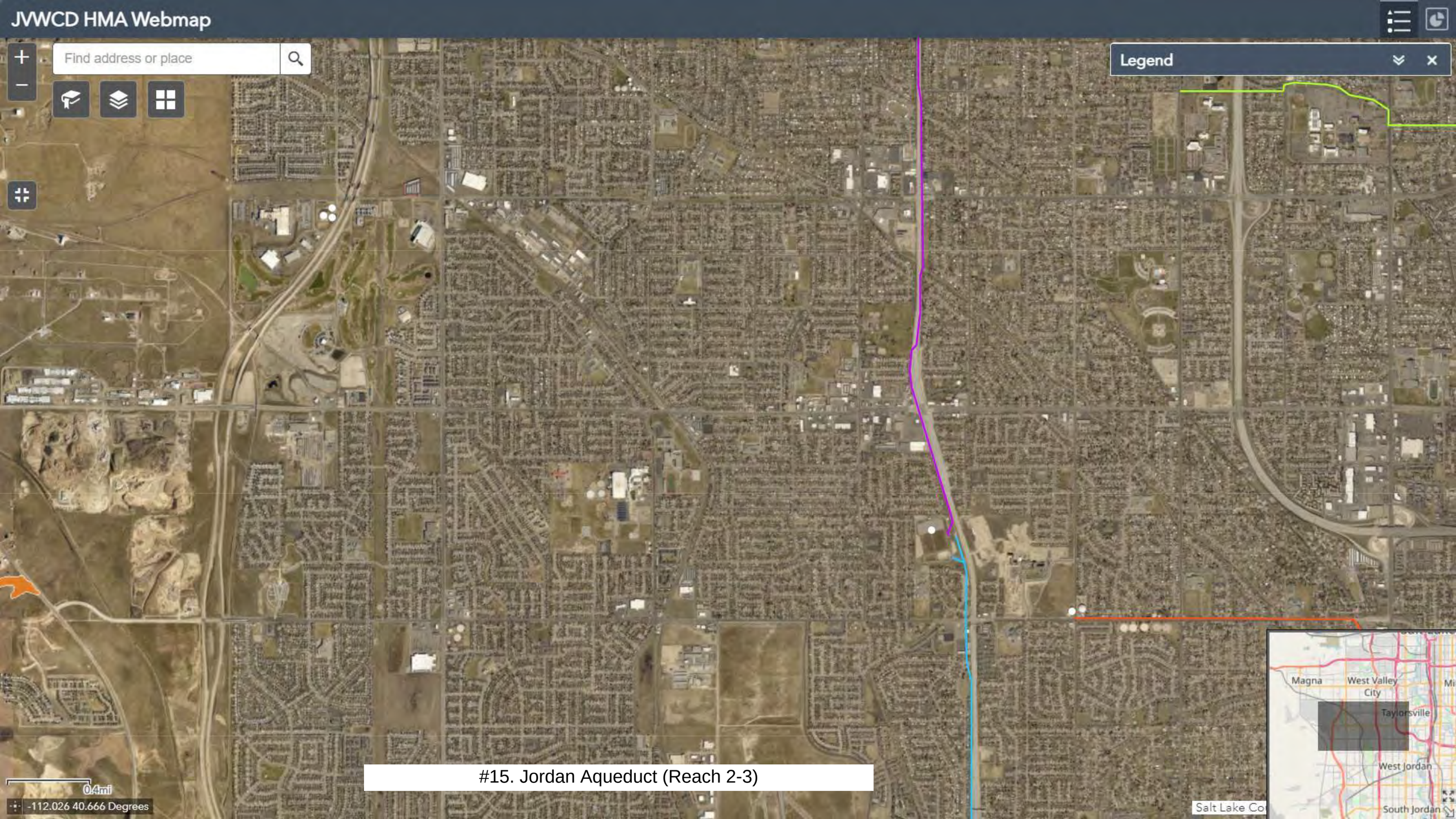
#15. Jordan Aqueduct (Reach 2)



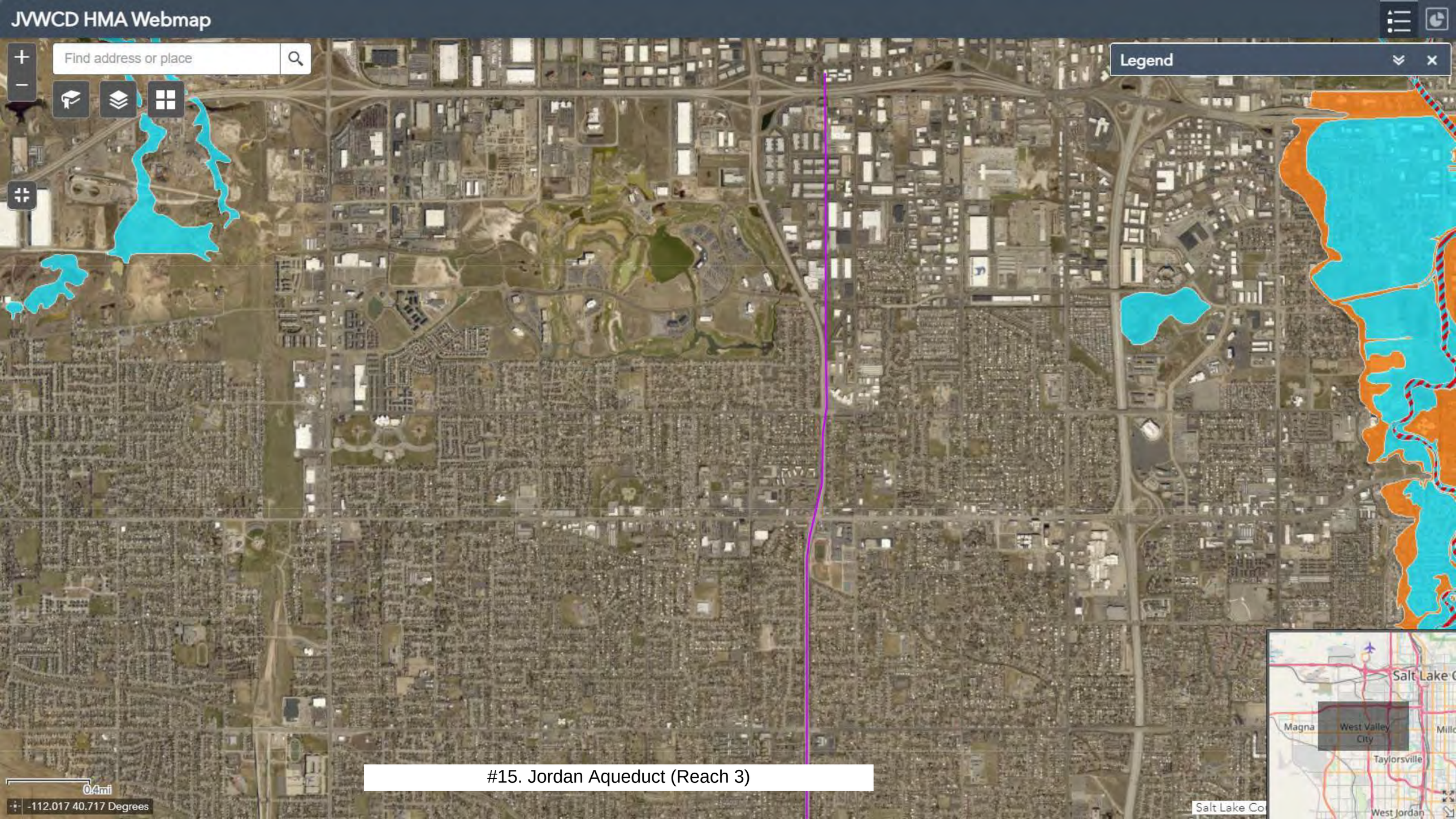
#15. Jordan Aqueduct (Reach 2)



#15. Jordan Aqueduct (Reach 2)

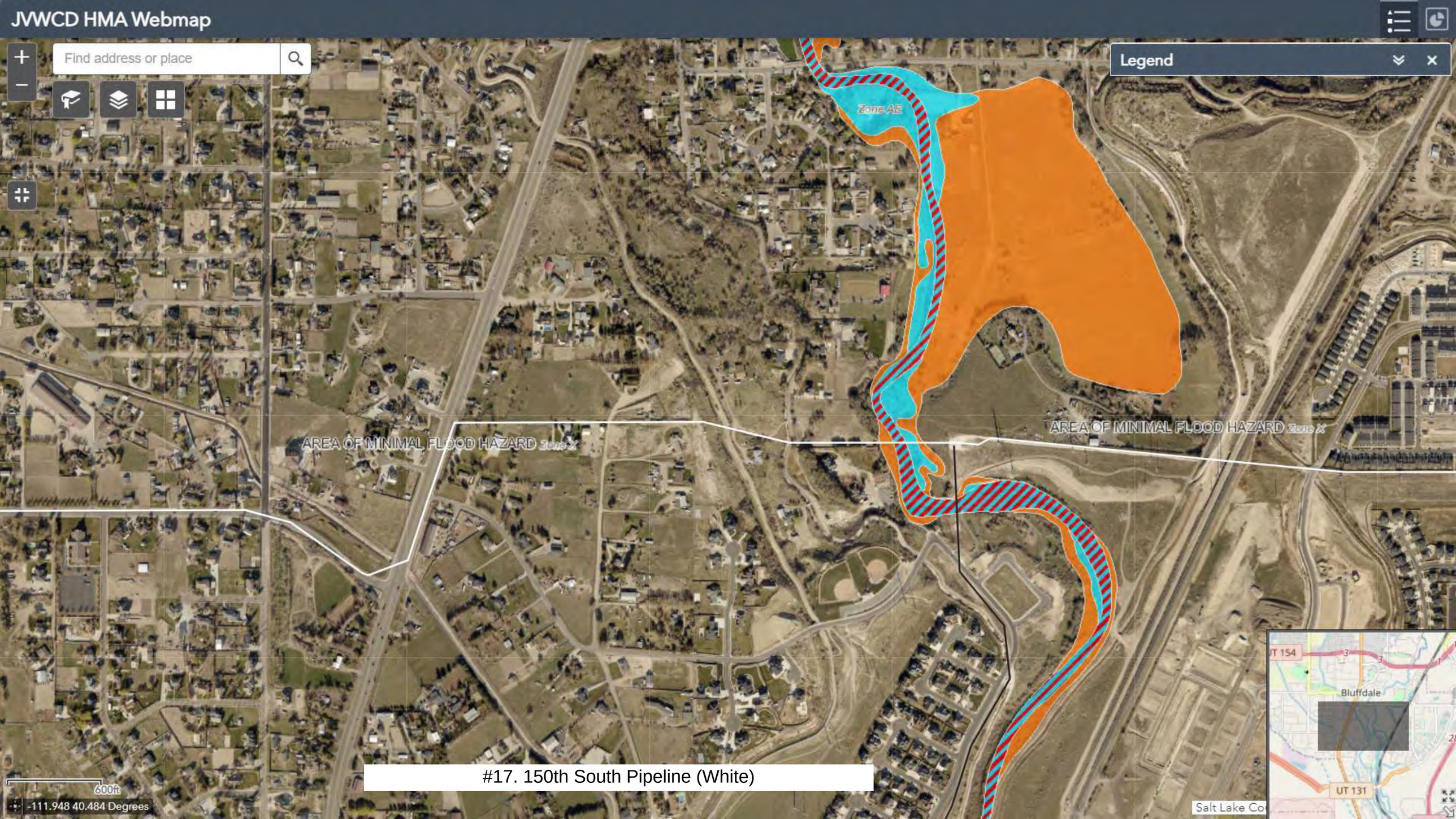


#15. Jordan Aqueduct (Reach 2-3)

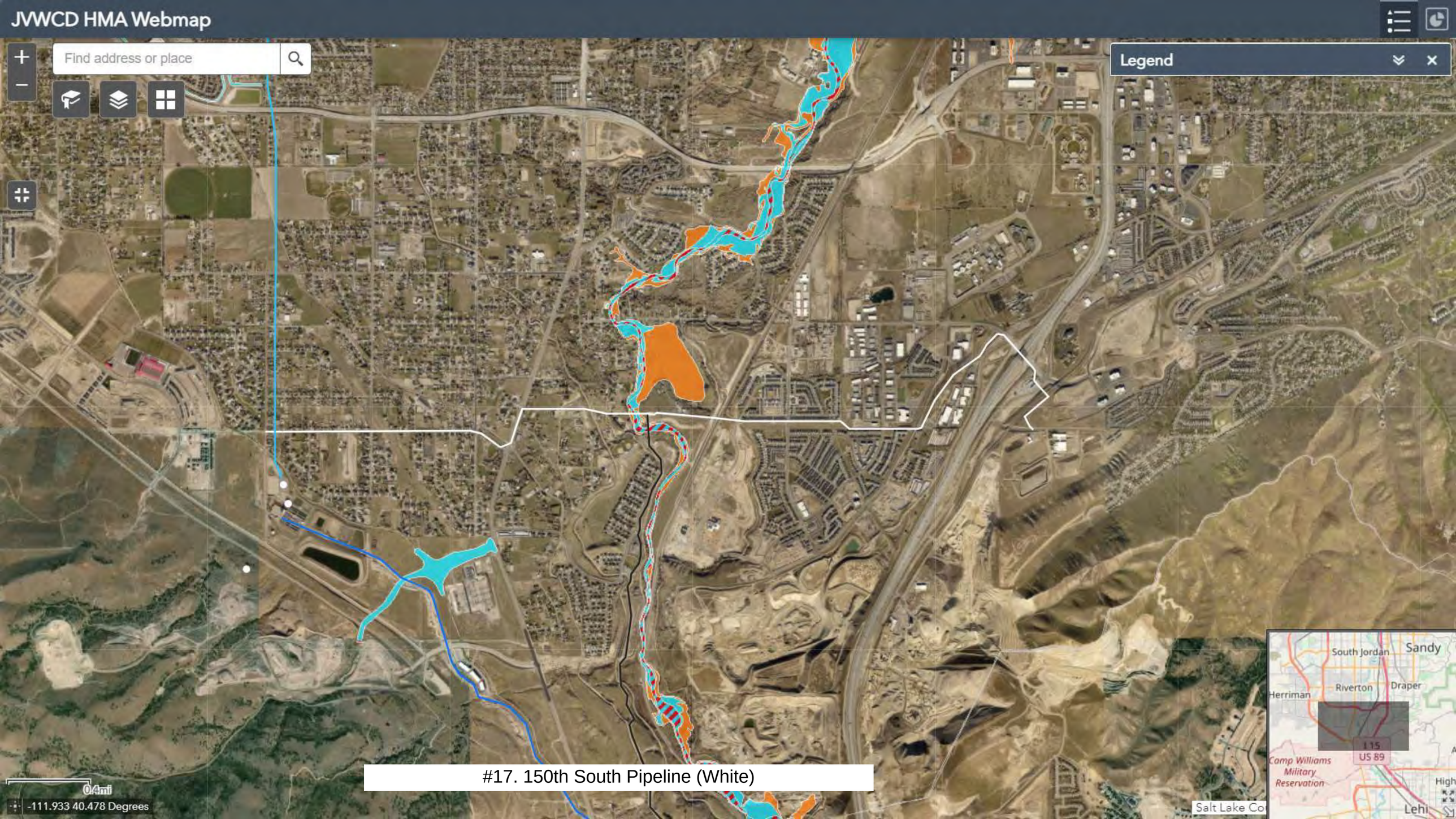


#15. Jordan Aqueduct (Reach 3)

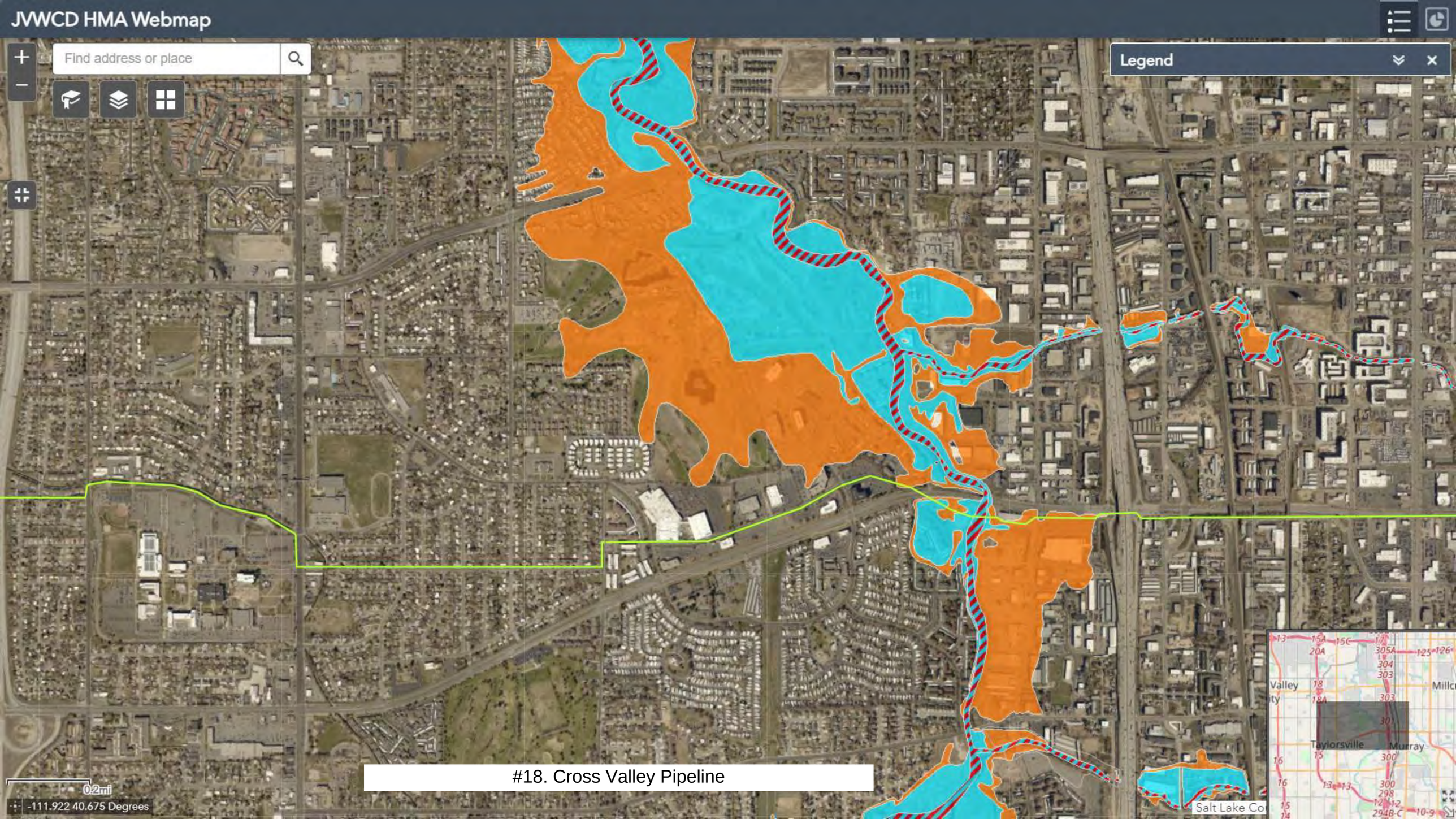
#16. Central Pipeline (Black)



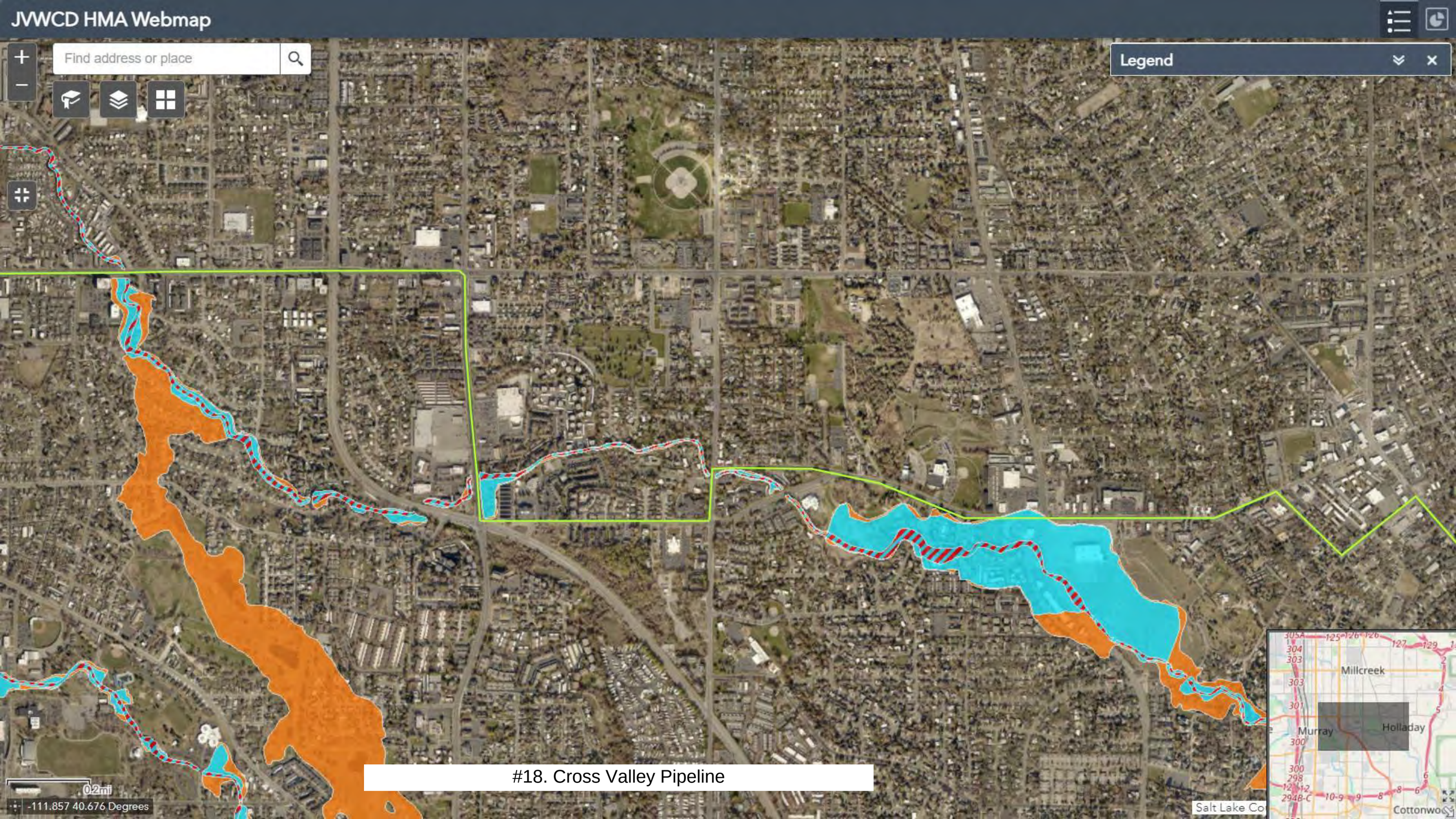
#17. 150th South Pipeline (White)



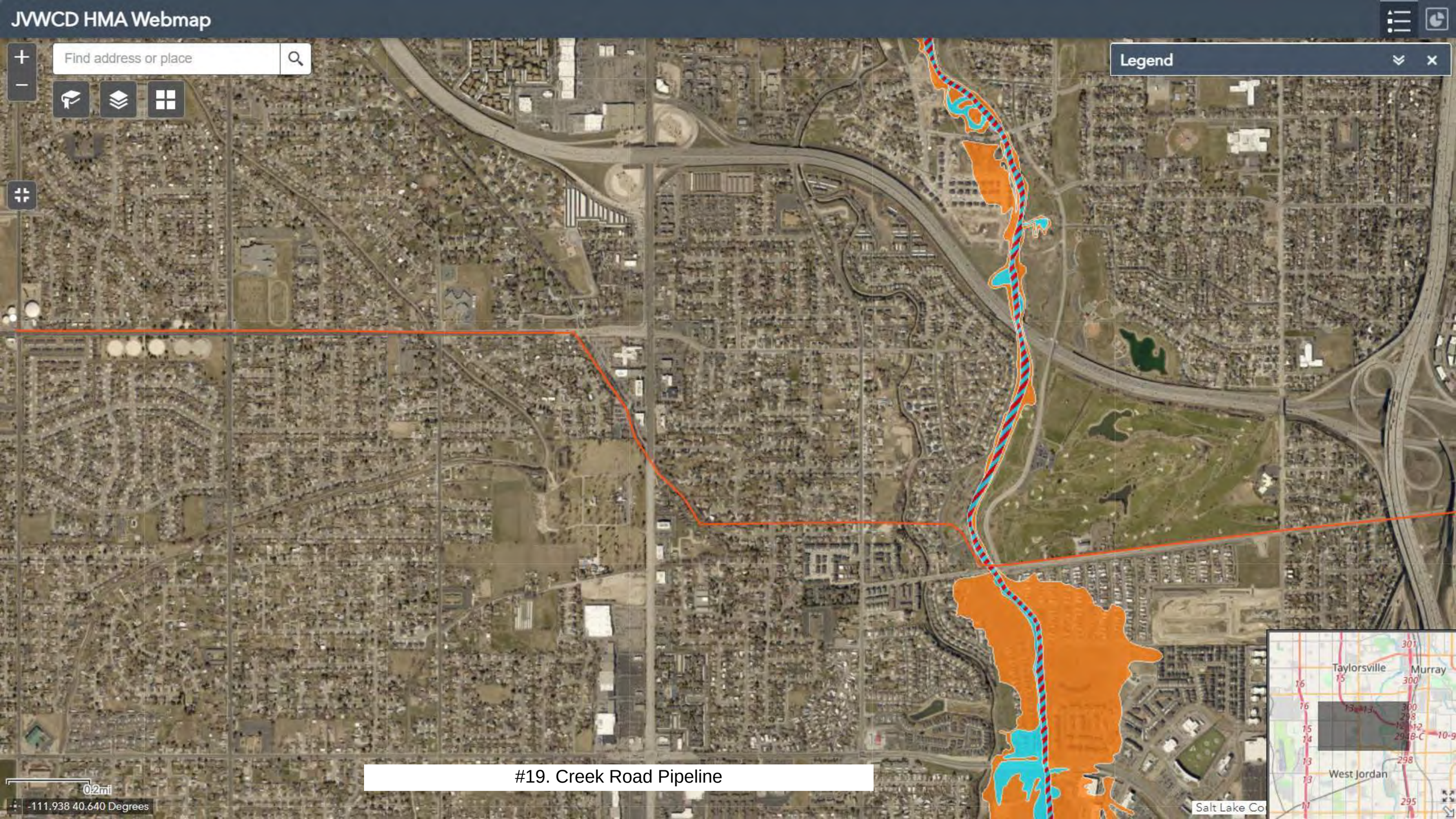
#17. 150th South Pipeline (White)



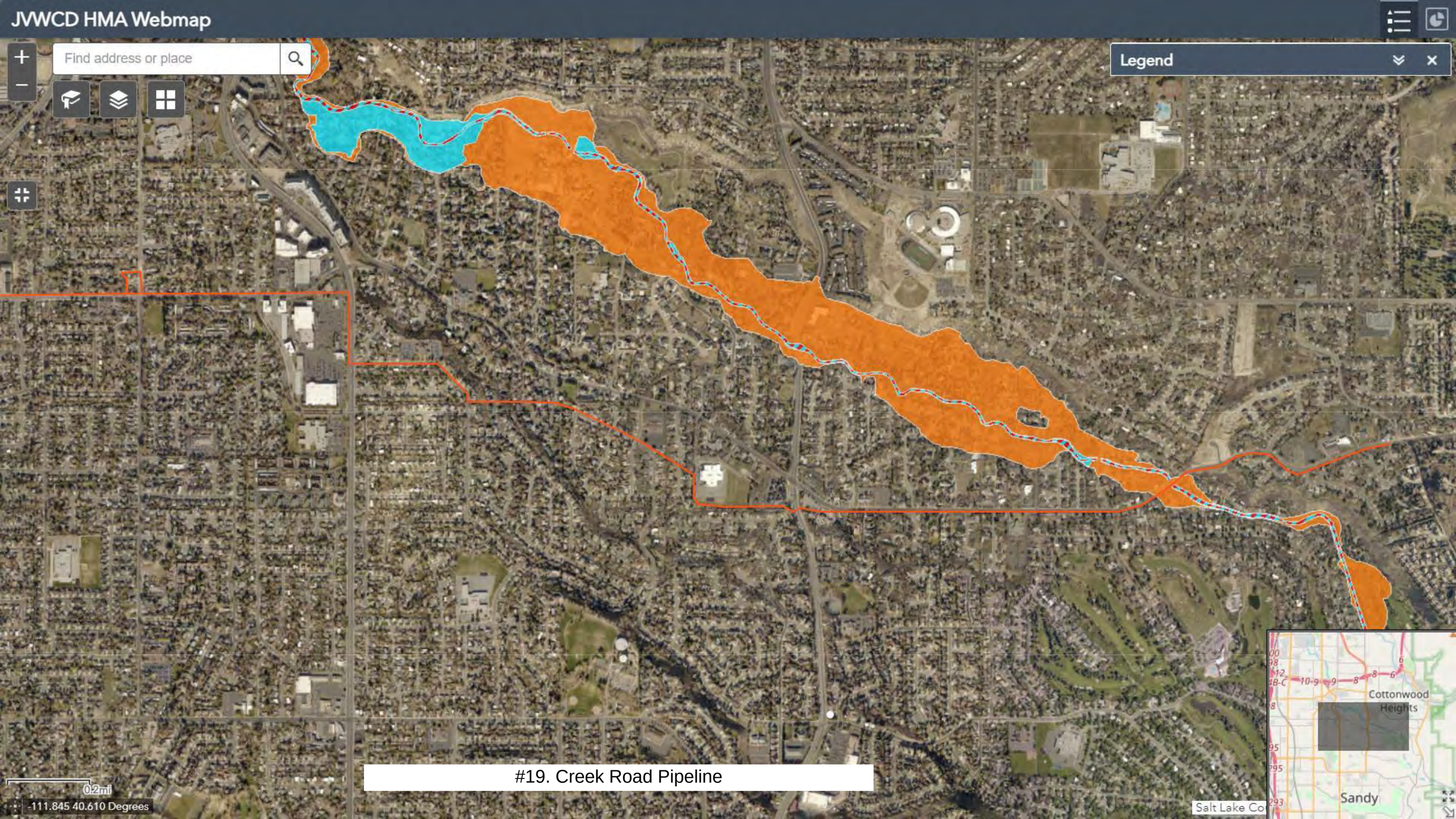
#18. Cross Valley Pipeline



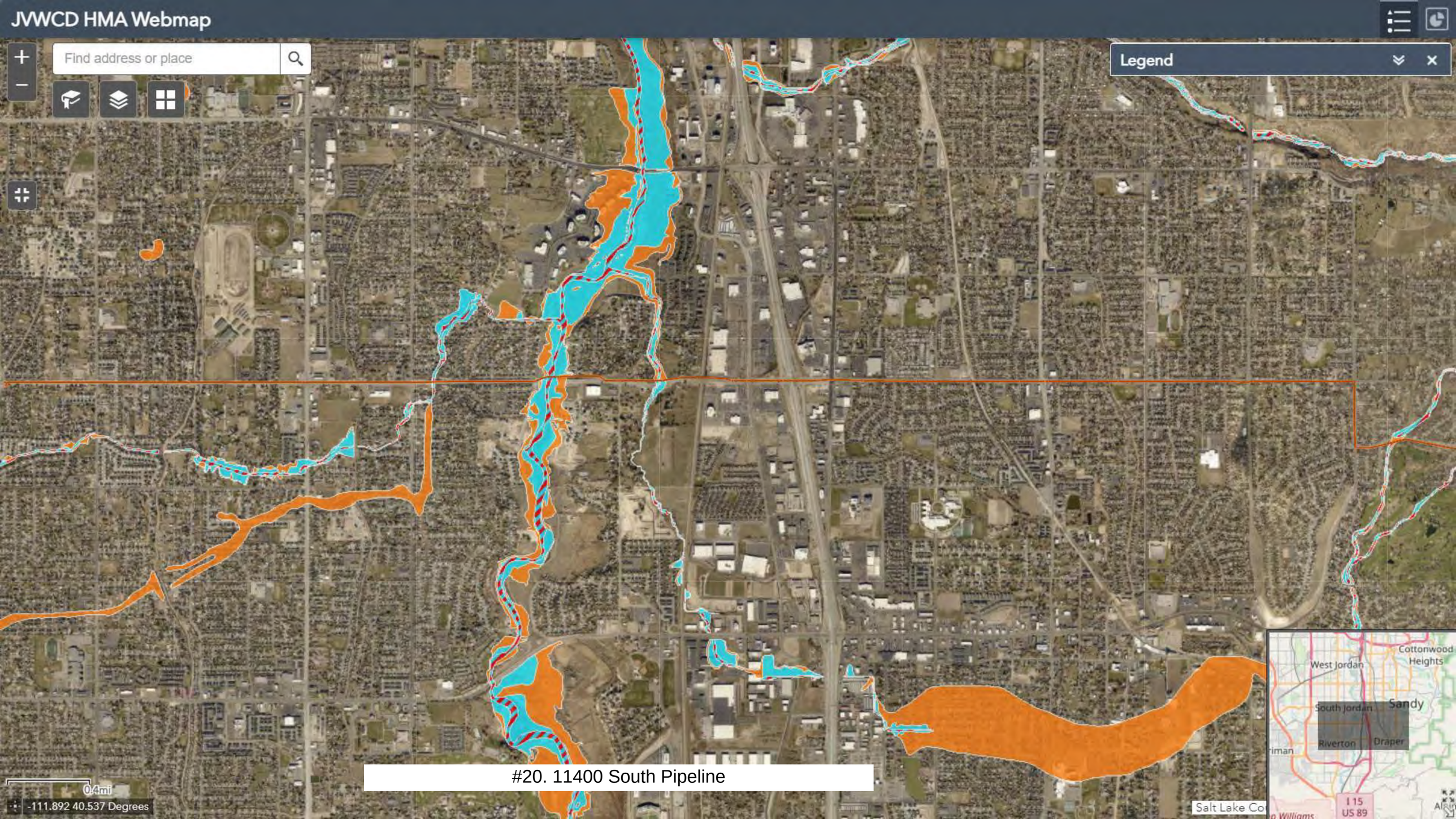
#18. Cross Valley Pipeline



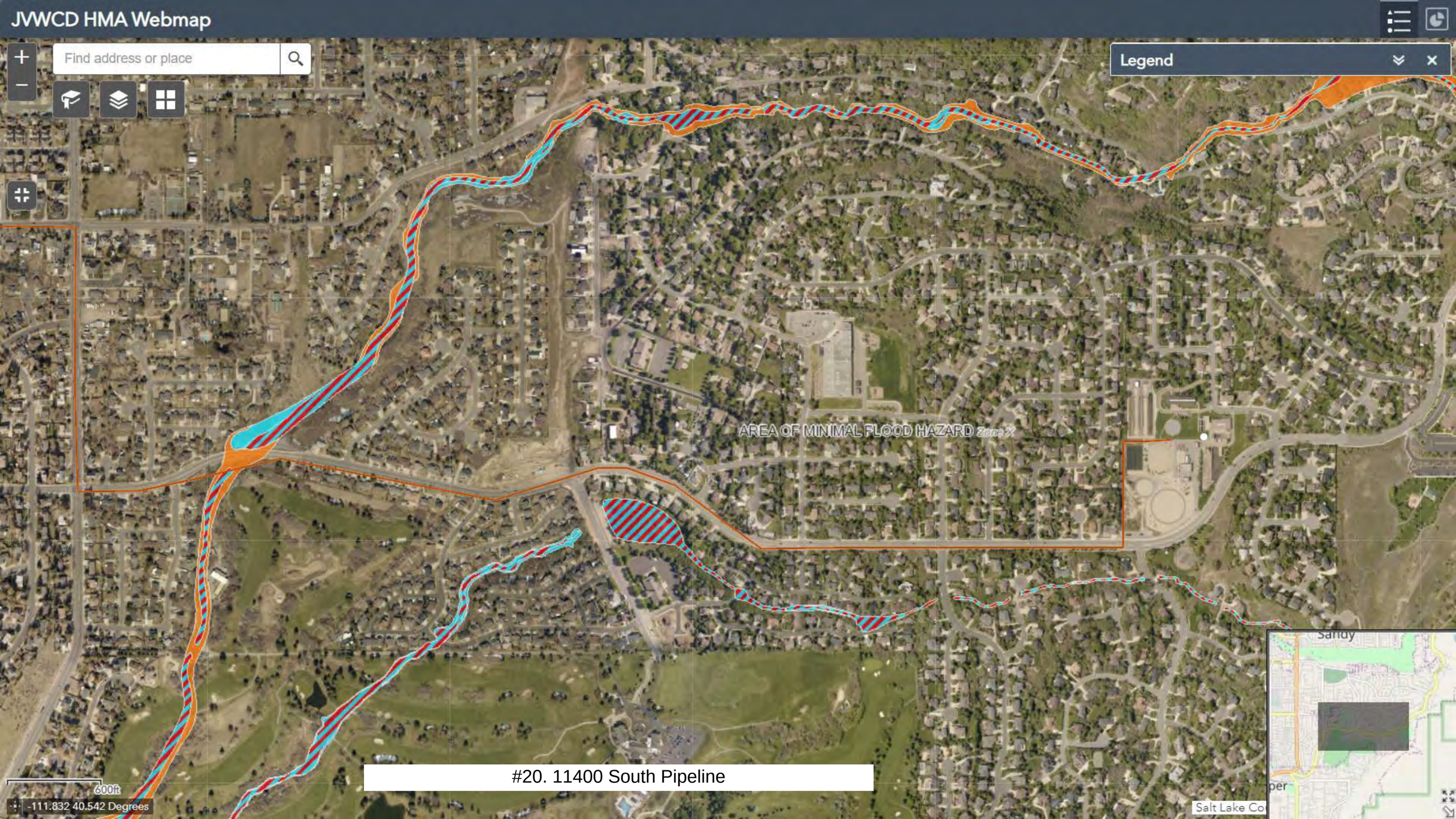
#19. Creek Road Pipeline



#19. Creek Road Pipeline



#20. 11400 South Pipeline



#20. 11400 South Pipeline

Appendix B: Stakeholder Participation Documentation

1_Stakeholder Mailing List
2_Stakeholder Meeting Invitation Letters
- Meeting 1 Email and Letter examples
- Meeting 2 Email and Letter examples
- Meeting 3 Email and Letter examples
- Meeting 4 Email and Letter examples

3_Stakeholder Meeting Agendas
- Stakeholder Meeting 1 Agenda_2021 0406
- Stakeholder Meeting 2 Agenda_2021 0608
- Stakeholder Meeting 3 Agenda_2021 0720
- Stakeholder Meeting 4 Agenda_2021 0902

4_Stakeholder Meeting Sign-in Sheets
- Stakeholder Meeting 1_Sign-in Sheet_2021 0406
- Stakeholder Meeting 2_Sign-in Sheet_2021 0608
- Stakeholder Meeting 3_Sign-in Sheet_2021_0720

5_Stakeholder Meeting #1 Questionnaire/Comment Sheets
- Stakeholder Questionnaire-Comment Sheet_Blank
- Stakeholder Questionnaire_Dan McDougal_TBID
- Stakeholder Questionnaire_Emily Alvarez_FEMA
- Stakeholder Questionnaire_Greg Anderson_KID
- Stakeholder Questionnaire_Quincy Bahr_Forest Service
- Stakeholder Questionnaire_Raymond Garrison_South Jordan City
- Stakeholder Questionnaire_T.JonesW.Skinner_RMP
- Stakeholder Comment_Steve Bowman_Utah Geological Survey

6_Stakeholder Meeting #2 Surveys
- Stakeholder Survey_Aaron Sainsbury_City of South Jordan
- Stakeholder Survey_Keith Ludwig_Midvale City
- Stakeholder Survey_Wade Tuft_ULWVA

JVWCD HMP Project - Stakeholders List

Stakeholder Organization	Name/Position Title	Email	Phone Number
Wholesale Member Agencies			
City of Bluffdale	Michael Fazio/City Engineer	mfazio@bluffdale.com	801-849-9430
Draper City	Brien Maxfield/Senior Engineer Manager	Brien.maxfield@draper.ut.us	801-576-6326
Granger-Hunter Improvement District	Todd Marti/Assistant General Manager Troy Stout/Assistant General Manager	t.marti@ghid.org	801-968-3551
Herriman City	Justun Edwards/Public Works Director	jedwards@herriman.org	801-446-5323
Hexcel Corporation	Jared Carling/Environmental Engineer	Jared.carling@hexcel.com	801-508-8583
Kearns Improvement District	Greg Anderson/Public Works Director Pam Gill/General Manager	ganderson@kearnsid.org pgill@kearnsid.org	801-968-1011 801-968-1011
Magna Water District	Trevor Andra/District Engineer	trevor@magnawater.com	801-250-6279
Midvale City	Keith Ludwig/City Engineer Curtis Nielsen/Public Utilities Manager	ludwigk@midvale.com	801-256-2574
Riverton City	Dan Woodbury/Water Engineer Stacie Olson/Water & Storm Water Manager Trace Robinson/Public Works Director Kal McDonald/Lead Operator	dwoodbury@rivertonutah.gov solson@rivertonutah.gov	801-208-3169 801-208-3187 Office 801-558-3088 Cell
City of South Jordan	Ray Garrison/Associate Public Works Director	rgarrison@sjc.utah.gov	801-253-5203

City of South Salt Lake	Dennis Pay/City Engineer Chris Merket/Staff Engineer	dpay@southsaltlakecity.com	801-483-6038
Taylorsville-Bennion Improvement District	Dan McDougal/Director Risk & Asset Management	Dan McDougal danmcdougal@tbid.org	801-968-9081

Utah Department of Corrections	Shawn Anderson/Bureau Director Facilities	shawnanderson@utah.gov	801-545-5500
WaterPro, Inc.	David Gardner/Assistant General Manager Jerry Nielson/Plant Manager	gardner@waterpro.net	801-571-2232
City of West Jordan	Nate Nelson/City Engineer	Nate.nelson@westjordan.utah.gov	801-569-5100
White City Water Improvement District	Ryan Johnson/Operations Manager	rjohnson@wcwid.org	801-571-3991
Retail Service & Local Jurisdictions			
Holladay City	Jared Bunch/City Engineer	jbunch@forsgren.com	801-272-9450
Murray City	Danny Astill/Public Works Director Joe Goodman/Water Distribution Supervisor	dastill@murray.utah.gov jgoodman@murray.utah.gov	801-270-2440 801-270-2458 Office 801-712-9382 Cell
Sandy City	Tom Ward, Director of Public Works	Utilities@sandy.utah.gov	801-568-7280
South Salt Lake	Dennis Pay/City Engineer	dpay@southsaltlakecity.com	801-483-6038
Greater Salt Lake Municipal Services District or Salt Lake County Public Works?	(Jake Young is already under SL County, so remove from here and replace w/GSLMWD or SL County Public Works?)		
County or Regional Agency			
Metropolitan Water District of SL & Sandy	Wayne Winsor/Assistant General Manager Ammon Allen/Engineering Supervisor	winsor@mwdsls.org allen@mwdsls.org	801-942-1391 801-942-9687
Salt Lake County Emergency Management/Unified Fire Authority	Clint S. Mecham/Director/Battalion Chief	cmecham@unifiedfire.org	801-743-7103

Mountainland Association of Governments	Shauna Mecham/Planner	smecham@mountainland.org	801-229-3838
Salt Lake County	Jake Young/Planning Program Manager	jayoung@slco.org	385-468-4859
Utah Lake Water Users Association[3]	Wade Tuft/Board Vice Chair	wadet@jvwcd.org	801-565-2000
State Agency			
Utah Division of Emergency Management	Bob Carey/Natural Hazards Bureau Chief Eric Martineau/Mitigation Planner	bcarey@utah.gov emartineau@utah.gov	435-841-4393 801-946-4002
Utah Division of Drinking Water	Pete Keers/Environmental Scientist and ESF#3 State EOC	pkeers@utah.gov	385-271-7045
Utah Division of Water Rights	Dave Marble/Assistant Utah State Engineer Everett Taylor/Assistant Utah State Engineer?	DaveMarble@utah.gov	801-538-7376
Utah Geological Survey	Steve Bowman/Geologic Hazard Program Manager[1] Rich Giraud/Senior Geologist[2]	SteveBowman@utah.gov RichardGiraud@utah.gov	801-537-3304 801-573-3351
Utah Division of Forestry, Fire & State Lands	Julie Murphy/Wildfire Risk Reduction Coordinator Laura Ault/Utah Shared Stewardship Coordinator	JulieMurphy@utah.gov lauraault@utah.gov	385-228-6439 801.550.7754
Federal Agency			
U.S. Bureau of Reclamation	Gary Henrie	ghenrie@usbr.gov	801-379-1097

U.S. Forest Service - Intermountain Region	Tyler Ashcroft/ Shared Stewardship Coordinator Quincy Barr/ Utah State Liaison Forest Service Intermountain Region	tyler.ashcroft@usda.gov quincy.bahr@usda.gov	801-625-5354 office 801-698-3857 cell 801-518-1479 cell
FEMA – Region VIII	Emily Alvarez/Community Planner	Emily.Alvarez@FEMA.DHS.gov	720-292-8702
Other			
Rocky Mountain Power	Travis Jones/Regional Business Manager Wade Skinner/Disaster Risk Manager	Travis.jones@rockymountainpower.net	801-220-7230
Dominion Energy	Ted F. Campbell/Lead Engineering Project Manager	ted.campbell@dominionenergy.com	

Notes:

1. Wrote majority of Geological Hazards Chapter in State of Utah HMP (2019)
2. State's Landslide expert.
3. Represents Canals
4. Red font text is used for Stakeholders added based on their attendance of Stakeholder Mtg#1 with potential need for their contact information. (Remove this Note, once all of the new contacts have been added and red font text changed to black?)

Ellisa Demetsky

From: Ellisa Demetsky
Sent: Wednesday, March 31, 2021 2:22 PM
To: 'Travis.jones@rockymountainpower.net'
Subject: Stakeholder Meeting #1 – JVWCD Hazard Mitigation Plan Project

Travis Jones, Regional Business Manager
Rocky Mountain Power
Travis.jones@rockymountainpower.net

Subject: Stakeholder Meeting #1 – JVWCD Hazard Mitigation Plan Project

Dear Mr. Jones,

Your firm, agency, or municipal entity has been identified as possibly having an interest in the hazard mitigation planning of the Jordan Valley Water Conservancy District (JVWCD). JVWCD is currently in the process of developing a new Hazard Mitigation Plan (HMP) to assess the risk of the District's facilities against natural hazards and develop mitigation strategies to reduce the risk. You or your designee are invited to attend JVWCD's first stakeholder meeting to be held on Tuesday, April 6, 2021 from 9:00 am to 11:00 am Virtually on Zoom at the following link:

Join Zoom Meeting https://us02web.zoom.us/j/83404506705?pwd=VWlod0NUWnhJcDlsK252U1VpUVhEZz09
Meeting ID: 834 0450 6705
Passcode: 334435
Phone: 669 900 6833

We will report on the previous 2004 Plan including hazard mitigation projects completed as well as our scope of the new HMP we are currently developing in 2021. We will also present the results of the new Plan's Phase A Planning Process with the planning activities accomplished to date.

We would appreciate participation by you or your designee in our planning efforts and look forward to seeing you at the stakeholder meeting (virtually on Zoom). We also plan on holding a stakeholder meeting at or near the completion of each of the remaining three phases of the planning process.

If you have any questions, please call Marcelo Anglade, Project Manager at our office, 801-565-4300.

Sincerely,

Alan Packard, PE
Assistant General Manager

JORDAN VALLEY WATER
CONSERVANCY DISTRICT

Delivering Quality Every Day

8215 South 1300 West • West Jordan, UT 84088 • Ph: 801.565.4300 • www.jvwcd.org

Barton A. Forsyth, *General Manager/CEO*
Alan E. Packard, *Assistant General Manager, Chief Engineer*
Shazelle Terry, *Assistant General Manager, Operations*
Matthew D. Olsen, *Assistant General Manager, Communications/Technology*

March 30, 2021

Wade Tuft, Board Member
Utah Lake Water Users Association
8215 S 1300 W
West Jordan, UT 84088

Subject: ***Stakeholder Meeting #1 – JVWCD Hazard Mitigation Plan Project***

Dear Mr. Tuft,

Your firm, agency, or municipal entity has been identified as possibly having an interest in the hazard mitigation planning of the Jordan Valley Water Conservancy District (JVWCD). JVWCD is currently in the process of developing a new Hazard Mitigation Plan (HMP) to assess the risk of the District's facilities against natural hazards and develop mitigation strategies to reduce the risk. You or your designee are invited to attend JVWCD's first stakeholder meeting to be held on Tuesday, April 6, 2021 from 9:00 am to 11:00 am Virtually on Zoom at the following link:

Join Zoom Meeting https://us02web.zoom.us/j/83404506705?pwd=VWlod0NUWnhJcDlsK252U1VpUVhEZz09
Meeting ID: 834 0450 6705
Passcode: 334435
Phone: 669 900 6833

We will report on the previous 2004 Plan including hazard mitigation projects completed as well as our scope of the new HMP we are currently developing in 2021. We will also present the results of the new Plan's Phase A Planning Process with the planning activities accomplished to date.

We would appreciate participation by you or your designee in our planning efforts and look forward to seeing you at the stakeholder meeting (virtually on Zoom). We also plan on holding a stakeholder meeting at or near the completion of each of the remaining three phases of the planning process.

If you have any questions, please call Marcelo Anglade, Project Manager at our office, 801-565-4300.

Sincerely,

Alan Packard, PE
Assistant General Manager

Ellisa Demetsky

From: Ellisa Demetsky
Sent: Wednesday, May 5, 2021 1:35 PM
To: 'winsor@mwdsls.org'
Subject: Stakeholder Meeting #2 – JVWCD Hazard Mitigation Plan Project
Attachments: Wayne Winsor PE, Assistant General Manager.pdf

JORDAN VALLEY WATER
CONSERVANCY DISTRICT
Delivering Quality Every Day

Wayne Winsor PE, Assistant General Manager
Metropolitan Water District of SL & Sandy
3430 E Danish Rd
Cottonwood Heights, UT 84093

Subject: Stakeholder Meeting #2 – JVWCD Hazard Mitigation Plan Project

Dear Mr. Winsor,

This is the invitation to the Stakeholder Meeting #2. Your firm, agency, or municipal entity has been identified as possibly having an interest in the hazard mitigation planning of the Jordan Valley Water Conservancy District (JVWCD). JVWCD is currently in the process of developing a new Hazard Mitigation Plan (HMP) to assess the risk of the District's facilities against natural hazards and develop mitigation strategies to reduce the risk. You or your designee are invited to attend JVWCD's second stakeholder meeting to be held on Tuesday, June 8, 2021 from 9:00 am to 11:00 am Virtually on Zoom at the following link:

Join Zoom Meeting
https://us02web.zoom.us/j/87235455441?pwd=R1doOWd3Q3FKckk1VWEyM3ArR0MrZz09
Meeting ID: 872 3545 5441
Passcode: 877774 Phone: 669 900 6833

We will review and provide a project briefing with project overview, and Phase B Risk Assessment activities and results towards development of our new HMP that have been completed since our last Stakeholder meeting on April 6, 2021. We will also solicit Stakeholder input and comments during the meeting and discuss next steps.

We would appreciate participation by you or your designee in our planning efforts and look forward to seeing you at the stakeholder meeting (virtually on Zoom). We intend on holding future stakeholder meetings at or near the completion of the remaining two phases of the planning process.

If you have any questions, please call Marcelo Anglade, Project Manager at our office, 801-565-4300.

Sincerely,

Alan Packard, PE
Assistant General Manager

JORDAN VALLEY WATER
CONSERVANCY DISTRICT

8215 South 1300 West • West Jordan, UT 84088 • Ph: 801.565.4300 • www.jvwcd.org

Barton A. Forsyth, *General Manager/CEO*
Alan E. Packard, *Assistant General Manager, Chief Engineer*
Shazelle Terry, *Assistant General Manager, Operations*
Matthew D. Olsen, *Assistant General Manager, Communications/Technology*

Tuesday, May 4, 2021

Wayne Winsor PE, Assistant General Manager
Metropolitan Water District of SL & Sandy
3430 E Danish Rd
Cottonwood Heights, UT 84093

Subject: ***Stakeholder Meeting #2 – JVWCD Hazard Mitigation Plan Project***

Dear Mr. Winsor,

This is the invitation to the Stakeholder Meeting #2. Your firm, agency, or municipal entity has been identified as possibly having an interest in the hazard mitigation planning of the Jordan Valley Water Conservancy District (JVWCD). JVWCD is currently in the process of developing a new Hazard Mitigation Plan (HMP) to assess the risk of the District's facilities against natural hazards and develop mitigation strategies to reduce the risk. You or your designee are invited to attend JVWCD's second stakeholder meeting to be held on Tuesday, June 8, 2021 from 9:00 am to 11:00 am Virtually on Zoom at the following link:

Join Zoom Meeting
https://us02web.zoom.us/j/87235455441?pwd=R1doOWd3Q3FKckk1VWEyM3ArR0MrZz09
Meeting ID: 872 3545 5441
Passcode: 877774 Phone: 669 900 6833

We will review and provide a project briefing with project overview, and Phase B Risk Assessment activities and results towards development of our new HMP that have been completed since our last Stakeholder meeting on April 6, 2021. We will also solicit Stakeholder input and comments during the meeting and discuss next steps.

We would appreciate participation by you or your designee in our planning efforts and look forward to seeing you at the stakeholder meeting (virtually on Zoom). We intend on holding future stakeholder meetings at or near the completion of the remaining two phases of the planning process.

If you have any questions, please call Marcelo Anglade, Project Manager at our office, 801-565-4300.

Sincerely,

Alan Packard, PE
Assistant General Manager

Ellisa Demetsky

From: Ellisa Demetsky
Sent: Tuesday, June 29, 2021 1:07 PM
To: Wade Tuft
Subject: Stakeholder Meeting #3 – JVWCD Hazard Mitigation Plan Project
Attachments: JVWCD HMP Ph C Stakeholder Mtg 07-20-2021 Agenda.pdf

Wade Tuft, Board Member
Utah Lake Water Users Association
8215 S 1300 W
West Jordan, UT 84088

Subject: ***Stakeholder Meeting #3 – JVWCD Hazard Mitigation Plan Project***

Dear Mr. Tuft,

This is the invitation to the Stakeholder Meeting #3. Your firm, agency, or municipal entity has been identified as possibly having an interest in the hazard mitigation planning of the Jordan Valley Water Conservancy District (JVWCD). JVWCD is currently in the process of developing a new Hazard Mitigation Plan (HMP) to assess the risk of the District's facilities against natural hazards and develop mitigation strategies to reduce the risk. You or your designee are invited to attend JVWCD's second stakeholder meeting to be held on Tuesday, July 20, 2021, from 10:00 am to 12:00 pm Virtually on Zoom at the following link:

Join Zoom Meeting
https://us02web.zoom.us/j/81479419225?pwd=UnFGSVRyMGlJbzdIMTRLZmJwNVo1QT09
Meeting ID: 814 7941 9225
Passcode: 804041

We will review and provide a project briefing with project overview, and Phase C Mitigation Strategy activities and results towards development of our new HMP that have been completed since our last Stakeholder meeting on June 8, 2021. We will also solicit Stakeholder input and comments during the meeting and discuss next steps. Please see the attached agenda for the Phase C Stakeholder meeting, which includes the Zoom meeting information and link.

We would appreciate participation by you or your designee in our planning efforts and look forward to seeing you at the stakeholder meeting (virtually on Zoom). We intend on holding one final stakeholder meeting during Phase D Plan Review & Adoption, to provide a briefing and solicit input on the Draft HMP.

If you have any questions, please call Marcelo Anglade, Project Manager at our office, 801-565-4300.

Sincerely,

Alan Packard, PE
Assistant General Manager

JORDAN VALLEY WATER
CONSERVANCY DISTRICT

8215 South 1300 West • West Jordan, UT 84088 • Ph: 801.565.4300 • www.jvwcd.org

Barton A. Forsyth, *General Manager/CEO*
Alan E. Packard, *Assistant General Manager, Chief Engineer*
Shazelle Terry, *Assistant General Manager, Operations*
Matthew D. Olsen, *Assistant General Manager, Communications/Technology*

Friday, June 25, 2021

Wade Tuft, Board Member
Utah Lake Water Users Association
8215 S 1300 W
West Jordan, UT 84088

Subject: ***Stakeholder Meeting #3 – JVWCD Hazard Mitigation Plan Project***

Dear Mr. Tuft,

This is the invitation to the Stakeholder Meeting #3. Your firm, agency, or municipal entity has been identified as possibly having an interest in the hazard mitigation planning of the Jordan Valley Water Conservancy District (JVWCD). JVWCD is currently in the process of developing a new Hazard Mitigation Plan (HMP) to assess the risk of the District's facilities against natural hazards and develop mitigation strategies to reduce the risk. You or your designee are invited to attend JVWCD's second stakeholder meeting to be held on Tuesday, July 20, 2021, from 10:00 am to 12:00 pm Virtually on Zoom at the following link:

Join Zoom Meeting
https://us02web.zoom.us/j/81479419225?pwd=UnFGSVRyMGlJbzdlMTRLZmJwNVo1QT09
Meeting ID: 814 7941 9225
Passcode: 804041

We will review and provide a project briefing with project overview, and Phase C Mitigation Strategy activities and results towards development of our new HMP that have been completed since our last Stakeholder meeting on June 8, 2021. We will also solicit Stakeholder input and comments during the meeting and discuss next steps. Please see the attached agenda for the Phase C Stakeholder meeting, which includes the Zoom meeting information and link.

We would appreciate participation by you or your designee in our planning efforts and look forward to seeing you at the stakeholder meeting (virtually on Zoom). We intend on holding one final stakeholder meeting during Phase D Plan Review & Adoption, to provide a briefing and solicit input on the Draft HMP.

If you have any questions, please call Marcelo Anglade, Project Manager at our office, 801-565-4300.
Sincerely,

Alan Packard, PE
Assistant General Manager

Ellisa Demetsky

From: Ellisa Demetsky
Sent: Monday, July 26, 2021 3:07 PM
To: Wade Tuft
Subject: Stakeholder Meeting #4 – JVWCD Hazard Mitigation Plan Project
Attachments: JVWCD HMP Ph D Stakeholder Mtg 9-2-21 Agenda.pdf

Wade Tuft, Board Member
Utah Lake Water Users Association
8215 S 1300 W
West Jordan, UT 84088

Subject: ***Stakeholder Meeting #4 – JVWCD Hazard Mitigation Plan Project***

Dear Mr. Tuft,

This is the invitation to our final Stakeholder Meeting #4. Your firm, agency, or municipal entity has been identified as possibly having an interest in the hazard mitigation planning of the Jordan Valley Water Conservancy District (JVWCD). JVWCD is currently in the process of developing a new Hazard Mitigation Plan (HMP) to assess the risk of the District's facilities against natural hazards and develop mitigation strategies to reduce the risk. You or your designee are invited to attend JVWCD's fourth stakeholder meeting to be held on Thursday, September 2, 2021 from 2:00 pm to 4:00 pm Virtually on Zoom at the following link:

Join Zoom Meeting
https://us02web.zoom.us/j/87956844743?pwd=YkhNdFV2WTRZcWFZdzUwczBYeW9oQT09

Meeting ID: 879 5684 4743
Passcode: 829591 Phone: 669 900 6833

We will review and provide a project briefing with project overview, and Phase D, Plan Review and Adoption activities and results including review of our new Draft HMP that have been completed since our last Stakeholder meeting held on July 20, 2021. We will also solicit Stakeholder input and comments during the meeting and discuss next steps towards approval and adoption of our new Plan (see attached Stakeholder Mtg#4 Agenda).

We would appreciate participation by you or your designee in our planning efforts and look forward to seeing you at the stakeholder meeting (virtually on Zoom). This is the final stakeholder meeting scheduled for the completion of the planning process.

If you have any questions, please contact Marcelo Anglade, Project Manager at our office, 801-565-4300.

Sincerely,

Alan Packard, PE
Assistant General Manager

801.565.4300
fax 801.565.4399
jvwcd.org
8215 South 1300 West
West Jordan, UT 84088

JORDAN VALLEY WATER
CONSERVANCY DISTRICT

Monday, July 26, 2021

Wade Tuft, Board Member
Utah Lake Water Users Association
8215 S 1300 W
West Jordan, UT 84088

Subject: ***Stakeholder Meeting #4 – JVWCD Hazard Mitigation Plan Project***

Dear Mr. Tuft,

This is the invitation to our final Stakeholder Meeting #4. Your firm, agency, or municipal entity has been identified as possibly having an interest in the hazard mitigation planning of the Jordan Valley Water Conservancy District (JVWCD). JVWCD is currently in the process of developing a new Hazard Mitigation Plan (HMP) to assess the risk of the District's facilities against natural hazards and develop mitigation strategies to reduce the risk. You or your designee are invited to attend JVWCD's fourth stakeholder meeting to be held on Thursday, September 2, 2021 from 2:00 pm to 4:00 pm Virtually on Zoom at the following link:

Join Zoom Meeting
https://us02web.zoom.us/j/87956844743?pwd=YkhNdFV2WTRZcWFZdzUwczBYeW9oQT09

Meeting ID: 879 5684 4743
Passcode: 829591 Phone: 669 900 6833

We will review and provide a project briefing with project overview, and Phase D, Plan Review and Adoption activities and results including review of our new Draft HMP that have been completed since our last Stakeholder meeting held on July 20, 2021. We will also solicit Stakeholder input and comments during the meeting and discuss next steps towards approval and adoption of our new Plan (see attached Stakeholder Mtg#4 Agenda).

We would appreciate participation by you or your designee in our planning efforts and look forward to seeing you at the stakeholder meeting (virtually on Zoom). This is the final stakeholder meeting scheduled for the completion of the planning process.

If you have any questions, please contact Marcelo Anglade, Project Manager at our office, 801-565-4300.

Sincerely,

Alan Packard, PE
Assistant General Manager

AGENDA

JVWCD Hazard Mitigation Plan (HMP) Project

Phase A Stakeholders Meeting #1

April 6, 2021
9:00 a.m. – 11:00 a.m.
Virtual Zoom Meeting (see link & phone info below)

Join Zoom Meeting: (Phone: 669 900 6833)
https://us02web.zoom.us/j/83404506705?pwd=VWlod0NUWnhJcDlsK252U1VpUVhEZz09
Meeting ID: 834 0450 6705
Passcode: 334435

1. **Introductions**
2. **Original JVWCD Plan**
3. **Mitigation Actions Accomplished**
4. **Project Overview - New HMP**
5. **Phase A - Planning Process - Results**
6. **Project Schedule**
7. **Next Steps – Phase B Risk Assessment**
8. **Stakeholder Input** (see Questionnaire/Comment Sheet)
9. **Adjourn**

AGENDA

JVWCD Hazard Mitigation Plan (HMP) Project

Phase B Stakeholders Meeting #2

June 8, 2021
9:00 a.m. – 11:00 a.m.
Virtual Zoom Meeting (see link & phone info below)

Join Zoom Meeting: (Phone: 669 900 6833)
https://us02web.zoom.us/j/87235455441?pwd=R1doOWd3Q3FKckk1VWEyM3ArR0MrZz09

Meeting ID: 872 3545 5441
Passcode: 877774

1. **Introductions**
2. **Project Overview**
3. **Phase B Risk Assessment - Results**
4. **Next Steps – Phase C Mitigation Strategy**
5. **Stakeholder Input** (see Stakeholder Survey#2)
6. **Project Schedule**
7. **Adjourn**

AGENDA

JVWCD Hazard Mitigation Plan (HMP) Project

Phase C Stakeholders Meeting #3

July 20, 2021
10:00 a.m. – 12:00 p.m.
Virtual Zoom Meeting (see link & phone info below)

Join Zoom Meeting: (Phone: 669 900 6833)
https://us02web.zoom.us/j/81479419225?pwd=UnFGSVRyMGlJbzdIMTRLZmJwNVo1QT09

Meeting ID: 814 7941 9225
Passcode: 804041

1. **Introductions**
2. **Project Overview**
3. **Phase C Mitigation Strategy - Results**
4. **Next Steps – Phase D Plan Review & Adoption**
5. **Stakeholder Input**
6. **Project Schedule**
7. **Adjourn**

AGENDA

JVWCD Hazard Mitigation Plan (HMP) Project

Phase D Stakeholders Meeting #4

September 2, 2021
2:00 p.m. – 4:00 p.m.
Virtual Zoom Meeting (see link & phone info below)

Join Zoom Meeting: (Phone: 669 900 6833)
https://us02web.zoom.us/j/87956844743?pwd=YkhNdFV2WTRZcWFZdzUwczBYeW9oQT09

Meeting ID: 879 5684 4743
Passcode: 829591

1. **Introductions**
2. **Project Overview**
3. **Phase D Plan Review & Adoption – Results – Draft Plan**
4. **Next Steps – Phase D: State & FEMA Review, Plan Adoption & FEMA Plan Approval**
5. **Stakeholder Input**
6. **Project Schedule**
7. **Adjourn**

Stakeholder Meeting #1 Sign-In Sheet

In Attendance					
	Project:	Jordan Valley Water Conservancy District (JVWCD) Hazard Mitigation Plan (HMP) Project		**Meeting Date:**	April 6, 2021
	Facilitator:	Bryon Elwell		**Place/Room:**	Virtual Zoom Meeting
	Name	**Title/Project Role**	**Organization**	**Phone**	**E-Mail**
X	Alan Packard	Assistant GM – Engineering, Strategic & Long-term Planning, & New Initiatives	JVWCD	801-565-4300 Office 801-330 -7783 Cell	alanp@jvwcd.org
X	Ammon Allen	Engineering Supervisor	Metropolitan Water District of SL & Sandy	801-942-9687	allen@mwdsls.org
X	Bob Carey	Natural Hazards Bureau Chief	Utah Division of Emergency Management	435-841-4393	bcarey@utah.gov
X	Brien Maxfield	Senior Engineer Manager	Draper City	801-576-6326	Brien.maxfield@draper.ut.us
X	Bryon Elwell	President/Project Manager	Elwell Consulting Group	801-870-9709 Cell	Bryonelwellsr@gmail.com
X	Chris Merket	Staff Engineer	City of South Salt Lake	801-483-6038	
X	Clint Mecham	Director/Battalion Chief	Salt Lake County Emergency Management/Unified Fire Authority	801-743-7103	cmecham@unifiedfire.org
X	Curtis Nielsen	Public Utilities Manager	Midvale City		
X	Dan McDougal	Director Risk & Asset Management	Taylorsville-Bennion Improvement District	801-968-9081	danmcdougal@tbid.org
X	Dan Woodbury	Water Engineer	Riverton City	801-208-3169	dwoodbury@rivertonutah.gov
X	David McLean	Senior Engineer	JVWCD	801-565-4300 Office 801-680-6334 Cell	dmclean@jvwcd.org
X	Emily Alvarez	Community Planner	FEMA – Region VIII	720-292-8702	Emily.Alvarez@FEMA.DHS.gov
X	Eric Martineau	Mitigation Planner	Utah Division of Emergency Management	801-946-4002	emartineau@utah.gov
X	Everett Taylor	Assistant Utah State Engineer	Utah Division of Water Rights		

Stakeholder Meeting #1 Sign-In Sheet

In Attendance					
	Project:	Jordan Valley Water Conservancy District (JVWCD) Hazard Mitigation Plan (HMP) Project		**Meeting Date:**	April 6, 2021
	Facilitator:	Bryon Elwell		**Place/Room:**	Virtual Zoom Meeting
	Name	**Title/Project Role**	**Organization**	**Phone**	**E-Mail**
X	Gordon Batt	Operations Dept. Manager	JVWCD	801-565-4300 Office 801-330-6507 Cell	gordonb@jvwcd.org
X	Greg Anderson	Public Works Director	Kearns Improvement District	801-968-1011	ganderson@kearnsid.org
X	Jake Young	Planning Program Manager	Salt Lake County	385-468-4859	jayoung@slco.org
X	Jared Carling	Environmental Engineer	Hexcel Corporation	801-508-8583	Jared.carling@hexcel.com
X	Jeff King	Security & Emergency Response Coordinator	JVWCD	801-565-4378 Office 801-330-1559 Cell	jeffk@jvwcd.org
X	Jeremy Williams	Client Service Manager/Facility Specialist	Brown & Caldwell	801-316-9826 Office 801-885-2060 Cell	Jwilliams1@browncaldwell.com
X	Jerry Nielson	Plant Manager	WaterPro, Inc.		
X	Joe Goodman	Water Distribution Supervisor	Murray City	801-270-2458 Office 801-712-9382 Cell	jgoodman@murray.utah.gov
X	Kal McDonald	Lead Operator	Riverton City		
X	Keith Ludwig	City Engineer	Midvale City	801-256-2574	ludwigk@midvale.com
X	Marcelo Anglade	Project Manager	JVWCD	801-565-4309 Office 801-634-9008 Cell	marceloa@jvwcd.org
X	Matt Hinckley		JVWCD		matth@jvwcd.org
X	Michael Fazio	City Engineer	City of Bluffdale	801-849-9430	mfazio@bluffdale.com
X	Pam Gill	General Manager	Kearns Improvement District	801-968-1011	pgill@kearnsid.org
X	Pete Keers	Environmental Scientist and ESF#3 State EOC	Utah Division of Drinking Water	385-271-7045	pkeers@utah.gov

Stakeholder Meeting #1 Sign-In Sheet

In Attendance					
	Project:	Jordan Valley Water Conservancy District (JVWCD) Hazard Mitigation Plan (HMP) Project		**Meeting Date:**	April 6, 2021
	Facilitator:	Bryon Elwell		**Place/Room:**	Virtual Zoom Meeting
	Name	**Title/Project Role**	**Organization**	**Phone**	**E-Mail**
X	Quincy Bahr	Utah State Liaison Forest Service Intermountain Region	U.S. Forest Service - Intermountain Region	801-518-1479	quincy.bahr@usda.gov
X	Raymond Garrison	Associate Public Works Director	City of South Jordan	801-253-5203	rgarrison@sjc.utah.gov
X	Shazelle Terry	Assistant GM – Operations & Maintenance	JVWCD	801-565-4300 Office 801-330-2186 Cell	shazellet@jvwcd.org
X	Stacie Olson	Water & Storm Water Manager	Riverton City	801-208-3187 Office 801-558-3088 Cell	solson@rivertonutah.gov
X	Todd Marti	Assistant General Manager	Granger-Hunter Improvement District	801-968-3551	t.marti@ghid.org
X	Trace Robinson	Public Works Director	Riverton City		
X	Travis Jones	Regional Business Manager	Rocky Mountain Power	801-220-7230	Travis.jones@rockymountainpower.net
X	Trevor Andra	District Engineer	Magna Water District	801-250-6279	trevor@magnawater.com
X	Troy Stout	Assistant General Manager	Granger-Hunter Improvement District		
X	Tyler Ashcroft	Shared Stewardship Coordinator	U.S. Forest Service - Intermountain Region	801-625-5354 Office 801-698-3857 Cell	tyler.ashcroft@usda.gov
X	Wade Skinner	Disaster Risk Manager	Rocky Mountain Power		
X	Wade Tuft	Board Vice Chair	Utah Lake Water Users Association	801-565-2000	wadet@jvwcd.org

Stakeholder Meeting #2 Sign-In Sheet

In Attendance					
	Project:	Jordan Valley Water Conservancy District (JVWCD) Hazard Mitigation Plan (HMP) Project		**Meeting Date:**	June 8, 2021
	Facilitator:	Bryon Elwell		**Place/Room:**	Virtual Zoom Meeting
	Name	**Title/Project Role**	**Organization**	**Phone**	**E-Mail**
X	Alan Packard	Assistant GM – Engineering, Strategic & Long-term Planning, & New Initiatives	JVWCD	801-565-4300 Office 801-330 -7783 Cell	alanp@jvwcd.org
X	Ammon Allen	Engineering Supervisor	Metropolitan Water District of SL & Sandy	801-942-9687	allen@mwdsls.org
X	Bob Carey	Natural Hazards Bureau Chief	Utah Division of Emergency Management	435-841-4393	bcarey@utah.gov
X	Brien Maxfield	Senior Engineer Manager	Draper City	801-576-6326	Brien.maxfield@draper.ut.us
X	Bryon Elwell	President/Project Manager	Elwell Consulting Group	801-870-9709 Cell	Bryonelwellsr@gmail.com
X	Curtis Nielsen	Public Utilities Manager	Midvale City		
X	Emily Alvarez	Community Planner	FEMA – Region VIII	720-292-8702	Emily.Alvarez@FEMA.DHS.gov
X	Eric Martineau	Mitigation Planner	Utah Division of Emergency Management	801-946-4002	emartineau@utah.gov
X	Everett Taylor	Assistant Utah State Engineer	Utah Division of Water Rights		
X	Gordon Batt	Operations Dept. Manager	JVWCD	801-565-4300 Office 801-330-6507 Cell	gordonb@jvwcd.org
X	Greg Anderson	Public Works Director	Kearns Improvement District	801-968-1011	ganderson@kearnsid.org
X	Hiram Alba	Principal/Lead Geotechnical Engineer	Geo Strata	801-501-0583 Office 801-792-4152 Cell	hirama@geostrata-llc.com
X	Jared Bunch	City Engineer	Holladay City	801-272-9450	jbunch@forsgren.com
X	Jared Carling	Environmental Engineer	Hexcel Corporation	801-508-8583	Jared.carling@hexcel.com
X	Jeff King	Security & Emergency Response Coordinator	JVWCD	801-565-4378 Office 801-330-1559 Cell	jeffk@jvwcd.org

Stakeholder Meeting #2 Sign-In Sheet

In Attendance					
	Project:	Jordan Valley Water Conservancy District (JVWCD) Hazard Mitigation Plan (HMP) Project		**Meeting Date:**	June 8, 2021
	Facilitator:	Bryon Elwell		**Place/Room:**	Virtual Zoom Meeting
	Name	**Title/Project Role**	**Organization**	**Phone**	**E-Mail**
X	Jeremy Williams	Client Service Manager/Facility Specialist	Brown & Caldwell	801-316-9826 Office 801-885-2060 Cell	Jwilliams1@browncaldwell.com
X	Jerry Nielson	Plant Manager	WaterPro, Inc.		
X	Julie Murphy	Wildfire Risk Reduction Coordinator	Utah Division of Forestry, Fire & State Lands	385-228-6439	JulieMurphy@utah.gov
X	Justun Edwards	Public Works Director	Herriman City	801-446-5323	jedwards@herriman.org
X	Keith Ludwig	City Engineer	Midvale City	801-256-2574	ludwigk@midvale.com
X	Marcelo Anglade	Project Manager	JVWCD	801-565-4309 Office 801-634-9008 Cell	marceloa@jvwcd.org
X	Matt Hinckley		JVWCD		matth@jvwcd.org
X	Michael Fazio	City Engineer	City of Bluffdale	801-849-9430	mfazio@bluffdale.com
X	Nate Nelson	City Engineer	City of West Jordan	801-569-5100	Nate.nelson@westjordan.utah.gov
X	Pete Keers	Environmental Scientist and ESF#3 State EOC	Utah Division of Drinking Water	385-271-7045	pkeers@utah.gov
X	Quincy Bahr	Utah State Liaison Forest Service Intermountain Region	U.S. Forest Service - Intermountain Region	801-518-1479	quincy.bahr@usda.gov
X	Raymond Garrison	Associate Public Works Director	City of South Jordan	801-253-5203	rgarrison@sjc.utah.gov
X	Shazelle Terry	Assistant GM – Operations & Maintenance	JVWCD	801-565-4300 Office 801-330-2186 Cell	shazellet@jvwcd.org
X	Travis Jones	Regional Business Manager	Rocky Mountain Power	801-220-7230	Travis.jones@rockymountainpower.net
X	Wade Skinner	Disaster Risk Manager	Rocky Mountain Power		

Stakeholder Meeting #2 Sign-In Sheet

In Attendance					
	Project:	Jordan Valley Water Conservancy District (JVWCD) Hazard Mitigation Plan (HMP) Project		**Meeting Date:**	June 8, 2021
	Facilitator:	Bryon Elwell		**Place/Room:**	Virtual Zoom Meeting
	Name	**Title/Project Role**	**Organization**	**Phone**	**E-Mail**
X	Wade Tuft	Board Vice Chair	Utah Lake Water Users Association	801-565-2000	wadet@jvwcd.org

Stakeholder Meeting #3 Sign-In Sheet

In Attendance					
	Project:	Jordan Valley Water Conservancy District (JVWCD) Hazard Mitigation Plan (HMP) Project		**Meeting Date:**	July 20, 2021
	Facilitator:	Bryon Elwell		**Place/Room:**	Virtual Zoom Meeting
	Name	**Title/Project Role**	**Organization**	**Phone**	**E-Mail**
X	Alan Packard	Assistant GM – Engineering, Strategic & Long-term Planning, & New Initiatives	JVWCD	801-565-4300 Office 801-330 -7783 Cell	alanp@jvwcd.org
X	Ammon Allen	Engineering Supervisor	Metropolitan Water District of SL & Sandy	801-942-9687	allen@mwdsls.org
X	Brien Maxfield	Senior Engineer Manager	Draper City	801-576-6326	Brien.maxfield@draper.ut.us
X	Brian Callister				
X	Bryon Elwell	President/Project Manager	Elwell Consulting Group	801-870-9709 Cell	Bryonelwellsr@gmail.com
X	Chris Merket	Staff Engineer	City of South Salt Lake	801-483-6038	
X	Curtis Nielsen	Public Utilities Manager	Midvale City		
X	David McLean	Senior Engineer	JVWCD	801-565-4300 Office 801-680-6334 Cell	dmclean@jvwcd.org
X	Dennis Pay	City Engineer	South Salt Lake	801-483-6038	dpay@southsaltlakecity.com
X	Eric Martineau	Mitigation Planner	Utah Division of Emergency Management	801-946-4002	emartineau@utah.gov
X	Gordon Batt	Operations Dept. Manager	JVWCD	801-565-4300 Office 801-330-6507 Cell	gordonb@jvwcd.org
X	Greg Anderson	Public Works Director	Kearns Improvement District	801-968-1011	ganderson@kearnsid.org
X	Hiram Alba	Principal/Lead Geotechnical Engineer	Geo Strata	801-501-0583 Office 801-792-4152 Cell	hirama@geostrata-llc.com
X	Jared Carling	Environmental Engineer	Hexcel Corporation	801-508-8583	Jared.carling@hexcel.com
X	Jared Elliott				

Stakeholder Meeting #3 Sign-In Sheet

In Attendance					
	Project:	Jordan Valley Water Conservancy District (JVWCD) Hazard Mitigation Plan (HMP) Project		**Meeting Date:**	July 20, 2021
	Facilitator:	Bryon Elwell		**Place/Room:**	Virtual Zoom Meeting
	Name	**Title/Project Role**	**Organization**	**Phone**	**E-Mail**
X	Jeff King	Security & Emergency Response Coordinator	JVWCD	801-565-4378 Office 801-330-1559 Cell	jeffk@jvwcd.org
X	Julie Murphy	Wildfire Risk Reduction Coordinator	Utah Division of Forestry, Fire & State Lands	385-228-6439	JulieMurphy@utah.gov
X	Keith Ludwig	City Engineer	Midvale City	801-256-2574	ludwigk@midvale.com
X	Marcelo Anglade	Project Manager	JVWCD	801-565-4309 Office 801-634-9008 Cell	marceloa@jvwcd.org
X	Michael Fazio	City Engineer	City of Bluffdale	801-849-9430	mfazio@bluffdale.com
X	Pete Keers	Environmental Scientist and ESF#3 State EOC	Utah Division of Drinking Water	385-271-7045	pkeers@utah.gov
X	Raymond Garrison	Associate Public Works Director	City of South Jordan	801-253-5203	rgarrison@sjc.utah.gov
X	Ryan Johnson	Operations Manager	White City Water Improvement District	801-571-3991	rjohnson@wcwid.org
X	Shawn Anderson	Bureau Director Facilities	Utah Department of Corrections	801-545-5500	shawnanderson@utah.gov
X	Shane Swensen	Engineering Dept. Manager	JVWCD	801-565-4326 Office 801-674 3310 Cell	shanes@jvwcd.org
X	Shazelle Terry	Assistant GM – Operations & Maintenance	JVWCD	801-565-4300 Office 801-330-2186 Cell	shazellet@jvwcd.org
X	Travis Jones	Regional Business Manager	Rocky Mountain Power	801-220-7230	Travis.jones@rockymountainpower.net
X	Victor Narteh				
X	Wade Tuft	Board Vice Chair	Utah Lake Water Users Association	801-565-2000	wadet@jvwcd.org

Stakeholder Meeting #4 Sign-In Sheet

In Attendance					
	Project:	Jordan Valley Water Conservancy District (JVWCD) Hazard Mitigation Plan (HMP) Project		**Meeting Date:**	September 2, 2021
	Facilitator:	Bryon Elwell		**Place/Room:**	Virtual Zoom Meeting
	Name	**Title/Project Role**	**Organization**	**Phone**	**E-Mail**
X	Alan Packard	Assistant GM – Engineering, Strategic & Long-term Planning, & New Initiatives	JVWCD	801-565-4300 Office 801-330 -7783 Cell	alanp@jvwcd.org
X	Brien Maxfield	Senior Engineer Manager	Draper City	801-576-6326	Brien.maxfield@draper.ut.us
X	Brian Callister	Maintenance Dept. Manager	JVWCD	801-565-4300 Office 801-403-5574 Cell	brianc@jvwcd.org
X	Bryon Elwell	President/Project Manager	Elwell Consulting Group	801-870-9709 Cell	Bryonelwellsr@gmail.com
X	Chris Merket	Staff Engineer	City of South Salt Lake	801-483-6038	
X	Gardner Olson	Engineer	MWDSLS	801-942-1391	
X	Gordon Batt	Operations Dept. Manager	JVWCD	801-565-4300 Office 801-330-6507 Cell	gordonb@jvwcd.org
X	Hiram Alba	Principal/Lead Geotechnical Engineer	Geo Strata	801-501-0583 Office 801-792-4152 Cell	hirama@geostrata-llc.com
X	Jacob Young	QA/QC	Brown & Caldwell	801-316-9816 Office 801-214-4549 Cell	jyoung@brwncald.com
X	Jeremy Gregory	Staff Engineer	Granger-Hunter Improvement District	801-968-3551	
X	Jeff King	Security & Emergency Response Coordinator	JVWCD	801-565-4378 Office 801-330-1559 Cell	jeffk@jvwcd.org
X	Marcelo Anglade	Project Manager	JVWCD	801-565-4309 Office 801-634-9008 Cell	marceloa@jvwcd.org
X	Matt Hinkley	Operations Dept. Manager	JVWCD	801-565-4300 Office	matth@jvwcd.org
X	Michael Fazio	City Engineer	City of Bluffdale	801-849-9430	mfazio@bluffdale.com
X	Pete Keers	Environmental Scientist and ESF#3 State EOC	Utah Division of Drinking Water	385-271-7045	pkeers@utah.gov

Stakeholder Meeting #4 Sign-In Sheet

In Attendance					
	Project:	Jordan Valley Water Conservancy District (JVWCD) Hazard Mitigation Plan (HMP) Project		**Meeting Date:**	September 2, 2021
	Facilitator:	Bryon Elwell		**Place/Room:**	Virtual Zoom Meeting
	Name	**Title/Project Role**	**Organization**	**Phone**	**E-Mail**
X	Raymond Garrison	Associate Public Works Director	City of South Jordan	801-253-5203	rgarrison@sjc.utah.gov
X	Shawn Anderson	Bureau Director Facilities	Utah Department of Corrections	801-545-5500	shawnanderson@utah.gov
X	Shane Swensen	Engineering Dept. Manager	JVWCD	801-565-4326 Office 801-674 3310 Cell	shanes@jvwcd.org
X	Ted Campbell	Lead Engineering Project Manager	Dominion Energy		ted.campbell@dominionenergy.com
X	Wade Tuft	Board Vice Chair	Utah Lake Water Users Association	801-565-2000	wadet@jvwcd.org
X	Woody Woodruff	Public Works Director	Kearns Improvement District	801-968-1011	

Questionnaire/Comment Sheet

JVWCD 2021 Hazard Mitigation Plan
Stakeholders Meeting #1
April 6, 2021

Stakeholder Agency: _____

Representative Name: _____ Email: _____

1. Natural Hazard History:
   a. Past Occurrences (Hazard type, Year, Damages, Repair/Restore Costs):

_____

_____

_____

_____

2. Natural Hazard Emergency Planning:
   a. Alternative water supplies (Interconnects/MOUs, Bottled Water, etc.):

_____

_____

_____

   b. Water Storage (Qty. and/or # of Hours or Days):

_____

_____

   c. Water Conservation Plans(% Reduction Goal, Conservation Measures, Effectiveness):

_____

_____

   d. Water Restriction Plans (Types & Levels of restrictions):

_____

_____

_____

3. Other Input/Comments:

_____

_____

_____

Questionnaire/Comment Sheet

JVWCD 2021 Hazard Mitigation Plan
Stakeholders Meeting #1
April 6, 2021

Stakeholder Agency: Taylorsville-Bennion Improvement District

Representative Name: Dan McDougal Email: dan@tbid.org

1. Natural Hazard History:
   a. Past Occurrences (Hazard type, Year, Damages, Repair/Restore Costs):

      - Flood, 1982-83, District Wastewater facilities and culinary deep water wells sites accessibility was limited due to the proximity of the Jordan River. No noted damage to facilities.

2. Natural Hazard Emergency Planning:
   a. Alternative water supplies (Interconnects/MOUs, Bottled Water, etc.):

      - JVWCD primary connections: Bennion, Westbrook, Cougar Lane
      - JVWCD secondary connections: American Express, Low Zone, North, 1700 West 4500 South
      - Connection under construct with JVWCD: 5200 West Booster
      - TBID deep water wells

   b. Water Storage (Qty. and/or # of Hours or Days):

      - 55.5 million gallons. If reservoirs are full and considering winter usage, possibly 10 days at 5 million gallons usage per day

   c. Water Conservation Plans (% Reduction Goal, Conservation Measures, Effectiveness):

      - Water Conservation goal: 25% by 2025 currently at 97%

   d. Water Restriction Plans (Types & Levels of restrictions):

      - Currently under revision
      - Existing plan includes voluntary and mandatory water rationing of outdoor water usage

3. Other Input/Comments:

Questionnaire/Comment Sheet

JVWCD 2021 Hazard Mitigation Plan
Stakeholders Meeting #1
April 6, 2021

Stakeholder Agency: FEMA Region 8 - Mitigation Division

Representative Name: Emily Alvarez Email: emily.alvarez@fema.dhs.gov

1. Natural Hazard History:
   a. Past Occurrences (Hazard type, Year, Damages, Repair/Restore Costs):

2. Natural Hazard Emergency Planning:
   a. Alternative water supplies (Interconnects/MOUs, Bottled Water, etc.):
   b. Water Storage (Qty. and/or # of Hours or Days):
   c. Water Conservation Plans(% Reduction Goal, Conservation Measures, Effectiveness):
   d. Water Restriction Plans (Types & Levels of restrictions):

3. Other Input/Comments:
   In addition to simply adding the public comment as an appendix, consider explaining in the plan how the input was used to shape it. For community engagement, have you considered adding an announcement for the survey or anything in customer bills?

Questionnaire/Comment Sheet

JVWCD 2021 Hazard Mitigation Plan
Stakeholders Meeting #1
April 6, 2021

Stakeholder Agency: KEARNS IMPROVEMENT DISTRICT

Representative Name: GREG ANDERSON Email: ganderson@kearnsid.org

1. Natural Hazard History:
   a. Past Occurrences (Hazard type, Year, Damages, Repair/Restore Costs):

2. Natural Hazard Emergency Planning:
   a. Alternative water supplies (Interconnects/MOUs, Bottled Water, etc.):
   12 WELLS, GHID INTERCONNECT
   b. Water Storage (Qty. and/or # of Hours or Days):
   28.5 MG TOTAL TANK STORAGE - 17,579,000 gal PEAK USE 1.62 DAYS
   28.5 MG TOTAL TANK STORAGE - 3,763,000 gal NO IRRIGATION 7.6 DAYS
   c. Water Conservation Plans(% Reduction Goal, Conservation Measures, Effectiveness):
   KID USE 157 gal/CAPITA REGIONAL GOAL 187 gal/CAPITA
   d. Water Restriction Plans (Types & Levels of restrictions):
   SEE ATTACHED

3. Other Input/Comments:

4.12. Drought

4.12.1. Emergency Water Rationing Program

Upon receipt of notification from the Jordan Valley Water Conservancy District that water supplies will be curtailed and/or upon receipt of other relevant information that indicates a shortage of available water supplies, the Board of Trustees and/or the General Manager of the District shall have the power and authority to declare a drought and the District shall implement a water rationing program as determined by the Board and/or the General Manager.

4.12.2. Drought Stages

If conditions meet any two of the (a) through (c) conditions listed below for a drought stage, the Board of Trustees may declare one of the following stages of drought.

4.12.3. Drought Advisory

Drought Advisory: (a) the rainfall percentage, as determined by the National Weather Service, is 85% or less of normal for 12 months, (b) snowpack, as determined by the state snow survey for the Provo River Basin, is not more than 90% of normal over the most recent winter or (c) Deer Creek and Jordanelle Reservoirs are at not more than 90% of capacity on March 15.

4.12.4. Drought Watch

Drought Watch: (a) the rainfall percentage, as determined by the National Weather Service, is 75% or less of normal for 12 months, (b) snowpack, as determined by the state snow survey for the Provo River Basin, is not more than 80% of normal over the most recent winter, or (c) Deer Creek and Jordanelle Reservoirs are at not more than 80% of capacity on March 15.

4.12.5. Drought Warning

Drought Warning: (a) the rainfall percentage, as determined by the National Weather Service, is 85% or less of normal for 24 months, (b) snowpack, as determined by the state snow survey for the Provo River Basin, is not more than 70% of normal over the most recent winter, or (c) Deer Creek and Jordanelle Reservoirs are at not more than 70% of capacity on March 15.

4.12.6. Drought Emergency

Drought Emergency: (a) the rainfall percentage, as determined by the National Weather Service is 75% or less of normal for 24 months, (b) snowpack, as determined by the state snow survey for the Provo River Basin, is not more than 70% of normal over the most recent winter, or (c) Deer Creek and Jordanelle Reservoirs are at not more than 60% of capacity on March 15.

4.12.7. Actions for Drought Condition

Drought Advisory: (a) limit watering times to 6:00 p.m. to 10:00 a.m. and (b) notify customer of broken and misdirected sprinkler heads.

Drought Watch (a) limit watering times to 6:00 p.m. to 8:00 a.m., (b) limit outside watering to three times a week (c) increase outside watering service charges to Emergency Conservation Rates Level 2, and (d) notify customer of broken and/or misdirected sprinkler heads.

Drought Warning: (a) limit watering times to 8:00 p.m. to 8:00 a.m., (b) limit outside watering to twice a week and no watering on Saturdays, with house numbers ending in 0-2 watering restricted to Mondays and Thursdays, house numbers ending in 3-5 watering restricted to Tuesdays and Fridays, and house numbers ending in 6-9 watering restricted to Sundays and Wednesdays; (c)

increase outside watering service charges to Emergency Conservation Rates Level 3, and (d) turn off a customer's outside water after the second notice of broken and/or misdirected sprinkler heads.

Drought Emergency: (a) limit watering times to 8:00 p.m. to 6:00 a.m., (b) limit outside watering to once a week and no watering on Saturdays or Sundays, with house numbers ending in 0-1 watering restricted to Mondays, house numbers ending in 2-3 watering restricted to Tuesdays, house numbers ending in 4-5 watering limited to Wednesdays, house numbers ending in 6-7 watering restricted to Thursdays, and house numbers ending in 8-9 watering restricted to Fridays, (c) increase outside watering service charges to Emergency Conservation Rates Level 4, and (d) turn off a customer's outside water after the first notice of broken and/or misdirected sprinkler heads.

Additional Restrictions: The program may, in the District's discretion, include additional elements such as curtailing outside water use by large water users such as schools, churches, parks and recreation areas, or requiring them to use outside water only during off-peak times such as after 10:00 p.m. and prior to 9:00 a.m.; curtailing all outside watering and all industrial and commercial use of water; etc.

4.12.8. Board Discretion

Actions for Drought Condition: The Board or the General Manager may authorize the implementation of the following actions to curtail water supply in response to drought conditions:
The District Board of Trustees shall have discretion to determine the propriety of implementing an emergency water rationing program and shall direct the imposition of such restrictions and actions as the Board, in its discretion and based upon available facts and information, deems expedient. In the event that the General Manager declares a drought emergency and/or implements an emergency water rationing program, that declaration and the program shall be placed upon the agenda of the next regular meeting or of a special meeting of the Board of Trustees for review, ratification and/or modification.

4.12.9. Notice - Discontinuance of Service

Notice - Discontinuance of Service: Notice shall be given to all customers of any limitations and schedules established, and if any customer neglects, fails or refuses to abide by those limitations and schedules, the District may discontinue service to the customer after proper notice and shall not be required to resume service until the customer has provided to the District adequate assurances that the customer will strictly abide by those limitations, restrictions and schedules in the future and the customer has paid the District's then standard re-connection fee.

Gmail

Bryon Elwell <bryonelwellsr@gmail.com>

US Forest Service Input on JVWCD Hazard Mitigation Plan Stakeholder Mtg

Bahr, Quincy - FS <Quincy.Bahr@usda.gov> Tue, Apr 6, 2021 at 11:11 AM
To: "marceloA@jvwcd.org" <marceloA@jvwcd.org>, "bryonelwellsr@gmail.com" <bryonelwellsr@gmail.com>
Cc: "shazelle@jvwcd.org" <shazelle@jvwcd.org>, "Ashcroft, Tyler - FS" <tyler.ashcroft@usda.gov>, Laura Ault <lauraault@utah.gov>, "juliemurphy@utah.gov" <juliemurphy@utah.gov>

Marcelo and Bryon,

Thank you for inviting the Forest Service to attend today's Hazard Mitigation Plan Stakeholder Meeting. We appreciate the opportunity to consider hazard mitigation to the water resources associated with the JVWCD. We also appreciate the District's involvement in discussions regarding the State's and Forest Service's Shared Stewardship efforts to reduce the risk of unwanted wildfires and their associated damage to forest watersheds and community water treatment and transportation infrastructure.

In looking over the questionnaire associated with today's meeting, it seems like most of the questions do not directly apply to the Forest Service (e.g., water storage, alternative water supplies, the nature of the water conservation plan information being sought). National Forest System lands experience several of the hazards identified in the presentation, including avalanches, wildfires, floods, debris flows, and drought. If you would like information related to these threats on National Forest System lands we would be happy to provide that information.

Quincy Bahr
Utah State Liaison

Forest Service

Intermountain Region

c: 801-518-1479 (teleworking)
quincy.bahr@usda.gov

324 24th Street
Odgen, UT 84401
www.fs.fed.us

Caring for the land and serving people

Questionnaire/Comment Sheet

JVWCD 2021 Hazard Mitigation Plan
Stakeholders Meeting #1
April 6, 2021

Stakeholder Agency: South Jordan City

Representative Name: Raymond Garrison Email: rgarrison@sjc.utah.gov

1. Natural Hazard History:
   a. Past Occurrences (Hazard type, Year, Damages, Repair/Restore Costs):
   * Have experienced flooding in the past No damages resulted from the hazard.

2. Natural Hazard Emergency Planning:
   a. Alternative water supplies (Interconnects/MOUs, Bottled Water, etc.):
   * We have emergency connections w/ Riverton City & West Jordan City.

   b. Water Storage (Qty. and/or # of Hours or Days):
   * We have 38 million gallons of storage - water tanks.

   c. Water Conservation Plans(% Reduction Goal, Conservation Measures, Effectiveness):
   * Our plan follows the state goals for water reduction

   d. Water Restriction Plans (Types & Levels of restrictions):
   * The city has adopted a Water Shortage Plan

3. Other Input/Comments:

Questionnaire/Comment Sheet

JVWCD 2021 Hazard Mitigation Plan
Stakeholders Meeting #1
April 6, 2021

Stakeholder Agency: ROCKY MOUNTAIN POWER

Representative Name: TRAVIS JONES Email: TRAVIS.JONES@PACIFICORP.COM
WADE SKINNER WADE.SKINNER@PACIFICORP.COM

1. Natural Hazard History:

   a. Past Occurrences (Hazard type, Year, Damages, Repair/Restore Costs):
   EARTHQUAKES = MINOR DAMAGE & VIBRATION DAMAGE
   TEMPORARY OUTAGES IMPACTING WASATCH REGION

2. Natural Hazard Emergency Planning:

   a. Alternative water supplies (Interconnects/MOUs, Bottled Water, etc.):

   b. Water Storage (Qty. and/or # of Hours or Days):

   c. Water Conservation Plans(% Reduction Goal, Conservation Measures, Effectiveness):

   d. Water Restriction Plans (Types & Levels of restrictions):

3. Other Input/Comments:

Gmail **Bryon Elwell <bryonelwellsr@gmail.com>**

FW: Stakeholder Meeting #3 – JVWCD Hazard Mitigation Plan Project

Marcelo Anglade <MarceloA@jvwcd.org> Mon, Jul 12, 2021 at 9:17 AM
To: Bryon Elwell <bryonelwellsr@gmail.com>

Bryon,

I am forwarding the email we received from Steve Bowman, Geological Hazards Project Manager, which may be useful for this and other projects.

Cordially,

Marcelo Anglade, P.E.

Senior Engineer

801-565-4300 | jvwcd.org

JORDAN VALLEY WATER CONSERVANCY DISTRICT

From: Ellisa Demetsky <EllisaD@jvwcd.org>
Sent: Monday, July 12, 2021 8:03 AM
To: Marcelo Anglade <MarceloA@jvwcd.org>
Cc: 'stevebowman@utah.gov' <stevebowman@utah.gov>
Subject: FW: Stakeholder Meeting #3 – JVWCD Hazard Mitigation Plan Project

Marcelo,

Please see the email below.

Thank you,

Ellisa

From: Steve Bowman <stevebowman@utah.gov>
Sent: Monday, July 12, 2021 7:52 AM
To: Ellisa Demetsky <EllisaD@jvwcd.org>
Subject: Re: Stakeholder Meeting #3 – JVWCD Hazard Mitigation Plan Project

Ellisa- Geologic information the Utah Geological Survey has that may be useful to the JVWCD Hazard Mitigation Plan Project includes:

- Utah Geologic Hazards Portal (https://geology.utah.gov/apps/hazards/) - online geologic hazard mapping
- Utah Geologic Maps (https://geology.utah.gov/apps/intgeomap/) - online geologic maps
- Individual Utah Geologic Hazard Maps (https://geology.utah.gov/hazards/info/publications/) - PDFs and GIS data
- Utah Geologic Hazard Map GIS Data (Danger, do not click!)
- Utah Historical Aerial Imagery (https://geology.utah.gov/map-pub/data-databases/aerial-imagery/) - scanned air photos and other materials
- Utah Lidar Elevation Data (https://gis.utah.gov/data/elevation-and-terrain/ and https://opentopography.org)
- Utah State Hazard Mitigation Plan (https://hazards.utah.gov/state-of-utah-hazard-mitigation-plan/) - contains mitigation strategies
- UGS Geologic Hazard Investigation Guidelines (https://ugspub.nr.utah.gov/publications/circular/c-128.pdf)

Let me know if you need additional information.

Thanks, Steve

Steve D. Bowman, Ph.D., P.E., P.G.
Geologic Hazards Program Manager
Utah Geological Survey
1594 West North Temple, P.O. Box 146100
Salt Lake City, Utah 84114-6100
(801) 537-3304
https://geology.utah.gov/

On Tue, Jun 29, 2021 at 1:00 PM Ellisa Demetsky <EllisaD@jvwcd.org> wrote:

> Steve Bowman, Geologic Hazard Program Manager
>
> Utah Geological Survey
>
> 1594 W North Temple Ste 3110
>
> Salt Lake City, UT 84116
>
> Subject: Stakeholder Meeting #3 – JVWCD Hazard Mitigation Plan Project
>
> Dear Mr. Bowman,
>
> This is the invitation to the Stakeholder Meeting #3. Your firm, agency, or municipal entity has been identified as possibly having an interest in the hazard mitigation planning of the Jordan Valley Water Conservancy District (JVWCD). JVWCD is currently in the process of developing a new Hazard Mitigation Plan (HMP) to assess the risk of the District's facilities against natural hazards and develop mitigation strategies to reduce the risk. You or your designee are invited to attend JVWCD's second stakeholder meeting to be held on Tuesday, July 20, 2021, from 10:00 am to 12:00 pm Virtually on Zoom at the following link:
>
> **Join Zoom Meeting**
>
> https://us02web.zoom.us/j/81479419225?pwd=UnFGSVRyMGlJbzdIMTRLZmJwNVo1QT09
>
> Meeting ID: 814 7941 9225

Passcode: 804041

We will review and provide a project briefing with project overview, and Phase C Mitigation Strategy activities and results towards development of our new HMP that have been completed since our last Stakeholder meeting on June 8, 2021. We will also solicit Stakeholder input and comments during the meeting and discuss next steps. Please see the attached agenda for the Phase C Stakeholder meeting, which includes the Zoom meeting information and link.

We would appreciate participation by you or your designee in our planning efforts and look forward to seeing you at the stakeholder meeting (virtually on Zoom). We intend on holding one final stakeholder meeting during Phase D Plan Review & Adoption, to provide a briefing and solicit input on the Draft HMP.

If you have any questions, please call Marcelo Anglade, Project Manager at our office, 801-565-4300.

Sincerely,

Alan Packard, PE

Assistant General Manager

Stakeholder Survey

JVWCD 2021 Hazard Mitigation Plan
Stakeholders Meeting #2
June 8, 2021

Stakeholder Agency: City of South Jordan

Representative Name: Aaron Sainsbury Email: asainsbury@sjc.utah.gov

1. Customer Stakeholder populations served by JVWCD:
   a. Total population: January 1, 2021 79,200
   b. % of Potable Water provided by JVWCD (i.e., Sole Source = 100%, Stakeholder wells at 40% & JVWCD at 60%): 100%
   c. % of Secondary Water provided by JVWCD: 0%

2. Do you have your own or do you participate in a FEMA-approved Regional or Local Hazard Mitigation Plan? ☒ Yes ☐ No
   Plan Name: Salt Lake County multi-Jurisdiction Hazard mitigation Plan
   Year Approved by FEMA: 2019

3. Mitigation Action Ideas for Hazards Assessed (i.e., Earthquake – anchor & brace nonstructural equipment)

Hazard	Mitigation Action
Severe Weather	Buried Power Lines
Communication Failure	Redundant/back-up Radio Repeaters
Drought	water Conservation program

4. Stakeholder Experience with Mitigation Actions
   a. Mitigation Action: Water Conservation program
   b. Effectiveness of Mitigation Action: Household Usage decline Annually Total Approx 508,000 gallons saved
   c. Year Implemented: 2014
   d. Approximate Cost: $200,000
      Employee Salaries $100,000 JVWCD grant $60,000 city budget $40,000

5. Other Stakeholder Input:

Stakeholder Survey

JVWCD 2021 Hazard Mitigation Plan
Stakeholders Meeting #2
June 8, 2021

Stakeholder Agency: Midvale City

Representative Name: Keith Ludwig Email: ludwigK_@midvale.com

1. Customer Stakeholder populations served by JVWCD:
   a. Total population: approximately 15,300
   b. % of Potable Water provided by JVWCD (i.e., Sole Source = 100%, Stakeholder wells at 40% & JVWCD at 60%): 50%
   c. % of Secondary Water provided by JVWCD: 0%

2. Do you have your own or do you participate in a FEMA-approved Regional or Local Hazard Mitigation Plan? ☐ Yes ☒ No
   Plan Name: —
   Year Approved by FEMA: —

3. Mitigation Action Ideas for Hazards Assessed (i.e., Earthquake – anchor & brace nonstructural equipment)

Hazard	Mitigation Action
Earthquake	Anchor & Brace Piping @ wells.
Wild Fire	Sites free of brush & Debris

4. Stakeholder Experience with Mitigation Actions
   a. Mitigation Action: —
   b. Effectiveness of Mitigation Action: —
   c. Year Implemented: —
   d. Approximate Cost: —

5. Other Stakeholder Input:

Stakeholder Survey

JVWCD 2021 Hazard Mitigation Plan
Stakeholders Meeting #2
June 8, 2021

Stakeholder Agency: ULWUA

Representative Name: Wade Tuft Email: Wadet@jvwcd.org

1. Customer Stakeholder populations served by JVWCD:
   a. Total population: _____
   b. % of Potable Water provided by JVWCD (i.e., Sole Source = 100%, Stakeholder wells at 40% & JVWCD at 60%): _____
   c. % of Secondary Water provided by JVWCD: Welby/Jacob 100%

2. Do you have your own or do you participate in a FEMA-approved Regional or Local Hazard Mitigation Plan? ☐ Yes ☒ No
   Plan Name: _____
   Year Approved by FEMA: _____

3. Mitigation Action Ideas for Hazards Assessed (i.e., Earthquake – anchor & brace nonstructural equipment)

	Hazard	Mitigation Action
A	Power Outage Due to Natural Disaster or lightning	A. Generators or Back up Power Supply to Jordan Narrow Pumping Station
B	Pipe failures	B. Stock Pile of Correct Diameter Piping

4. Stakeholder Experience with Mitigation Actions
   a. Mitigation Action: _____
   b. Effectiveness of Mitigation Action: _____
   c. Year Implemented: _____
   d. Approximate Cost: _____

5. Other Stakeholder Input:
   It has always been a great Concern of the Welby Jacob Canal Company to lose Power for an extended Period of time at the Jordan Narrows Pumping Station. We would like to See some kind of Back up Power in Place.

Appendix C: Asset Pair Wise Comparison Matrices

Asset Prioritization _Mission Criteria

Criteria 1 – Reliability

Criteria 2 – Quality

Criteria 3 – Safety

Criteria 4 – Value

Summary

JVWCD HMP Project
Asset Prioritization
April 2, 2021

Mission Criteria	Reliability	Quality	Safety	Value	Criteria Weighting Factors	Rank
Reliability		4	4	5	13	1
Quality	2		2	4	8	3
Safety	2	4		5	11	2
Value	1	2	1		4	4

JVWCD Mission & Vision

Delivering quality water and services every day.

Our vision is to provide a sustainable water supply to promote individual and community well-being

JVWCD Values

Safety: We are committed to employee and public safety; Service: We care about our customers' needs and strive to fulfill them.; Respect: We care about our employees and invest in their success; Integrity: We believe in doing the right thing-individually and as an organization; Leadership: Our passion for quality drives us to employ innovative practices.

Mission Criteria Definitions:

Reliability: Consistently delivering water services to customers with priority for indoor demands and maintaining minimum water pressure

Quality: Meeting all Federal, State and internal water quality standards for drinking water

Safety: Employee safety, public safety, injury/illness/deaths associated with critical assets. This does not include water quality safety issues. Does not include property damage liability in Value criteria.

Value: Financial Accountability in terms of efficient & cost-effective management of assets (i.e., costs, property, value, employees, customers, etc)

JVWCD HMP Project
Asset Prioritization
April 2, 2021

Asset Number	Reliability	South East Regional Water Treatment Plant (20 MGD)	Jordan Valley Water Treatment Plant (180 MGD)	Moniter Drive Well	Newbury Well	1443 E. 9400 S. Well	JVWTP 8 MG Reservoir	JVWTP 1 MG Reservoir	Old Bingham 3 MG Tank	Zone B North Reservoirs 1 MG steel, 2 MG buried con	Terminal Reservoir (100 MG)	Jordan Narrows Pump Station	118th South Zone C Pump Station	Pump Station serving Zone B North (3200 W. 6200 S.)	Pump Station along 102nd South Zone D: Old Bingham	Jordan Aqueduct (Reaches 1 – 4)	Central Pipeline	150th South Pipeline	24" Cross Valley Pipeline	Creek Road Pipeline (24" to 33")	114th South Pipeline	Sum	
1	**South East Regional Water Treatment Plant (20 MGD)**		1	4	4	4	4	2	3	3	1	3	2	2	2	1	2	2	2	2	2	46	SERWTP has some backup to its capacity to meet indoor demand similar to Old Bingham Tank. Actual capacity of SERWTP is around 15 MGD rather than rated 20 MGD. In future trying to not be reliant upon SERWTP to meet demands.
2	**Jordan Valley Water Treatment Plant (180 MGD)**	5		5	5	5	5	4	5	5	5	5	5	5	5	3	5	5	5	5	5	92	Can operate the JVWTP without the Terminal Resrvoir, but it would be difficult. There is a 1 MG backwash reservoir which is being considered part of the WTP.
3	**Moniter Drive Well**	2	1		3	3	2	1	2	2	1	2	1	1	2	1	1	1	1	1	1	29	8 CFS
4	**Newbury Well**	2	1	3		3	2	1	2	2	1	2	1	1	2	1	1	1	1	1	1	29	8..9 CFS
5	**1443 E. 9400 S. Well**	2	1	3	3		3	1	2	2	1	2	1	1	2	1	1	1	1	1	1	30	9.5 CFS
6	**JVWTP 8 MG Reservoir**	2	1	4	4	3		1	3	3	2	2	1	1	2	1	1	1	2	2	2	38	If still have 12 MG Reservoir then JVWTP can still produce 180 MGD. The 8 MG Reservoir has hazard concerns, but the District would likely replace 8 MG with a new 12 MG Reservoir rather than upgrading the 8 MG Reservoir.
7	**JVWTP 1 MG Reservoir**	4	2	5	5	5	5		5	5	5	5	5	5	5	3	5	5	5	5	5	89	Pretty tough to bypass the 1 MG Reservoir to operate JVWTP at 180 MGD due to providing process water for Chemical feed and other utility water uses. This Reservoir has no redundancy so need to consider for 10 year Plan to construct another reservoir as backup
8	**Old Bingham 3 MG Tank**	3	1	4	4	4	3	1		3	2	3	3	3	2	1	1	1	2	2	2	45	Still have Kennecott Bingham Canyon WTP (3 MGD) to bckup this Old Bingham Tank
9	**Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete**	3	1	4	4	4	3	1	3		3	3	3	3	2	1	1	1	2	2	2	46	
10	**Terminal Reservoir (100 MG)**	5	1	5	5	5	4	1	4	3		4	3	3	4	2	3	3	3	3	3	64	
11	**Jordan Narrows Pump Station**	3	1	4	4	4	4	1	3	3	2		2	2	3	1	3	3	3	3	3	52	This is to provide irrigation water, but there is an exchange agreement with irrigators that drives this PS. 25,000 to 30,000 Ac-Ft exchange is pumped through this PS.
12	**118th South Zone C Pump Station**	4	1	5	5	5	5	1	3	3	3	4		3	4	1	3	3	3	3	3	62	
13	**Pump Station serving Zone B North (3200 W. 6200 S.)**	4	1	5	5	5	5	1	3	3	3	4	3		4	1	3	3	3	3	3	62	
14	**Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W**	4	1	4	4	4	4	1	4	4	2	3	2	2		1	2	2	2	2	2	50	Member agencies served: KID GHID, TBID, and Magna WD.
15	**Jordan Aqueduct (Reaches 1 – 4)**	5	3	5	5	5	5	3	5	5	4	5	5	5	5		5	5	5	5	5	90	
16	**Central Pipeline**	4	1	5	5	5	5	1	5	5	3	3	3	3	4	1		3	3	3	3	65	
17	**150th South Pipeline**	4	1	5	5	5	5	1	5	5	3	3	3	3	4	1	3		3	3	3	65	
18	**24" Cross Valley Pipeline**	4	1	5	5	5	4	1	4	4	3	3	3	3	4	1	3	3		3	3	62	
19	**Creek Road Pipeline (24" to 33")**	4	1	5	5	5	4	1	4	4	3	3	3	3	4	1	3	3	3		3	62	
20	**114th South Pipeline**	4	1	5	5	5	4	1	4	4	3	3	3	3	4	1	3	3	3	3		62	

Reliability Definition:
Reliability: Consistently delivering water services to customers with priority for indoor demands and maintaining minimum water pressure

JVWCD HMP Project
Asset Prioritization
April 2, 2021

Asset Number	Quality	South East Regional Water Treatment Plant (20 MGD)	Jordan Valley Water Treatment Plant (180 MGD)	Moniter Drive Well	Newbury Well	1443 E. 9400 S. Well	JVWTP 8 MG Reservoir	JVWTP 1 MG Reservoir	Old Bingham 3 MG Tank	Zone B North Reservoirs 1 MG steel, 2 MG buried conc	Terminal Reservoir (100 MG)	Jordan Narrows Pump Station	118th South Zone C Pump Station	Pump Station serving Zone B North (3200 W. 6200 S.)	Pump Station along 102nd South Zone D: Old Bingham	Jordan Aqueduct (Reaches 1 – 4)	Central Pipeline	150th South Pipeline	24" Cross Valley Pipeline	Creek Road Pipeline (24" to 33")	114th South Pipeline	Sum	
1	**South East Regional Water Treatment Plant (20 MGD)**		3	4	4	4	4	3	4	4	4	5	5	5	5	4	4	4	4	4	4	78	
2	**Jordan Valley Water Treatment Plant (180 MGD)**	3		4	4	4	4	3	4	4	4	5	5	5	5	4	4	4	4	4	4	78	
3	**Moniter Drive Well**	2	2		3	3	3	4	4	4	3	5	3	3	3	3	3	3	3	3	3	60	Fluoride is fed at all 3 Well and also Chlorine feed is available.
4	**Newbury Well**	2	2	3		3	3	4	4	4	3	5	3	3	3	3	3	3	3	3	3	60	
5	**1443 E. 9400 S. Well**	2	2	3	3		3	4	4	4	3	5	3	3	3	3	3	3	3	3	3	60	
6	**JVWTP 8 MG Reservoir**	2	2	3	3	3		2	3	3	3	5	3	3	3	3	3	3	3	3	3	56	Could be used for Chlorine contact time, but currently using 12 MG reservoir.
7	**JVWTP 1 MG Reservoir**	3	3	2	2	2	4		3	3	3	5	3	3	3	3	3	3	3	3	3	57	Essential to make JVWTP operational for chemical feed.
8	**Old Bingham 3 MG Tank**	2	2	2	2	2	3	3		3	3	5	3	3	3	3	3	3	3	3	3	54	
9	**Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete**	2	2	2	2	2	3	3	3		3	5	3	3	3	3	3	3	3	3	3	54	
10	**Terminal Reservoir (100 MG)**	2	2	3	3	3	3	3	3	3		5	3	3	3	3	3	3	3	3	3	57	Chlorine feed to the Terminal Reservoir via JA-3
11	**Jordan Narrows Pump Station**	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	19	
12	**118th South Zone C Pump Station**	1	1	3	3	3	3	3	3	3	3	5		3	3	3	3	3	3	3	3	55	
13	**Pump Station serving Zone B North (3200 W. 6200 S.)**	1	1	3	3	3	3	3	3	3	3	5	3		3	3	3	3	3	3	3	55	
14	**Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W**	1	1	3	3	3	3	3	3	3	3	5	3	3		3	3	3	3	3	3	55	
15	**Jordan Aqueduct (Reaches 1 – 4)**	2	2	3	3	3	3	3	3	3	3	5	3	3	3		3	3	3	3	3	57	
16	**Central Pipeline**	2	2	3	3	3	3	3	3	3	3	5	3	3	3	3		3	3	3	3	57	
17	**150th South Pipeline**	2	2	3	3	3	3	3	3	3	3	5	3	3	3	3	3		3	3	3	57	
18	**24" Cross Valley Pipeline**	2	2	3	3	3	3	3	3	3	3	5	3	3	3	3	3	3		3	3	57	
19	**Creek Road Pipeline (24" to 33")**	2	2	3	3	3	3	3	3	3	3	5	3	3	3	3	3	3	3		3	57	
20	**114th South Pipeline**	2	2	3	3	3	3	3	3	3	3	5	3	3	3	3	3	3	3	3		57	

Quality Definition:

Quality: Meeting all Federal, State and internal water quality standards for drinking water

JVWCD HMP Project
Asset Prioritization
April 2, 2021

Asset Number	Safety	South East Regional Water Treatment Plant (20 MGD)	Jordan Valley Water Treatment Plant (180 MGD)	Moniter Drive Well	Newbury Well	1443 E. 9400 S. Well	JVWTP 8 MG Reservoir	JVWTP 1 MG Reservoir	Old Bingham 3 MG Tank	Zone B North Reservoirs 1 MG steel, 2 MG buried concr	Terminal Reservoir (100 MG)	Jordan Narrows Pump Station	118th South Zone C Pump Station	Pump Station serving Zone B North (3200 W. 6200 S.)	Pump Station along 102nd South Zone D: Old Bingham	Jordan Aqueduct (Reaches 1 – 4)	Central Pipeline	150th South Pipeline	24" Cross Valley Pipeline	Creek Road Pipeline (24" to 33")	114th South Pipeline	Sum	
1	**South East Regional Water Treatment Plant (20 MGD)**		2	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	**89**	SERWTP has fluoride, NaOCl present which has a higher safety hazard. Higher quantities at SERWTP site than Wells and manned WTP vs unmanned Well sites.
2	**Jordan Valley Water Treatment Plant (180 MGD)**	4		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	**94**	High safety hazard at JVWTP due to gaseous Chlorine and large number of people present at this facility than all others in the District. Also, neigbors near plant have a safety issue.
3	**Moniter Drive Well**	2	1		3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	**69**	Fluoride chemicals at Wells present a higher safety hazard
4	**Newbury Well**	2	1	3		3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	**69**	
5	**1443 E. 9400 S. Well**	2	1	3	3		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	**69**	
6	**JVWTP 8 MG Reservoir**	1	1	2	2	2		3	3	3	3	3	3	3	3	3	3	3	3	3	3	**50**	Confined space in vaults associated with pipelines & Reservoirs
7	**JVWTP 1 MG Reservoir**	1	1	2	2	2	3		3	3	3	3	3	3	3	3	3	3	3	3	3	**50**	
8	**Old Bingham 3 MG Tank**	1	1	2	2	2	3	3		3	3	3	3	3	3	3	3	3	3	3	3	**50**	
9	**Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete**	1	1	2	2	2	3	3	3		3	3	3	3	3	3	3	3	3	3	3	**50**	
10	**Terminal Reservoir (100 MG)**	1	1	2	2	2	3	3	3	3		3	3	3	3	3	3	3	3	3	3	**50**	
11	**Jordan Narrows Pump Station**	1	1	2	2	2	3	3	3	3	3		3	3	3	3	3	3	3	3	3	**50**	Pump stations can also have vaults that are accessed outside of the building and electrical safety issues, so essentially equivalent to Reservoirs & Pipelines for safety.
12	**118th South Zone C Pump Station**	1	1	2	2	2	3	3	3	3	3	3		3	3	3	3	3	3	3	3	**50**	
13	**Pump Station serving Zone B North (3200 W. 6200 S.)**	1	1	2	2	2	3	3	3	3	3	3	3		3	3	3	3	3	3	3	**50**	
14	**Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W**	1	1	2	2	2	3	3	3	3	3	3	3	3		3	3	3	3	3	3	**50**	
15	**Jordan Aqueduct (Reaches 1 – 4)**	1	1	2	2	2	3	3	3	3	3	3	3	3	3		3	3	3	3	3	**50**	Confined space in vaults associated with pipelines & Reservoirs
16	**Central Pipeline**	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3		3	3	3	3	**50**	
17	**150th South Pipeline**	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3	3		3	3	3	**50**	
18	**24" Cross Valley Pipeline**	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3		3	3	**50**	
19	**Creek Road Pipeline (24" to 33")**	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3		3	**50**	
20	**114th South Pipeline**	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3		**50**	

Safety Definition:

Safety: Employee safety, public safety, injury/illness/deaths associated with critical assets. This does not include water quality safety issues. Does not include property damage liability in Value criteria.

JVWCD HMP Project
Asset Prioritization
April 2, 2021

Asset Number	Value	South East Regional Water Treatment Plant (20 MGD)	Jordan Valley Water Treatment Plant (180 MGD)	Moniter Drive Well	Newbury Well	1443 E. 9400 S. Well	JVWTP 8 MG Reservoir	JVWTP 1 MG Reservoir	Old Bingham 3 MG Tank	Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete	Terminal Reservoir (100 MG)	Jordan Narrows Pump Station	118th South Zone C Pump Station	Pump Station serving Zone B North (3200 W. 6200 S.)	Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W	Jordan Aqueduct (Reaches 1 – 4)	Central Pipeline	150th South Pipeline	24" Cross Valley Pipeline	Creek Road Pipeline (24" to 33")	114th South Pipeline	Sum	Insurance Values
1	**South East Regional Water Treatment Plant (20 MGD)**		2	5	5	5	4	4	5	4	2	4	4	4	4	2	3	3	3	3	3	69	$48.5M
2	**Jordan Valley Water Treatment Plant (180 MGD)**	4		5	5	5	5	5	5	5	4	5	5	5	5	4	4	4	4	4	4	87	$434M
3	**Moniter Drive Well**	1	1		3	3	2	2	3	2	2	2	2	2	2	1	2	2	2	2	2	38	$75M for all wells, so approx. $2.5M per Well
4	**Newbury Well**	1	1	3		3	2	2	3	2	2	2	2	2	2	1	2	2	2	2	2	38	
5	**1443 E. 9400 S. Well**	1	1	3	3		2	2	3	2	2	2	2	2	2	1	2	2	2	2	2	38	
6	**JVWTP 8 MG Reservoir**	2	1	4	4	4		2	4	3	2	4	4	4	4	1	2	2	2	2	2	53	$8M estimated at $1/Gallon Could cause flooding to nearby neighborhood, but maybe dampened by being buried. Welby canal could potentially catch release from this tank.
7	**JVWTP 1 MG Reservoir**	2	1	4	4	4	4		4	4	2	4	4	4	4	1	2	2	2	2	2	56	$1M estimated at $1/Gallon catestrophic failure could impact Mountain View Corridor roadway
8	**Old Bingham 3 MG Tank**	1	1	3	3	3	2	2		2	1	4	4	4	4	1	2	2	2	2	2	45	$3M estimated at $1/Gallon. Mostly burried so probably not a major flooding issue.
9	**Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete**	2	1	4	4	4	3	2	4		2	4	4	4	4	1	2	2	2	2	2	53	$9M estimated at $1/Gallon
10	**Terminal Reservoir (100 MG)**	4	2	4	4	4	4	4	5	4		5	5	5	5	2	3	3	3	3	3	72	$130M Bangerter Hwy below the burried Reservoirs which are located above the Hwy on a hill.
11	**Jordan Narrows Pump Station**	2	1	4	4	4	2	2	2	2	1		2	2	2	1	2	2	2	2	2	41	$14.5M
12	**118th South Zone C Pump Station**	2	1	4	4	4	2	2	2	2	1	4		3	3	1	2	2	2	2	2	45	$45M Total for all PSs -> assume approx. $6M to $7M each PS
13	**Pump Station serving Zone B North (3200 W. 6200 S.)**	2	1	4	4	4	2	2	2	2	1	4	3		3	1	2	2	2	2	2	45	
14	**Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W**	2	1	4	4	4	2	2	2	2	1	4	3	3		1	2	2	2	2	2	45	
15	**Jordan Aqueduct (Reaches 1 – 4)**	4	2	5	5	5	5	5	5	5	4	5	5	5	5		4	4	4	4	4	85	$257M
16	**Central Pipeline**	3	2	4	4	4	4	4	4	4	3	4	4	4	4	2		3	3	3	3	66	$21.5M
17	**150th South Pipeline**	3	2	4	4	4	4	4	4	4	3	4	4	4	4	2	3		3	3	3	66	$16M
18	**24" Cross Valley Pipeline**	3	2	4	4	4	4	4	4	4	3	4	4	4	4	2	3	3		3	3	66	Not Insured: $25M from Asset Mgmt Plan replacement value
19	**Creek Road Pipeline (24" to 33")**	3	2	4	4	4	4	4	4	4	3	4	4	4	4	2	3	3	3		3	66	Not Insured: $34M from Asset Mgmt Plan replacement value
20	**114th South Pipeline**	3	2	4	4	4	4	4	4	4	3	4	4	4	4	2	3	3	3	3		66	Not Insured: $27M from Asset Mgmt Plan replacement value

Value:

Value: Financial Accountability in terms of efficient & cost-effective management of assets (i.e., costs, property, value, employees, customers, etc)

JVWCD HMP Project
Asset Prioritization
April 2, 2021

Asset Number	Summary Sheet	Reliability			Quality			Safety			Value			Total Weighted Sum	Normalized Asset Score	Rank	1.00 Overall Asset Score
		Sum (Reliability)	Pairwise Criteria Evaluation	Weighted Sum	Sum (Quality)	Pairwise Criteria Evaluation	Weighted Sum	Sum (Safety)	Pairwise Criteria Evaluation	Weighted Sum	Sum (Value)	Pairwise Criteria Evaluation	Weighted Sum				
1	South East Regional Water Treatment Plant (20 MGD)	46	13	598	78	8	624	89	11	979	69	4	276	2477	0.72	3	0.72
2	Jordan Valley Water Treatment Plant (180 MGD)	92	13	1196	78	8	624	94	11	1034	87	4	348	3202	0.94	1	0.94
3	Moniter Drive Well	29	13	377	60	8	480	69	11	759	38	4	152	1768	0.52	16	0.52
4	Newbury Well	29	13	377	60	8	480	69	11	759	38	4	152	1768	0.52	16	0.52
5	1443 E. 9400 S. Well	30	13	390	60	8	480	69	11	759	38	4	152	1781	0.52	15	0.52
6	JVWTP 8 MG Reservoir	38	13	494	56	8	448	50	11	550	53	4	212	1704	0.50	19	0.50
7	JVWTP 1 MG Reservoir	89	13	1157	57	8	456	50	11	550	56	4	224	2387	0.70	4	0.70
8	Old Bingham 3 MG Tank	45	13	585	54	8	432	50	11	550	45	4	180	1747	0.51	18	0.51
9	Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete	46	13	598	54	8	432	50	11	550	53	4	212	1792	0.52	14	0.52
10	Terminal Reservoir (100 MG)	64	13	832	57	8	456	50	11	550	72	4	288	2126	0.62	5	0.62
11	Jordan Narrows Pump Station	52	13	676	19	8	152	50	11	550	41	4	164	1542	0.45	20	0.45
12	118th South Zone C Pump Station	62	13	806	55	8	440	50	11	550	45	4	180	1976	0.58	11	0.58
13	Pump Station serving Zone B North (3200 W. 6200 S.)	62	13	806	55	8	440	50	11	550	45	4	180	1976	0.58	11	0.58
14	Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W	50	13	650	55	8	440	50	11	550	45	4	180	1820	0.53	13	0.53
15	Jordan Aqueduct (Reaches 1 – 4)	90	13	1170	57	8	456	50	11	550	85	4	340	2516	0.74	2	0.74
16	Central Pipeline	65	13	845	57	8	456	50	11	550	66	4	264	2115	0.62	6	0.62
17	150th South Pipeline	65	13	845	57	8	456	50	11	550	66	4	264	2115	0.62	6	0.62
18	24” Cross Valley Pipeline	62	13	806	57	8	456	50	11	550	66	4	264	2076	0.61	8	0.61
19	Creek Road Pipeline (24” to 33”)	62	13	806	57	8	456	50	11	550	66	4	264	2076	0.61	8	0.61
20	114th South Pipeline	62	13	806	57	8	456	50	11	550	66	4	264	2076	0.61	8	0.61

Tier 1	1-5
Tier 2	6-10
Tier 3	11-15
Tier 4	16-20

Highest Possible Score = 3420

Appendix D: Risk Screening & Selection

Preliminary Risk Screening Table_2021 0427

Final Risk Screening and Selection Table_2021 0607

JVWCD HMP - Project Planning #2 Meeting Minutes_2021 0428

Asset-Hazard Pair and Estimated Consequence Matrix

Risk Screening Table

Assets - LCWTP HAP	GS / BC Debris Flow	BC / ECG Drought	GS / BC Earthquake - Ground Shaking (2PE50 &	GS / BC Earthquake – Liquefaction	GS / BC Earthquake - Surface Fault Rupture/Fault Crossings	BC / ECG Flood	GS / BC Landslide including Rockfall	BC / ECG Lightning	GS / BC Problem Soils (including collapsible soils, expansive soils, erosion, & undocumented fills)	BC / ECG Severe Wind	BC / ECG Severe Winter Weather	BC / ECG Wildfire	H	N/S	M	L	N/A	
									Natural Hazards									
1 South East Regional Water Treatment Plant (SERWTP)	N/A	H	H	N/A	N/A	L	N/A	H	L	L	L	H	4	0	0	4	4	
2 Jordan Valley Water Treatment Plant (JVWTP)	N/A	H	H	N/A	N/A	L	N/A	H	L	M	L	H	4	0	1	3	4	
3 Moniter Drive Well	N/A	M	H	N/A	N/A	L	N/A	M	L	L	L	L	1	0	2	5	4	
4 Newbury Well	N/A	M	H	N/A	N/A	L	N/A	M	L	L	L	L	1	0	2	5	4	
5 1443 E. 9400 S. Well	N/A	M	H	N/A	N/A	L	N/A	M	L	L	L	L	1	0	2	5	4	
6 JVWTP 8 MG Reservoir	M	N/A	H	N/A	N/A	L	N/A	L	L	L	L	L	1	0	1	6	4	
7 JVWTP 1 MG Reservoir	N/A	N/A	H	N/A	N/A	L	N/A	L	L	L	L	L	1	0	0	6	5	
8 Old Bingham 3 MG Tank	N/A	N/A	H	N/A	N/A	L	N/A	L	L	M	L	L	1	0	1	5	5	
9 Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete	N/A	N/A	H	H	N/A	L	N/A	L	L	M	L	L	2	0	1	5	4	
10 Terminal Reservoir (100 MG)	N/A	N/A	M	N/A	N/A	L	N/A	M	L	L	L	L	0	0	2	5	5	
11 Jordan Narrows Pump Station	N/A	M	H	H	N/A	H	L	H	L	M	L	L	4	0	2	4	2	
12 118th South Zone C Pump Station	N/A	N/A	H	N/A	N/A	L	N/A	H	L	L	L	L	2	0	0	5	5	
13 Pump Station serving Zone B North (3200 W. 6200 S.)	N/A	N/A	H	N/A	N/A	L	N/A	H	L	L	L	L	2	0	0	5	5	
14 Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W	N/A	N/A	H	N/A	N/A	L	N/A	H	L	L	L	L	2	0	0	5	5	
15 Jordan Aqueduct (Reaches 1 – 4)	H	H	H	H	H	M	H	N/A	L	N/A	L	H	7	0	1	2	2	
16 Central Pipeline	L	N/A	H	H	N/A	L	H	N/A	L	N/A	L	N/A	3	0	0	4	5	
17 150th South Pipeline	L	N/A	H	H	N/A	L	N/A	N/A	L	N/A	L	N/A	2	0	0	4	6	
18 24” Cross Valley Pipeline	N/A	N/A	H	H	H	L	N/A	N/A	L	N/A	L	N/A	3	0	0	3	6	
19 Creek Road Pipeline (24” to 33”)	N/A	N/A	H	H	N/A	L	N/A	N/A	L	N/A	L	N/A	2	0	0	3	7	
20 114th South Pipeline	L	N/A	H	H	N/A	L	N/A	N/A	L	N/A	L	N/A	2	0	0	4	6	
													45	**0**	**15**	**88**	**92**	**240** **Totals**
Number of **Highs**	1	3	19	8	2	1	2	6	0	0	0	3	**45**	**District to Select up to Top 40 Pairs**				
Number of **N/Ss**	0	0	0	0	0	0	0	0	0	0	0	0	**0**					
Number of **Mediums**	1	4	1	0	0	1	0	4	0	4	0	0	**15**					
Number of **Lows**	3	0	0	0	0	18	1	4	20	10	20	12	**88**					
Number of N/As	15	13	0	12	18	0	17	6	0	6	0	5	**92**					
													240 **Totals**					

Estimated Consequence Scores

H	**High (H)**: asset completely disabled; utility's mission fully or nearly defeated; deaths, injuries, or other high costs.
N/S	Not Selected (N/S): initial scoring of H, but not selected by Utility for further assessment due to limited resources.
M	**Medium (M)**: asset partially disabled; utility's mission moderately impacted; moderate amount of other costs.
L	**Low (L)**: asset not or only slightly disabled; utility's mission only slightly impacted; low amount of other costs.
N/A	**Not Applicable (N/A)**: given threat cannot be carried out at, or otherwise does not apply to, the given asset.

Asset-Hazard Pair and Estimated Consequence Matrix

Risk Screening Table	GS / BC	BC / ECG	GS / BC	GS / BC	GS / BC	BC / ECG	GS / BC	BC / ECG	GS / BC	BC / ECG	BC / ECG	BC / ECG					
	Natural Hazards																
Assets - JVWCD HMP	Debris Flow	Drought	Earthquake - Ground Shaking (2PE50 &	Earthquake – Liquefaction	Earthquake - Surface Fault Rupture/Fault Crossings	Flood	Landslide including Rockfall	Lightning	Problem Soils (including collapsible soils, expansive soils, erosion, & undocumented fills)	Severe Wind	Severe Winter Weather	Wildfire	**H**	**N/S**	**M**	**L**	**N/A**
1 South East Regional Water Treatment Plant (SERWTP)	N/A	H	H	N/A	N/A	N/A	N/A	H	L	L	L	H	4	0	0	3	5
2 Jordan Valley Water Treatment Plant (JVWTP)	M	H	H	N/A	N/A	L	N/A	M	L	L	L	H	3	0	2	4	3
3 Moniter Drive Well	N/A	L	H	N/A	N/A	N/A	N/A	M	L	L	L	N/A	1	0	1	4	6
4 Newbury Well	N/A	L	H	N/A	N/A	N/A	N/A	M	L	L	L	L	1	0	1	5	5
5 1443 E. 9400 S. Well	N/A	L	H	N/A	N/A	N/A	N/A	M	L	L	L	N/A	1	0	1	4	6
6 JVWTP 8 MG Reservoir	M	N/A	H	N/A	N/A	N/A	N/A	L	L	L	L	N/A	1	0	1	4	6
7 JVWTP 1 MG Reservoir	N/A	N/A	H	N/A	N/A	N/A	N/A	L	L	L	L	N/A	1	0	0	4	7
8 Old Bingham 3 MG Tank	N/A	N/A	H	N/A	N/A	N/A	N/A	L	L	L	L	N/A	1	0	0	4	7
9 Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete	N/A	N/A	H	H	N/A	N/A	N/A	L	L	L	L	N/A	2	0	0	4	6
10 Terminal Reservoir (100 MG)	N/A	N/A	M	N/A	N/A	N/A	N/A	L	L	L	L	L	0	0	1	5	6
11 Jordan Narrows Pump Station	L	M	H	H	N/A	H	M	H	L	L	L	M	4	0	3	4	1
12 118th South Zone C Pump Station	N/A	N/A	H	N/A	N/A	L	N/A	H	L	L	L	N/A	2	0	0	4	6
13 Pump Station serving Zone B North (3200 W. 6200 S.)	N/A	N/A	H	N/A	N/A	N/A	N/A	H	L	L	L	N/A	2	0	0	3	7
14 Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W	N/A	N/A	M	N/A	N/A	N/A	N/A	H	L	L	L	N/A	1	0	1	3	7
15 Jordan Aqueduct (Reaches 1 – 4)	N/S	N/A	H	H	H	M	H	L	L	N/A	L	M	4	1	2	3	2
16 Central Pipeline	L	N/A	H	H	N/A	M	H	L	L	N/A	L	N/A	3	0	1	4	4
17 150th South Pipeline	L	N/A	H	H	N/A	M	N/A	L	L	N/A	L	N/A	2	0	1	4	5
18 24” Cross Valley Pipeline	N/A	N/A	H	H	H	M	N/A	L	L	N/A	L	N/A	3	0	1	3	5
19 Creek Road Pipeline (24” to 33”)	N/A	N/A	H	H	N/A	M	N/A	L	L	N/A	L	N/A	2	0	1	3	6
20 114th South Pipeline	N/A	N/A	H	H	N/A	M	N/A	L	L	N/A	L	N/A	2	0	1	3	6
													40	**1**	**18**	**75**	**106**	**240**	**Totals**
Number of **Highs**	0	2	18	8	2	1	2	5	0	0	0	2	**40**	**District to Select up to Top 40 Pairs**					
Number of **N/Ss**	1	0	0	0	0	0	0	0	0	0	0	0	**1**						
Number of **Mediums**	2	1	2	0	0	6	1	4	0	0	0	2	**18**						
Number of **Lows**	3	3	0	0	0	2	0	11	20	14	20	2	**75**						
Number of N/As	14	14	0	12	18	11	17	0	0	6	0	14	**106**						
													240						
													Totals						

Estimated Consequence Scores

H	**High (H)**: asset completely disabled; utility's mission fully or nearly defeated; deaths, injuries, or other high costs.
N/S	Not Selected (N/S): initial scoring of H, but not selected by Utility for further assessment due to limited resources.
M	**Medium (M)**: asset partially disabled; utility's mission moderately impacted; moderate amount of other costs.
L	**Low (L)**: asset not or only slightly disabled; utility's mission only slightly impacted; low amount of other costs.
N/A	**Not Applicable (N/A)**: given threat cannot be carried out at, or otherwise does not apply to, the given asset.

Meeting Minutes

6975 Union Park Center, Suite 490
Midvale, UT 84047-4135

T: 801.316.9800

Prepared for: Jordan Valley Water Conservancy District
Project Title: Hazard Mitigation Plan
Project No.: 156690

Purpose of Meeting: Planning Team Meeting #2 (Risk Screening) **Date:** April 28, 2021
Meeting Location: Virtual Zoom Meeting **Time:** 1 – 5 PM
Minutes Prepared by: Shania Lynch, Brown and Caldwell

Attendees:

Alan Packard, JVWCD	Brian Callister, JVWCD
Bryon Elwell, ELWELL Consulting Group	David McLean, JVWCD
Gordon Batt, JVWCD	Hiram Alba, Geo Strata
Jacob Young, Brown and Caldwell	Jeff King, JVWCD
Jeremy Williams, Brown and Caldwell	Marcelo Anglade, JVWCD
Matt Hinckley, JVWCD	Shane Swensen, JVWCD
Shazelle Terry, JVWCD	Sofia Agopian, Geo Strata

Summary

1. Meeting Objectives

Bryon reviewed today's meeting objectives for Phase B Risk Assessment as follows:

- Review hazard profile table & finalize
- Review Final Asset list
- Review Risk Screening Table (hazard-asset pairs)
- Verify consequence ratings in Risk Screening Table
- Select up to 40 hazard-asset pairs from Risk Screening Table
- Confirm next steps for risk analysis
- Review document request list & project schedule

2. Review Tasks 4, 5, & 6 (Preface)

Bryon reviewed the Hazard Profile Table dated 4/19/21 with the Planning Team and there were no comments, so this Hazard Profile Table is now considered Final. Bryon briefly reviewed the Final Asset List dated 4/1/21 which was used to develop the Risk Screening Table that will be reviewed in detail next with the Planning Team. Finally, Bryon provided a brief overview of today's risk screening table and the process of screening all of the assets against the hazards.

3. Risk Screening Table

Bryon led the review of the Risk Screening Table with the Planning Team. This included assistance from the ECG Team and discussion and input from the JVWCD Planning Team on reviewing the 240 hazard-asset pairs for their consequence scoring. The results of that review and scoring are as follows:

Debris Flow - risk was evaluated with recorded debris flow events.

- Asset 2 – Jordan Valley Water Treatment Plant (12 MG Reservoir, Sedimentation Basins and JVWTP facilities) are subject to the same debris flow as Asset 6 – JVWTP 8 MG Reservoir. **Change to Medium Consequence Score.**
- Asset 11 – Jordan Narrows Pump Station has similar impacts as Asset 16, 17 and 20 pipelines. **Change to Low Consequence Score.**
- Asset 15 – Jordan Aqueduct (Reaches 1-4) initial high consequence score but not selected for further assessment due to limited resources. **Change to Not Selected (N/S) Consequence Score.**
- Asset 20 – 114th South Pipeline changed from low consequence score to not applicable. **Change to Not Applicable (N/A) Consequence Score.**

Drought

- Asset 3, 4, and 5 – Wells have been changed by the District from medium to low consequence scores because out of 45 wells there may be only some impact on lowering of the aquifer, which will occur of a longer period of time. Adding more wells and groundwater recharge is a potential mitigation measure. **Change to Low Consequence Score.**
- Asset 15 – Jordan Aqueduct (Reaches 1-4) changed from high consequence score to not applicable. There is a potential high consequence for raw water/low water quantity available that could impact JVWTP and already covered in JVWTP high consequence risk assessment. **Change to Not Applicable (N/A) Consequence Score.**

Earthquake – Ground Shaking - risk was evaluated with recorded fault lines.
All assets except for Asset 14 remained the same risk assessment rating. The comments below add further details to the reasoning for each decision.

- Asset 1 and 2 – remain as a high consequence score.
- Assets 3, 4, and 5 – Wells were built in early-mid 2000's and likely not designed for seismic consideration. Assets to remain as a high consequence score.
- Assets 6 and 7 – remain as a high consequence score.
- Asset 8 – Old Bingham 3 MG Tank built in 1976 to remain as a high consequence score based on age of asset.
- Asset 9 – Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete built in the early-mid 60's to remain as a high consequence score based on age of asset.
- Asset 10 – Terminal Reservoir (100 MG) Phase 1 was started in 1984 and Phase 2 in 1997. Asset was built on cut and expected to only be moderately impacted during an earthquake. Asset to remain as a medium consequence score.
- Asset 11 – Jordan Narrows Pump Station built in 1980 to remain as a high consequence score based on age of asset.
- Asset 12 – 118th South Zone C Pump Station built in 2007-2008 to remain as high consequence score. May be considered as a medium consequence score but built in a higher seismic zone than Asset 13.
- Asset 13 – Pump Station serving Zone B North (3200 W. 6200 S.) built in early 1960's to remain as a high consequence score based on age of asset.
- Asset 14 – Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W built in 2007-2008 and built in a lower seismic zone than Asset 12 and to be changed from high to medium consequence score. **Change to Medium Consequence Score.**
- Asset 15 – Jordan Aqueduct (Reaches 1-4) have susceptibilities to fuel hazards and crosses fault lines and to remain as a high consequence score.
- Asset 16 – remain as a high consequence score.
- Asset 17 – 150th South Pipeline built in 2002 to remain as a high consequence score based on age of asset.
- Asset 18 – 24" Cross Valley Pipeline built in 1959 to remain as a high consequence score based on age of asset.
- Asset 19 – Creek Road Pipeline (24" to 33") built in 1960 to remain as a high consequence score based on age of asset.
- Asset 20 – 114th South Pipeline built in 1982 to remain as a high consequence score based on age of asset.

Earthquake – Liquefaction
No changes were made to the original risk assessment ratings.

Earthquake – Surface Fault Rupture/Fault Crossing – risk was evaluated by record fault lines.
No changes were made to the original risk assessment ratings.

Flood – risk was evaluated with recorded 100 year, 500 year and special flood zones.

- Asset 1 – South East Regional Water Treatment Plant. Flood zone located near creek to the side of plant but poses no risk to asset. **Change to Not Applicable (N/A) Consequence Score.**
- Asset 2 – Jordan Valley Water Treatment Plant. Stream channel on east side of the plant and the upper reservoir is a dam which was screened during the hazard profiling. Asset to remain as a low consequence score.
- Assets 3-10 – No flood zones that pose a risk to the assets. **Change to Not Applicable (N/A) Consequence Score.**

- Asset 11 – Jordan Narrows Pump Station is located within flood zones. Asset to remain as a high consequence score.
- Asset 12 – 118th South Zone C Pump Station is located within flood zones. Asset to remain as a low consequence score.
- Assets 13-14 – No flood zones that pose a risk to the assets. **Change to Not Applicable (N/A) Consequence Score.**
- Asset 15 – Jordan Aqueduct (Reaches 1-4) are located within flood zones. The District informed planning team that there had been flooding during construction as the pipelines go under stream crossings. Asset to remain as a medium consequence score.
- Asset 16 – Central Pipeline located within flood zone and has similar exposure as Asset 15. **Change to Medium Consequence Score.**
- Asset 17 – 150th South Pipeline crosses the Jordan River and is within flood zones. **Change to Medium Consequence Score.**
- Asset 18 – 24" Cross Valley Pipeline has creek crossings and is within flood zones. **Change to Medium Consequence Score.**
- Assets 19-20 – Located within flood zones. **Change to Medium Consequence Score.**

Landslide including Rockfall
All assets except for 11 remained the same risk assessment rating. The comments below add further details to the reasoning for each decision.

- Asset 11 – Jordan Narrows Pump Station. Landslide mapped near asset and District indicated landslide near facility in mid-2000's, steeper slopes greater than 30%, and unclassified deposits. **Change to Medium Consequence Score.**
- Asset 15 – Jordan Aqueduct (Reaches 1-4). JA-1 - no landslides mapped but unclassified landslide deposits. JA-2 has shallow landslides mapped. JA-4 has multiple active landslides mapped. Asset to remain as a high consequence score.
- Asset 16 – Central Pipeline to remain as a high consequence score.

Lightening

- Asset 2 – Jordan Valley Water Treatment Plant. No lightning protection systems to prevent damaging electrical switchgear and equipment. **Change to High Consequence Score.**
- Asset 10 – Terminal Reservoir. Even if this went offline the reservoir would still function. **Change to Low Consequence Score.**
- Assets 15-20. Initial risk assessment scored assets 15-20 as N/A. N/A is if there is no electrical equipment. These assets need to have a low consequence score as there is some electrical for valve actuators and other equipment. **Change to Low Consequence Score.**

Problem Soils (including collapsible soils, expansive soils, erosion, & undocumented fills)
No changes were made to the original risk assessment ratings.

Severe Wind

- Asset 2 – Jordan Valley Water Treatment Plant. Recently installed a new membrane due to high winds and other factors. $70k of damages have been repaired to address future wind issues. **Change to Low Consequence Score.**
- Assets 8-9, and 11. **Change to Low Consequence Score.**

Severe Winter Weather
No changes were made to the original risk assessment ratings.

Wildfire

- Assets 3, 5-9, and 12-14. **Change to Not Applicable (N/A) Consequence Score.**
- Asset 11 – Jordan Narrows Pump Station. Wildland interface presents more wildfire potential. **Change to Medium Consequence Score.**
- Asset 15 – Jordan Aqueduct (Reaches 1-4) Raw water Reaches 1 and 4 may contribute to poor water quality but no need to double count with Asset 2. Exposure to landslide/debris flow due to Wildfire. **Change to Medium Consequence Score.**

4. Hazard-Asset Pair Selection

After completing the Risk Screening there were 41 hazard-asset pairs with High consequence scores, so the JVWCD Planning Team only needed to identify 1 of those pairs to not select for further risk analysis. After discussion, the Planning Team decided not to select the Debris Flow hazard for the Jordan Aqueduct Reaches 1-4 asset pair, which resulted in the 40 hazard-asset pairs that will be advanced to the next step of risk analysis (see .

5. Next Steps, Info/Doc Request List & Schedule

Reviewed the next steps in the HMP planning process which will include completing the consequence assessment and holding a Risk Assessment Workshop to assess the risk of the 40 asset-hazard pairs selected by the District Planning Team at today's Risk Screening. To prepare for the Risk Assessment Workshop, consequence metrics were reviewed and edited by the Planning Team. Then an example risk analysis table was reviewed with the Planning Team to prepare them for the upcoming Workshop. Reviewed the Info/Document Request List V4 dated 4/28/21 draft and made notes in order to finalize the revision 4 of this list. Finally, the project schedule was then reviewed and confirmed the two upcoming meeting dates and times for Risk Assessment Workshop to be held on 5/27/21 from 1 to 3 pm, and Stakeholder Meeting #2 to be held on 6/8/21 from 9 to 11 am.

Meeting Summary/Recap – Assignments

A brief review of today's meeting results was provided by Bryon and action items were notes as listed below.

Action Required

The following are a list of actions required as a result of the meeting discussion:

1. Prepare meeting results. *Bryon by 4/30/21* including:
   a. Sign-in Sheet/Record
   b. Hazard Profiling Table – Final
   c. Consequence Metrics – Final
   d. Risk Screening Table – Final
   e. Info Request List v4 dated 4-28-2021
2. Prepare meeting minutes. *Shania by 5/5/21*
3. Info Request List Assignments – various Planning Team members with due dates (see Info Request List v4 dated 4-28-2021)

Adjourned at 4:40 pm

Appendix E: Risk Analysis & GRAT Top 5

Risk Analysis

Risk Chart

Risk Analysis Metrics

JVWCD HMP - Risk Assessment Workshop Meeting Minutes_2021 0527

Table 3.2 JVWCD HMP Risk Analysis Summary

		A	B	C	D	E	F	G	H	I	L	M	N	O	P	Q	R	S	Consequence (C)	System Effectiveness or Vulnerability	Vulnerability of Threat (V)	Conditional Risk (R = C x V x 1)	Relative Likelihood (R$_L$)	Relative Risk (R = C x V x R$_L$)	Risk Score	Average Risk Score	Weighted Average Calc	Weighted Average Risk Score
					Consequence				System Effectiveness				Vulnerability															
		Asset	Hazard Scenario Description (Baseline Assessment)	Threat Type	Public Health & Safety Effects (deaths, injuries, sicknesses)	Economic Loss of Physical Assets (replacement cost)	Loss of Service (service outage duration)	CONSEQUENCE (C)	Threat #1 - Contamination of Product/Source Water - Intentional/Accidental	Threat #2 - Directed: Active Shooter	Threat #3 - Process Sabotage Cyber - Insider/Outsider	Threat #4 - Physical Attacks (Aircraft-Borne IED, & Drone)	Threat #5 - Natural Hazard	Threat #6 - Dependency/Proximity	VULNERABILITY (V (V or 1-Sys Eff)	Conditional Risk (R = C x V x 1)	RELATIVE LIKELIHOOD (R$_L$)	RELATIVE RISK (R = C x V x R$_L$)										
1	ECG		SERWTP is dependent on raw water sources (Creek runoff in spring & SLA in late summer) that are impacted by Drought that results in a 25% or more reduction in production during the peak water demand summer months.	N(D)	L	ML	H	H	-	-	-	-	M	-	M	M	MH	ML	0.9	0.5	0.5	0.45	0.6	0.27	2		2.0	
2	GS/E ECG	1 South East Regional Water Treatment Plant (SERWTP)	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to Operations & Filter Bldgs and equipment due to ground shaking, and/or liquefaction	N(E-WF)	ML	H	VH	VH	-	-	-	-	VH	-	VH	H	M	MH	1	0.9	0.9	0.9	0.5	0.45	4		4.0	
3	ECG/BC		Lightning strike at SERWTP causes damages to electrical switchgear and/or equipment at WTP, since no lightning protection system.	N(L)	L	MH	MH	MH	-	-	-	-	M	-	M	ML	VH	M	0.7	0.5	0.5	0.35	0.9	0.315	3		3.0	
4			Wildfire in Watershed causes water quality issues at SERWTP with high turbidity water requiring additional treatment, reduction in production and potential bypassing of WTP at times.	N(W)	L	ML	MH	MH	-	-	-	-	M	-	M	ML	H	ML	0.7	0.5	0.5	0.35	0.8	0.28	2	2.8	2.0	2.8
5			JVWTP is dependent on raw water sources (JA: 1&4 raw water pipelines - Olmsted & Murdock Diversions from Provo River, released from Jordanelle & Deer Creek Reservoirs) that are impacted by Drought that results in a 25% or more reduction in production during the peak water demand summer months.	N(D)	L	H	VH	VH	-	-	-	-	M	-	M	M	MH	M	1	0.5	0.5	0.5	0.6	0.3	3		3.0	
6	GS/E	2 Jordan Valley Water Treatment Plant (JVWTP)	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to Floc/Sed Basins 1 & 2 and raw water ponds due to ground shaking	N(E-WF)	H	VH	VH	VH	-	-	-	-	VH	-	VH	H	M	MH	1	0.9	0.9	0.9	0.5	0.45	4		4.0	
7	ECG/		Wildfire in Watershed causes water quality issues at JVWTP with high turbidity water requiring additional treatment, reduction in production.	N(W)	L	H	VH	VH	-	-	-	-	M	-	M	M	H	M	1	0.5	0.5	0.5	0.8	0.4	3	3.3	3.0	3.3
8			3 Moniter Drive Well	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to non-structural equipment due to ground shaking, and/or liquefaction	N(E-WF)	ML	M	L	M	-	-	-	-	H	-	H	M	M	ML	0.5	0.8	0.8	0.4	0.5	0.2	2	2.0	2.0	2.0
9			4 Newbury Well	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to non-structural equipment due to ground shaking, and/or liquefaction	N(E-WF)	ML	M	L	M	-	-	-	-	H	-	H	M	M	ML	0.5	0.8	0.8	0.4	0.5	0.2	2	2.0	2.0	2.0
10			5 1443 E. 9400 S. Well	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to non-structural equipment due to ground shaking, and/or liquefaction	N(E-WF)	ML	M	L	M	-	-	-	-	H	-	H	M	M	ML	0.5	0.8	0.8	0.4	0.5	0.2	2	2.0	2.0	2.0
11			6 JVWTP 8 MG Reservoir	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to roof & walls at unreinforced expansion joints of concrete reservoir due to ground shaking, and/or liquefaction	N(E-WF)	ML	VH	MH	VH	-	-	-	-	H	-	H	H	M	M	1	0.8	0.8	0.8	0.5	0.4	3	3.0	3.0	3.0
12	GS/BC		7 JVWTP 1 MG Reservoir	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to reservoir structure & piping connections due to ground shaking, and/or liquefaction	N(E-WF)	ML	H	VH	VH	-	-	-	-	H	-	H	H	M	M	1	0.8	0.8	0.8	0.5	0.4	3	3.0	3.0	3.0
13			8 Old Bingham 3 MG Tank	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to tank structure & piping connections due to ground shaking, and/or liquefaction	N(E-WF)	M	H	MH	H	-	-	-	-	H	-	H	MH	M	M	0.9	0.8	0.8	0.72	0.5	0.36	3	3.0	3.0	3.0
14			9 Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to tank structures & piping connections due to ground shaking	N(E-WF)	M	H	H	H	-	-	-	-	H	-	H	MH	M	M	0.9	0.8	0.8	0.72	0.5	0.36	3		3.0	
15				2,500-yr earthquake event occurs on the Wasatch Fault causing damages to tank structures & piping connections due to liquefaction	N(E-WF)	M	M	M	M	-	-	-	-	H	-	H	M	M	ML	0.5	0.8	0.8	0.4	0.5	0.2	2	2.5	2.0	2.5
16			11 Jordan Narrows Pump Station	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to building, intake & piping due to ground shaking	N(E-WF)	L	VH	MH	VH	-	-	-	-	H	-	H	H	M	M	1	0.8	0.8	0.8	0.5	0.4	3		3.0	
17				2,500-yr earthquake event occurs on the Wasatch Fault causing damages to building, intake & piping due to liquefaction/lateral spread	N(E-WF)	L	VH	H	VH	-	-	-	-	H	-	H	H	M	M	1	0.8	0.8	0.8	0.5	0.4	3		3.0	
18				The 100 year flood overtops the bank of the Jordan River and causes minor flood damages to building and equipment at the Jordan Narrows PS.	N(F)	L	M	M	M	-	-	-	-	M		M	ML	M	L	0.5	0.5	0.5	0.25	0.5	0.125	1		1.0	
19	ECG/BC			Lightning strike at Pump Station (PS) causes damages to electrical switchgear and equipment at PS, since building is grounded but no lightning protection system.	N(L)	L	MH	M	MH	-	-	-	-	M	-	M	ML	VH	M	0.7	0.5	0.5	0.35	0.9	0.315	3	2.5	3.0	2.5
20	GS/E		12 118th South Zone C Pump Station	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to non-structural equipment & piping due to ground shaking	N(E-WF)	L	M	M	M	-	-	-	-	M	-	M	ML	M	L	0.5	0.5	0.5	0.25	0.5	0.125	1		1.0	
21	ECG/			Lightning strike at Pump Station (PS) causes damages to electrical switchgear and/or equipment at PS, since building is grounded but no lightning protection system.	N(L)	L	MH	H	H	-	-	-	-	M	-	M	M	VH	M	0.9	0.5	0.5	0.45	0.9	0.405	3	2.0	3.0	2.0
22	GS/E		13 Pump Station serving Zone B North (3200 W. 6200 S.)	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to building structure and non-structural piping & equipment due toground shaking	N(E-WF)	L	H	VH	VH	-	-	-	-	H	-	H	H	M	M	1	0.8	0.8	0.8	0.5	0.4	3		3.0	
23	ECG/BC			Lightning strike at Pump Station (PS) causes damages to electrical switchgear and/or equipment at PS, since building is grounded but no lightning protection system.	N(L)	L	MH	H	H	-	-	-	-	M	-	M	M	VH	M	0.9	0.5	0.5	0.45	0.9	0.405	3	3.0	3.0	3.0
24	ECG/BC		14 Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W	Lightning strike at Pump Station (PS) causes damages to electrical switchgear and/or equipment at PS, since building is grounded but no lightning protection system.	N(L)	L	M	M	M	-	-	-	-	M	-	M	ML	VH	ML	0.5	0.5	0.5	0.25	0.9	0.225	2	2.0	2.0	2.0
25				2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to fault rupture	N(E-WF)	H	VH	VH	VH	-	-	-	-	VH	-	VH	H	M	MH	1	0.9	0.9	0.9	0.5	0.45	4		4.0	
26			15 Jordan Aqueduct (Reaches 1 – 4)	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to ground shaking	N(E-WF)	H	VH	VH	VH	-	-	-	-	VH	-	VH	H	M	MH	1	0.9	0.9	0.9	0.5	0.45	4		4.0	
27				2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to liquefaction	N(E-WF)	M	VH	VH	VH	-	-	-	-	VH	-	VH	H	M	MH	1	0.9	0.9	0.9	0.5	0.45	4		4.0	
28				Landslide movement that damages and causes 1 or more breaks in the pipeline (JA-4)	N(LS)	H	VH	VH	VH	-	-	-	-	VH	-	VH	H	MH	MH	1	0.9	0.9	0.9	0.6	0.54	4	4.0	4.0	4.0
29			16 Central Pipeline	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to ground shaking	N(E-WF)	MH	H	H	H	-	-	-	-	M	-	M	M	M	ML	0.9	0.5	0.5	0.45	0.5	0.225	2		2.0	
30				2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to liquefaction	N(E-WF)	MH	H	H	H	-	-	-	-	M	-	M	M	M	ML	0.9	0.5	0.5	0.45	0.5	0.225	2		2.0	
31				Landslide movement that damages the pipeline and could cause some pipeline leak(s)	N(LS)	L	H	H	H	-	-	-	-	MH	-	MH	M	MH	M	0.9	0.6	0.6	0.54	0.6	0.324	3	2.3	3.0	2.3
32	GS/BC		17 150th South Pipeline	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to ground shaking	N(E-WF)	L	MH	MH	MH	-	-	-	-	H	-	H	M	M	ML	0.7	0.8	0.8	0.56	0.5	0.28	2		2.0	
33				2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to liquefaction	N(E-WF)	L	MH	H	H	-	-	-	-	H	-	H	MH	M	M	0.9	0.8	0.8	0.72	0.5	0.36	3	2.5	3.0	2.5
34			18 24" Cross Valley Pipeline	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to fault rupture	N(E-WF)	M	H	H	H	-	-	-	-	H	-	H	MH	M	M	0.9	0.8	0.8	0.72	0.5	0.36	3		3.0	
35				2,500-yr earthquake event occurs on the Wasatch Fault causing damages topiplelinedue to ground shaking	N(E-WF)	M	MH	MH	MH	-	-	-	-	H	-	H	M	M	ML	0.7	0.8	0.8	0.56	0.5	0.28	2		2.0	
36				2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to liquefaction	N(E-WF)	M	H	H	H	-	-	-	-	H	-	H	MH	M	M	0.9	0.8	0.8	0.72	0.5	0.36	3	2.7	3.0	2.7
37			19 Creek Road Pipeline (24" to 33")	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to ground shaking	N(E-WF)	M	MH	MH	MH	-	-	-	-	H	-	H	M	M	ML	0.7	0.8	0.8	0.56	0.5	0.28	2		2.0	
38				2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to liquefaction	N(E-WF)	M	H	H	H	-	-	-	-	H	-	H	MH	M	M	0.9	0.8	0.8	0.72	0.5	0.36	3	2.5	3.0	2.5
39			20 114th South Pipeline	2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to ground shaking	N(E-WF)	M	MH	MH	MH	-	-	-	-	H	-	H	M	M	ML	0.7	0.8	0.8	0.56	0.5	0.28	2		2.0	
40				2,500-yr earthquake event occurs on the Wasatch Fault causing damages to pipeline due to liquefaction	N(E-WF)	M	H	H	H	-	-	-	-	H	-	H	MH	M	M	0.9	0.8	0.8	0.72	0.5	0.36	3	2.5	3.0	2.5

40

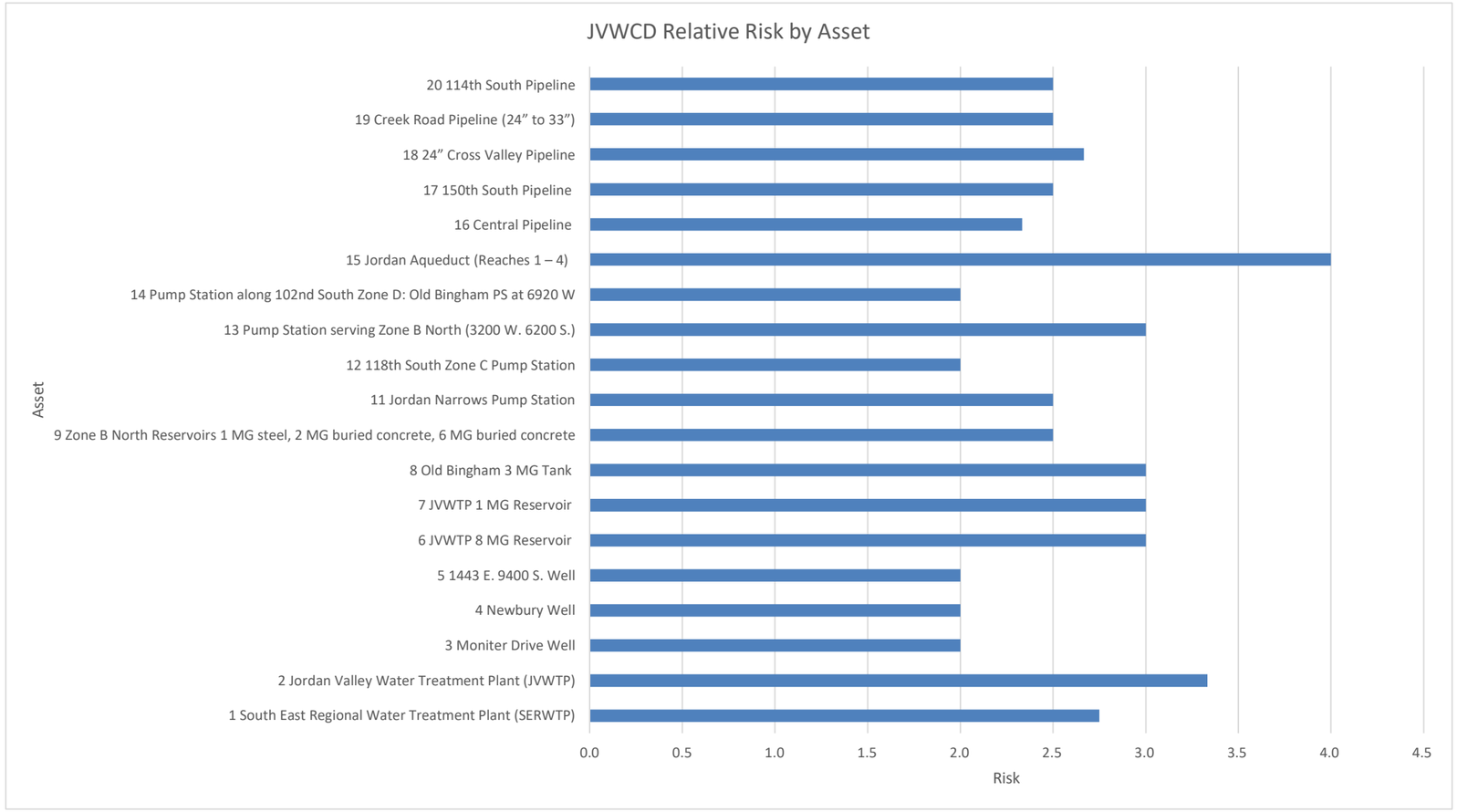
GS/BC	
ECG/BC	

	Risk Score	Average Risk Score	Weighted Average Calc	Weighted Average Risk Score
count:	19		19	
Max:	4.0		4.0	

L	1
ML	2
M	3
MH	4
H	5

Table 3.3 JVWCD Risk Analysis Summary

Asset	
1 South East Regional Water Treatment Plant (SERWTP)	2.8
2 Jordan Valley Water Treatment Plant (JVWTP)	3.3
3 Moniter Drive Well	2.0
4 Newbury Well	2.0
5 1443 E. 9400 S. Well	2.0
6 JVWTP 8 MG Reservoir	3.0
7 JVWTP 1 MG Reservoir	3.0
8 Old Bingham 3 MG Tank	3.0
9 Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete	2.5
11 Jordan Narrows Pump Station	2.5
12 118th South Zone C Pump Station	2.0
13 Pump Station serving Zone B North (3200 W. 6200 S.)	3.0
14 Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W	2.0
15 Jordan Aqueduct (Reaches 1 – 4)	4.0
16 Central Pipeline	2.3
17 150th South Pipeline	2.5
18 24” Cross Valley Pipeline	2.7
19 Creek Road Pipeline (24” to 33”)	2.5
20 114th South Pipeline	2.5
Count	19.0
Max	4.0



JVWCD
Hazards Mitigation Plan Project
Risk Analysis

Consequences

VH	1.0
H	0.9
MH	0.7
M	0.5
ML	0.3
L	0.1

Consequence Metrics

Measure of Consequence	Very High 1	High 0.9	Med High 0.7	Medium 0.5	Med Low 0.3	Low 0.1
Public Health & Safety Effects	>1 death or >1,000 sicknesses/ injuries	1 death or 101 to 1,000 sicknesses/ injuries	0 deaths and 21 to 100 sicknesses/ injuries	0 deaths and 6 to 20 sicknesses/ injuries	0 deaths and 1 to 5 sicknesses/ injury	No death or sickness/ injury
Economic Loss of Physical Assets (replacement $)	≥$5M	$1M to <$5M	$250K to <$1M	$100K to <$250K	$50K to <$100K	<$50K
Loss of Service	Service outage of ≥48 hours	Service outage of 24 to <48 hours	Service outage of 12 to <24 hours	Service outage of 4 to <12 hours	Service outage of <4 hours	No loss of service

Relative Likelihood of Attack/Hazard

A1	0.1
A2	0.1
A3	0.1
A4	0.1
A5	0.6
AT1	0.5
AT2	0.4
AT3	0.6
C(B)	0.2
C(C)	0.4
C(P)	0.3
C(R)	0.1
C(W)	0.1
D(C)	0.1
D(E)	0.4
D(P)	0.3
D(S)	0.5
D(T)	0.6
D(U)	0.8
N(D)	0.6
N(E)	0.2
N(E-WF)	0.5
N(F)	0.5
N(G)	0.5
N(L)	0.9
N(LS)	0.6
N(SW)	0.8
N(T)	0.4
N(W)	0.8
S(CI)	0.4
S(CU)	0.5
S(PI)	0.4
S(PU)	0.3
T(CI)	0.6
T(CU)	0.7
T(PI)	0.9
T(PU)	0.8
V1	0.4
V2	0.4
V3	0.3
V4	0.2

1.0	*e.g., Vandalism*	*Petty Theft*									
0.9	T(PI): Phys insider	N(L): Lightning									VH
0.8	D(U): Utilities	T(PU): Phys outsider	N(SW): Severe Weather	N(W): Wildfire							H
0.7	T(CU): Cyber outsider	N(I): Ice Storm									HM
0.6	T(CI): Cyber insider	A5: Drone	N(LS): Landslide	D(T): Transportation	N(D) Drought						MH
0.5	D(S): Suppliers	N(F): Flood	N(G): Erodible Soils	N(A): Avalanche	N(E-WF): EQ-Wasatch Front	AT1: 1 Assailant					M
0.4	D(E): Employees	V1: Car	V2: Van	C(C): Chemical	S(PI): Phys insider	S(CI): Cyber insider	AT2: 2-4 Assailants	N(T): Tornado			ML
0.3	D(P): Proximity	V3: Midsize truck	M1: Small boat	S(PU): Phys outsider	S(CU): Cyber outsider	C(P): Pathogen					LM
0.2	N(E): Earthquake	V4: 18-wheeler	M2: Fast boat	AT3: 5-8 Assailants	C(B): Biotoxin						L
0.1	D(C): Customers	A1: Helicopter	A2: Small plane	A3: Regional jet	A4: Large jet	M3: Barge	M(4): Ocean Ship	AT4: 9-16 Assailants	C(R): Radionuclide	C(W): Weaponization	VL
0.0	*e.g., Nuclear bomb*	*N(H): Hurricane*									

Hazards selected by JVWCD for risk assessment

Conditional Risk (V x C x 1)

R	greater than or equal to	Risk Level
0.0 to 0.2	0	L
0.2 to 0.4	0.2	ML
0.4 to 0.6	0.4	M
0.6 to 0.8	0.6	MH
0.8 to 1.0	0.8	H

Relative Risk (V x C x P_A)

R	greater than or equal to	Risk Level
0.0 to 0.15	0	L
0.15 to 0.3	0.15	ML
0.3 to 0.45	0.30	M
0.45 to 0.7	0.45	MH
0.7 to 1.0	0.70	H

6975 Union Park Center, Suite 490
Midvale, UT 84047-4135

T: 801.316.9800

Meeting Minutes

Prepared for: Jordan Valley Water Conservancy District
Project Title: Hazard Mitigation Plan
Project No.: 156690

Purpose of Meeting: Risk Assessment Workshop
Meeting Location: Virtual Zoom Meeting
Minutes Prepared by: Shania Lynch, Brown and Caldwell

Date: May 27, 2021
Time: 1 – 3 PM

Attendees:

Alan Packard, JVWCD
Bryon Elwell, ELWELL Consulting Group
David McLean, JVWCD
Gordon Batt, JVWCD
Jacob Young, Brown and Caldwell
Jeremy Williams, Brown and Caldwell
Marcelo Anglade, JVWCD
Matt Hinckley, JVWCD
Shane Swensen, JVWCD
Shazelle Terry, JVWCD
Tim Thompson, GeoStrata

Meeting Minutes

Summary

Risk Analysis Summary

The risk analysis table outlines the asset, the hazard scenario description, and the threat type. The consequence column it is split between health and safety, economic loss, and loss of service and is given a rating based on the highest rated consequence in the column. Each consequence category is given metrics to determine the appropriate rating. The relative risk, or overall rating for each asset-hazard pair is determined by the consequence, vulnerability, and relative likelihood of each threat type rated against the asset.

If no comments were captured below, The District agreed with the original ratings and had no changes to the asset analysis.

South East Regional Water Treatment Plant

N(D)/Drought:

- Loss of Service. Per Gordon Batt, depending on the time of year, Jordan Valley could pull from the Wells to create a South East flow in under 24 hours, changing this rating from "high" to "medium-high." This does not change the overall relative risk rating which remains at "medium-low".

N(E-WF)/Earthquake:

- Per Tim Thompson, two things to consider when you are near the fault is 1) the higher seismic shaking the more sediment movement and energy and 2) several feet in elevation drops could affect waterflow structures.

N(L)/Lightning:

- Economic loss could be upwards of one million dollars in damages which falls within the metrics for a "medium-high" consequence rating.

N(W)/Wildfire:

- Per Shazelle Terry, if issues arise, Jordan Valley could use another water source and not treat the water until a solution is determined.

Jordan Valley Water Treatment Plant

N(D)/Drought:

- June-August revenue is approximately 25 million dollars and at a 10 to 20% loss in revenue due to drought this would result in approximately 2.5 to 5 million dollars, which falls within the metrics for a "high" economic loss consequence rating.

N(E-WF)/Earthquake:

- This is a manned facility which carries for potential for injury, and illness with raw water flooding.
- Economic loss could be upwards of five million dollars in damages which falls within the metrics for a "very-high" consequence rating.
- Change vulnerability rating to "very-high, which changes the overall risk rating to "medium-high."

This also resulted in the JVWTP asset risk score increasing from 3.0 to 3.3.

N(W)/Wildfire:

- No changes.

Monitor Drive Well

N(E-WF)/Earthquake:

- Potential for 1-5 injuries which falls within the metrics for a "medium-low" public health and safety consequence rating.
- Economic loss could be between $100-250k in damages which falls within the metrics for a "medium-high" consequence rating.

Newbury Well

N(E-WF)/Earthquake:

- Potential for 1-5 injuries which falls within the metrics for a "medium-low" public health and safety consequence rating.
- Economic loss could be between $100-250k in damages which falls within the metrics for a "medium-high" consequence rating.

1443 E. 9400 S. Well

N(E-WF)/Earthquake:

- Potential for 1-5 injuries which falls within the metrics for a "medium-low" public health and safety consequence rating.
- Economic loss could be between $100-250k in damages which falls within the metrics for a "medium-high" consequence rating.

JVWTP 8 MG Reservoir

N(E-WF)/Earthquake:

- Economic loss could be upwards of five million dollars in damages which falls within the metrics for a "very-high" consequence rating.
- Loss of service duration would be between 12-24 hours which falls within the metrics for a "medium-high" consequence rating.
- Wasatch Front has between 7 to 11 different faults. Each fault has their own movement, and that movement occurs every 500-2,500 years. Probability occurrences are at or over the average occurrence interval (Brigham City is most overdue), with a 40-50% probability of a 6.5-7.9 magnitude earthquake depending on if it moves alone or in conjunction with other faults (which happens 30% of the time).

JVWTP 1 MG Reservoir

N(E-WF)/Earthquake:

- Loss of service is most critical to The District as it provides all of the plant water and water for the chemical feed systems. The water flow could only be changed safely for a few hours and is not a long-term solution.

Old Bingham 3 MG Tank

N(E-WF)/Earthquake:

- No changes.

Zone B North Reservoirs 1 MG steel, 2 MG buried concrete, 6 MG buried concrete

N(E-WF)/Earthquake (ground shaking):

- No changes.
-

N(E-WF)/Earthquake (liquefaction):

- No changes.

Jordan Narrows Pump Station

N(E-WF)/Earthquake (ground shaking):

- No changes.
-

N(E-WF)/Earthquake (liquefaction):

- No changes.

N(F)/Flood:

- No changes.

N(L)/Lightning:

- Changed vulnerability from high to medium, which lowered the overall relative risk rating from medium-high to medium.

118th South Zone C Pump Station

N(E-WF)/Earthquake:

- No changes.

N(L)/Lightning:

- No changes.

Pump Station serving Zone B North (3200 W. 6200 S.)

N(E-WF)/Earthquake:

- No changes.

N(L)/Lightning:

- No changes.

Pump Station along 102nd South Zone D: Old Bingham PS at 6920 W

- No changes.

Jordan Aqueduct (Reaches 1 – 4)

N(E-WF)/Earthquake:

- Change vulnerability rating from "high" to "very-high" which changes the overall risk rating from "medium" to "medium-high."

N(LS)/Landslide:

- Change vulnerability rating from "high" to "very-high", but overall risk rating remained at "medium-high"

This also resulted in the JA (1-4) asset risk score increasing from 3.3 to 4.0.

Central Pipeline

N(E-WF)/Earthquake:

- Change vulnerability rating from "high" to "medium", which lowered overall risk rating from "medium" to "medium-low".

N(LS)/Landslide:

- Change vulnerability rating from "high" to "medium-high", but overall risk rating remained at "medium".

This also resulted in the Central Pipeline asset risk score decreasing from 3.0 to 2.3.

150th South Pipeline
- No changes.

24" Cross Valley Pipeline
- No changes.

Creek Road Pipeline (24" to 33")
- No changes.

114th South Pipeline
- No changes.

From the Risk Analysis Summary and Assessment, the 8 highest assets were reviewed and the Top 5 chosen are shown in bold type and are listed below:

1 **Jordan Aqueduct (Reaches 1 – 4)**
2 **118th South Zone C Pump Station**
3 **Jordan Valley Water Treatment Plant**
4 **JVWTP 1 MG Reservoir**
5 **Old Bingham 3 MG Tank**
6 Jordan Narrows Pump Station
7 Pump Station serving Zone B North (3200 W 6200 S)
8 JVWTP 8 MG Reservoir

Appendix F: Mitigation Implementation Plan

Table F-1: JVWCD HMP Mitigation Actions Implementation Plan

Table F-1: JVWCD HMP Mitigation Actions Implementation Plan

	MITIGATION			Risk Scores Asset/T-A	Asset Priority Tier / #	B/C	Risk Implement Priority	Potential FUNDING SOURCES				IMPLEMENTATION per FISCAL YEAR					Project Subtotal
	Mitigation Action # / Asset Project Name	Hazard	Mitigation Action					O&M	CIP	FEMA Grant	Other	2022	2023	2024	2025	2026	
1	#1 / JA Reaches 1, 3, & 4 Project Scoping	Earthquake, Liquefaction, Landslide	Study earthquake (fault rupture & liquefaction) and landslide impacts on JA Reaches 1, 3, and 4 for preparation of detailed plan to harden the JA system	4.0	Tier 1 / Asset #2	N/A	High		X	X	X		$0.075 M	$0.227 M			**$0.302M**
2	#2 / JVWTP Sed Basins 1&2 Seismic, Drought, and Wildfire Resilience Upgrade	Earthquake, Drought, and Wildfire	Design and administer the construction contract for a seismic upgrade of the two, original floc/sed basins to mitigate ground shaking hazard and improve process resilience against water quality degradation from drought and fires.	3.3	Tier 1 / Asset #1	3.5	High		X	X	X	$2M	$2.4M	$15M	$11M		**$30.4M**
3	#3 / JVWTP 1 MG Reservoir Seismic Upgrade	Earthquake	Construct a new two-celled process-water tank to eliminate the single point of failure in the existing deficient tank. Install flexible connections for all piping. Remove the existing tank from service after the new tank is online and then demolish the existing tank.	3.0	Tier 1 / Asset #4	80.2	High		X	X	X			$0.61M	$1M		**$1.61M**
4	#4 / Old Bingham 3 MG Reservoir Seismic Upgrade	Earthquake	Remove the roof with failing post-tensioned tendons; place a coating on the tank interior to mitigate corrosion; construct a new roof; install flexible connections on all yard-piping connections to the tank.	3.0	Tier 4 / Asset #18	1.6	High		X	X						$2.0M	**$2.0M**
5	#5 / JVWTP 8 MG Reservoir Seismic, Wildfire, and Water Quality Improvements Project	Earthquake, Wildfire	Replace the existing deficient tank with a new larger tank to provide additional finished water storage for wildfire-related plant disruptions; the new tank will be highly baffled to improve water quality by reducing chlorine use.	3.0	Tier 4 / Asset #19	3.4	High		X	X	X					$16.31 M	**$16.31M**
6	#6 / JA Reaches 1, 3, & 4 Mitigation Project (s)	Earthquake, Landslide	Design and construct recommended mitigation measures for hardening JA Reaches 1, 3, and 4 (based on results of Mitigation Action 1, once completed)	4.0	Tier 1 / Asset #2	TBD	High		X	X	X				TBD	TBD	**TBD**
											Totals	$2M	$2.475 M	$15.837 M	$12M	$18.31 M	**$50.622M**

Appendix G: JVWCD Geohazards Technical Memorandum

JVWCD Geohazards Technical Memorandum

JVWCD GEOHAZARDS TECHNICAL MEMORANDUM

Introduction

GeoStrata as a part of the Elwell Consulting Team was asked to provide geohazard assessments for all of the Jordan Valley Water Conservancy District (JVWCD) facilities. The purpose for the assessment was to gain a better understanding of the impacts that the geohazards may have on the facilities. The hazards assessed as a part of this study included earthquake, landslides, debris flows, rock fall and problem soils. GeoStrata used available reports and maps provided by the Utah Geological Survey (UGS) and the United States Geological Survey (USGS). All references used in this study are presented in the bibliography at the end of this technical memo.

We note that several of the hazards had little impact on the facilities and are either minimally or not discussed in detail in this memo. These include rockfall, problem soils, and debris flows. For example, most all of the facilities do not currently exist close enough to the mountain fronts to be impacted by rockfall. Likewise, the mapped debris flow paths that could potentially impact JVWCD facilities have had development that intersects these drainage paths. This development significantly reduces the potential of debris flows impacting the facilities.

The following pages discuss the earthquake hazards, landslide hazards and debris flow hazards. Earthquake hazards included ground shaking, fault rupture and liquefaction. Tables are presented in each of the sections that provide our teams assessment of the hazard with respect to the JVWCD facility.

Faults and Liquefaction

Key JVWCD facilities are widely distributed adjacent to the Wasatch fault along the benches of the Wasatch Front and near the mouths of canyons as well as near the West Valley fault. As a result of the varied geographic area over which the JVWCD system spreads, a wide range of seismic exposure and risk exists among individual facilities. The earthquake assessment of key JVWCD facilities addressed the three types of seismic threats: ground shaking, fault rupture, and liquefaction.

Ground Shaking is associated with seismic accelerations. The seismic ground motion hazard is highest for facilities near the Wasatch fault and the West Valley fault due to the fault's potential for high-magnitude earthquakes, as well as the higher occurrence frequency of smaller earthquakes in the vicinity of the two faults noted.

The nearest active faults that would likely be the source of ground shaking in the JVWCD service area include the Salt Lake segment and the Provo segment of the Wasatch fault zone and the Granger segment and the Taylorsville segment of the West Valley fault zone. Table 1 lists the ground motion parameters for each of these faults in relation to the seismic event that would affect the JVWCD service area.

Table 1 Ground Motion Parameters of Active Faults Near JVWCD facilities

Fault	Length of fault (miles)	Slip rate (mm/year)	Age of most recent event (years)	Potential Magnitude (Moment Magnitude scale)
Salt Lake Segment	28	0.2 – 5.0	< 15,000	6.9[1]
Provo Segment	37	0.2 – 5.0	< 15,000	7.3[2,3]
Granger Segment	10	0.2 – 1.0	< 15,000	6.5[4]
Taylorsville Segment	9	< 0.2	< 15,000	6.5[4]

[1]Black, B.D., Lund, W.R., Schwartz, D.P., Gill, H.E., and Mayes, B.H., 1996, Paleoseismic investigation on the Salt Lake City segment of the Wasatch fault zone at the South Fork Dry Creek and Dry Gulch sites, Salt Lake County, Utah: Utah Geological Survey Special Study 92, Paleoseismology of Utah, Volume 7, 22 p., 1 plate.

[2]Lund, W.R., Schwartz, D.P., Muvey, W.E., Budding, K.E., and Black, B.D., 1991, Fault behavior and earthquake recurrence on the Provo segment of the Wasatch fault zone at Mapleton, Utah County, Utah: Utah Geological Survey Special Study 75, Paleoseismology of Utah, Volume 1, 41 p.

[3]Lund, W.R., and Black, B.D., 1998, Paleoseismic investigation at Rock Canyon, Provo segment, Wasatch fault zone, Utah county, Utah: Utah Geological Survey Special Study 93, Paleoseismology of Utah, Volume 8, 21 p., 2 plates.

[4]Hylland, M.D., DuRoss, C.B., McDonald, G.N., Olig, S.S., Oviatt, C.G., Mahan, S.A., Crone, A.J., and Personius, S.F., 2014, Late Quaternary paleoseismology of the West Valley fault zone—insights from the Baileys Lake trench site, in DuRoss, C.B., and Hylland, M.D., Evaluating surface faulting chronologies of graben-bounding faults in Salt Lake Valley, Utah—new paleoseismic data from the Salt Lake City segment of the Wasatch fault zone and the West Valley fault zone: Utah Geological Survey Special Study 149, Paleoseismology of Utah, Volume 24: p. 41–76, 8 appendices, 1 plate, CD.

The ground shaking potential due to an earthquake on these and other faults in the Wasatch region is best represented by U.S. Geological Survey (USGS) determined peak ground acceleration (PGA) values. Table 2 includes the facilities assessed for ground shaking hazard and Plate G-1 in Appendix G shows the PGA contours for the JVWCD service area for the 475-year seismic event and the 2,475-year event, respectively. The maps illustrate how for both return periods, PGA amplitudes (i.e., intensity of ground shaking) are the highest in close proximity to the Wasatch fault and the West Valley fault. The PGA's noted will be used by the structural engineer in their assessment of the impact to the JVWCD facility.

Areas of potential surface fault rupture and liquefaction are described below and were considered as a group of permanent ground displacement hazards that serve to modify and intensify the seismic ground motion hazard at each site.

Fault Rupture is the surface manifestation of an active fault. Surface fault rupture refers to permanent displacement of the ground surface along an active fault that is caused by tectonic slip on the fault plane at depth. Surface fault rupture accompanies major earthquakes, generally of moment magnitude M 5.0 and greater for the Great Basin region of Nevada and Utah. In the JVWCD planning area, the Salt Lake and Provo segments of the Wasatch Fault zone along with the Granger segment and Taylorsville segment of the West Valley Fault zone are the most active fault systems in the area.

Based on fault studies compiled by the United States Geological Survey (USGS), the Salt Lake City segment has ruptured four times in the last 6,000 years, according to the Consensus Preferred Recurrence-Interval and Vertical Slip Rate Estimates: Review of Utah Paleoseismic-Trenching Data by the Utah Quaternary Fault Parameters Working Group, (Lund, 2005). Earthquakes occurred 1300 ± 650, 2450 ± 550, 3950 ± 550, and 5300 ± 750 years before present. Consensus preferred recurrence interval for these recent events is 1,300 ± 400 years with a slip

rate of 1.0 to 5.0 mm per year. Four known older earthquakes occurred ~7.5 ka, ~9ka, ~17 ka, and ~17-20 ka ago.

Paleoseismic studies conducted on the Provo segment suggest that the magnitude of earthquakes that did rupture the entire length of the Provo segment may have been as large as M 7.3. Based on fault studies compiled by the USGS of the Provo segment, the last three events on the Provo segment occurred 600 ± 350 cal BP, 2,850 ± 650 cal BP and 5,300 cal BP (Olig, 2011). These three events resulted in approximately 4.7 ± 0.5 meters, 0.5 to 2.2 meters, and 2.2 to 2.7 meters of displacement respectively.

The Granger segment and Taylorsville segment of the West Valley Fault zone is an intrabasin graben-bounding fault zone located west of the Salt Lake City segment of the Wasatch Fault zone. Based on paleosiesmic studies performed by the USGS and Utah Geological Survey (UGS), there has been at minimum eight large earthquakes along the West Valley Fault zone in the last 18,000 years with four of those events occurring on the Granger segments (1.4 ± 0.7 (ka), 12.3 ± 1.1 (ka), 13.0 ± 1.1 (ka) and 15.7 ± 3.4 (ka)), three events occurring on the Taylorsville segment (0.4 ± 0.2 (ka), 0.6 ± 0.2 (ka) and 2.1 ± 0.3/-0.4 (ka)) and one event occurring on both the Granger segment (5.5 ± 0.8 (ka)) and Taylorsville segment (5.1 ± 0.3 (ka)). Five of these events correspond with events that have also occurred along the Salt Lake City segment. Consensus preferred recurrence interval for the West Valley Fault zone is 1.8 to 2.2 k.y. and a slip rate 0.5 to 0.6 mm/yr. The displacement per event along the West Valley Fault Zone is estimated to be 1.2 to 1.5 meters.

Surface rupture displacement is commonly distributed across a zone of deformation that can be several meters to tens of meters wide as measured perpendicular to the fault. Normal faults, such as the Wasatch fault that dips at a steep angle towards the west, can produce zones of surface deformation tens of meters wide or more on the down-thrown side of the fault. Additionally, the full width of the active fault zone, including associated splays, can only be determined from detailed geological investigations that involves careful geological mapping and exploratory fault trenching. Such detailed investigations are commonly performed at critical facility sites but are rarely performed along the entire length of an active fault. Consequently, uncertainty exists as to the actual fault width at any location where such investigations have not been performed. This uncertainty extends to the plotted map location of the faults relative to the mapped location of each JVWCD facility site. Recommendations for additional studies and estimated costs for these studies have been prepared and are presented in the Mitigation Project Cost Estimates, Section 4.5.2 of the JVWCD HMP.

Facilities located within a UGS defined Special Study Zone, as defined in Table 3, are considered to have a potential for fault rupture impacts. Facilities that fall within the special study zones are shown in Table 4 and in Appendix G of the JVWCD Hazard Mitigation Plan (HMP), Plate G-2.

Table 3 UGS Defined Special Study Zone

Fault Type	Upthrown Distance (ft)	Downthrown Distance (ft)
Well Located (solid)	250	500
Approximately Located (dashed)	1000	1000
Inferred (dotted)	1000	1000

Liquefaction is the loss of bearing capacity in loose, saturated, granular soil deposits during a ground shaking event. Among other effects, liquefaction can result in densification of such deposits causing settlement of overlying layers as excess pore water pressures are dissipated after an earthquake. Liquefaction may also cause slope movement on relatively flat slopes; this phenomenon is known as lateral spread. The primary factors affecting liquefaction potential of a soil deposit are: (1) level and duration of seismic ground motions, (2) soil type and consistency, and (3) depth to groundwater. This type of environment is typical of low-lying areas in proximity to bodies of water, such as valley floors and floodplains. Appendix G of the JVWCD HMP Plate G-3 Liquefaction Map shows the liquefaction hazard potential for the JVWCD planning area

Liquefaction is produced by intense seismic shaking which causes a buildup of pore pressure in loosely deposited granular soils within areas of shallow groundwater. This causes the soil deposits to lose their bearing capacity and excessive settlements can occur. Other liquefaction concerns include the floating of pipelines and tanks due to the presence of high pore pressures. A liquefaction hazard map for the JVWCD service area during the 2,475-year earthquake is presented in Appendix G Plate G-3. This hazard map was used to assist in the assessment of each District asset for liquefaction potential.

Many JVWCD assets are located in relatively high seismic areas. Table 2 identifies the JVWCD facilities which were evaluated for the ground shaking potential, Table 3 presents the liquefaction potential for JVWCD facilities and Table 4 provides the surface fault rupture hazard for JVWCD facilities.

Table 2 Facilities Assessed for Ground Shaking Hazard

	Facility	Nearest Fault	MCA-PGA Associated with a 2% Probability of Exceedance in 50 years (%g)
Reservoir	JVWTP 8 MG	Provo	120-160
	JVWTP 1 MG	Provo	120-160
	Old Bingham 3 MG	Unnamed	80-100
	Terminal	Granger	120-160
	Zone B North	Granger	120-160
Water Treatment Plants	JVWTP 180 MGD	Provo	120-160
	SERWTP 20 MGD	Salt Lake City	120-160
Wells	1443 E. 9400 S.	Salt Lake City	160-240
	Monitor Drive	Salt Lake City	160-240
	Newbury	Salt Lake City	160-240
Pump Stations	118th South Zone C	Unnamed	120-160
	3200 W 6200 S	Granger	120-160
	Jordan Narrows	Provo	120-160
	Old Bingham	Unnamed	80-100
Pipelines	11400 South	Salt Lake City	160-240
	150th South	Provo	120-160
	24 inch Cross Valley	Salt Lake City; Granger	160-240
	Central	Provo	120-160
	Creek Rd	Salt Lake City;	160-240

		Granger	
Aqueducts	Jordan Reach 1	Provo	120-160
	Jordan Reach 2	Granger	120-160
	Jordan Reach 3	Granger	160-240
	Jordan Reach 4	Provo	120-160

Table 3 Facilities Assessed for Earthquake Fault Rupture

	Facility	**Nearest Fault**	**Approximate Distance to Special Study Zone (mi)**
Reservoir	JVWTP 8 MG	Provo	5.6
	JVWTP 1 MG	Provo	5.6
	Old Bingham 3 MG	Unnamed	1.9
	Terminal	Granger	1.7
	Zone B North	Granger	4.0
Water Treatment Plant	JVWTP 180 MGD	Provo	5.7
	SERWTP 20 MGD	Salt Lake City	0.2
Wells	1443 E. 9400 S.	Salt Lake City	2.7
	Monitor Drive	Salt Lake City	1.8
	Newbury	Salt Lake City	2.0
Pump Stations	118th South Zone C	Unnamed	6.5
	3200 W 6200 S	Granger	1.8
	Jordan Narrows	Provo	3.1
	Old Bingham	Unnamed	1.9
Pipelines	11400 South	Salt Lake City	0.2
	150th South	Provo	2.4
	24 inch Cross Valley	Salt Lake City; Granger	0; 0[1]
	Central	Provo	3.1
	Creek Rd	Salt Lake City; Granger	0.5; 1.5
Aqueducts	Jordan Reach 1	Provo	2.8
	Jordan Reach 2	Granger	1.8
	Jordan Reach 3	Granger	0[1]
	Jordan Reach 4	Provo	0[1]

1- Facility lies within the special study zone, additional study required to define the hazard in accordance with current standard of care.

Table 4 Facilities Assessed for Liquefaction

	Facility	**Liquefaction Hazard**
Reservoir	JVWTP 8 MG	Very Low
	JVWTP 1 MG	Very Low
	Old Bingham 3 MG	Very Low
	Terminal	Very Low
	Zone B North	High

Water Treatment Plant	JVWTP 180 MGD	Very Low
	SERWTP 20 MGD	Very Low
Wells	1443 E. 9400 S.	Very Low
	Monitor Drive	Very Low
	Newbury	Very Low
Pump Stations	118th South Zone C	Very Low
	3200 W 6200 S	Very Low
	Jordan Narrows	Very Low
	Old Bingham	Very Low
Pipelines	11400 South	Very High
	150th South	Very High
	24 inch Cross Valley	Very High
	Central	Very High
	Creek Rd	Very High
Aqueducts	Jordan Reach 1	Very High
	Jordan Reach 2	Very Low
	Jordan Reach 3	Very High
	Jordan Reach 4	Very Low

Landslide

Landslides are defined as all slope failures including slump, slide, debris/earth flow, and rock fall that may be induced by ground shaking or other failure mechanisms. It is noted, however, that not all slopes represent a landslide hazard. Slopes that contain layers of weak material (especially landslide deposits), are overly steep for the strength of the materials that comprise the slope, and/or are impacted by groundwater are susceptible to landslide failure. Movement can occur at the top of a slope where the slope has been loaded by fill placement, at the base of a slope that have been undercut, or where local groundwater rises resulting in increased pore pressures within the slope. Furthermore, landslide hazards are specifically increased in areas where previous slope failures have occurred, and landslide deposits are present. Previous slope failures leave landslide deposits that are in a state of residual strength and are more susceptible to slope failure than a slope with no landslide deposits. A landslide hazard map for the JVWCD planning area is presented in Appendix G of the JVWCD HMP Plate G-4, and Table 5 identifies the JVWCD facilities which were specifically evaluated for the landslide hazard.

Table 5 Facilities Assessed for Landslide

	Facility	Hazard Rating	Notes
Reservoir	JVWTP 8 MG	Very Low	
	JVWTP 1 MG	Very Low	
	Old Bingham 3 MG	Very Low	
	Terminal	Very Low	
	Zone B North	Very Low	
Water Treatment Plant	JVWTP 180 MGD	Very Low	
	SERWTP 20 MGD	Very Low	
Wells	1443 E. 9400 S.	Very Low	
	Monitor Drive	Very Low	
	Newbury	Very Low	
Pump Stations	118th South Zone C	Very Low	
	3200 W 6200 S	Very Low	
	Jordan Narrows	Very Low	
	Old Bingham	Very Low	
Pipelines	11400 South	Very Low	
	150th South	Very Low	
	24 inch Cross Valley	Very Low	
	Central	High	Crosses area identified as landslide and greater than 30% slope
	Creek Rd		
Aqueducts	Jordan Reach 1	Low	Crosses small area identified as greater than 30% slope
	Jordan Reach 2	Very Low	
	Jordan Reach 3	Very Low	
	Jordan Reach 4	High	Crosses mapped landslide deposits and areas greater than 30% slope

Susceptibility descriptions come from the Utah Geological Survey and are described as such:

High – Areas of existing shallow and deep landslides. * Slope angle and geologic map unit are not considered in this category
Moderate – Areas that have slopes prone to landsliding based on observed landslide slope angles. This category includes slopes greater than 7° (12%) to great than 18° (32%) depending on the geologic unit.
Low – Areas that have slopes that may produce landslides. The category includes slopes from 5°-7° (9%-12%) for lower slope-angle threshold ranging up to 13°-18° (23% - 32%) for the upper slope-angle threshold depending on the geologic unit.
Very Low – Areas that are unlikely to produce landslides. The category includes slopes less than 5° (9%) to less than 7° (12%) depending on the geologic unit.

*Based on mapped landslides; many areas have not been mapped for landslide.

We recommend that special landslide hazard studies be completed for those facilities that have been identified as having a High potential for impact from a landslide. These studies would include trenching the limits of mapped landslide deposits, performing drilling into or near the apex of each landslide deposit, and generating a geologic cross section of the landslide deposit. Additionally, an engineering study of the stability of the landslide deposit would need to be completed. All detailed description of all work completed as part of the landslide hazard studies and engineering studies and the results and associated recommendations of the studies would be presented in a final report. Costs for these studies have been prepared and are presented in the Mitigation Project Cost Estimate Section of the JVWCD HMP (Section 4.5.2).

Debris Flow

Debris flows are water-laden masses of soil and fragmented rock often called mudslides, mudflows, or debris avalanches and usually associated with flooding types of rainfall events or rapidly melting snowmelt. The debris within a debris flow is typically comprised of soil, rock fragments, and organic material such as trees and other vegetation that are picked up by scouring of rapidly moving water as the flow moves down a confining channel. Debris flow deposits are categorized based on the water to sediment ratio and viscosity of the debris flow. Debris flows may also be generated when a landslide deposit becomes rapidly saturated with water and flows into a channel.

Intense rainfall and rapid snowmelt are generally events that may trigger debris flow movement. Debris flows and floods also occur when heavy rains on recently burned slopes results in higher-than-normal runoff and in turn channel scour. Repeated debris flows and/or flood events deposit sediment at the mouth of canyons, forming an alluvial fan. Flows may travel farther down the fan from the mouth of the canyon if the channel becomes entrenched and the flow is confined.

Debris flows can be viscous and can transport extremely large boulders (greater than 6-foot diameter); debris flows may eventually become muddy flood waters as they deposit their debris. Debris flows tend to move in pulses. Early pulses or previous debris flows form levees that channel the flow until the levees are breached. The presence of older levees indicates the recurrence and characteristics of debris flows in a particular canyon.

A debris flow hazard map for the JVWCD planning area is presented in Appendix G Plate G-5 and Table 6 identifies the JVWCD facilities which were specifically evaluated for the debris flow hazard.

Debris Flow Hazard Potential is defined as follows:
High – Facility is located on a Holocene age mapped alluvial fan
Moderate – Facility is located within ½ mile of a mapped modern debris flow
Low – Site does not exist near debris flow hazard

Table 6 Facilities Assessed for Debris Flow

	Facility	Near Slopes > 30%	Mapped Debris Flow Deposit	Debris Flow Hazard	Notes
Reservoir	JVWTP 8 MG	Yes	Yes	High[1]	Underground facility
	JVWTP 1 MG	Yes	No	Low	
	Old Bingham 3 MG	No	No	Low	
	Terminal	No	No	Low	
	Zone B North	No	No	Low	
Water Treatment Plant	JVWTP 180 MGD	Yes	Yes	High[1]	Approx. 445ft from mapped debris flow deposit.
	SERWTP 20 MGD	No	No	Low	
Wells	1443 E. 9400 S.	No	No	Low	

	Monitor Drive	No	No	Low	
	Newbury	No	No	Low	
Pump Stations	118th South Zone C	No	No	Low	
	3200 W 6200 S	No	No	Low	
	Jordan Narrows	Yes	No	Low	
	Old Bingham	No	No	Low	
Pipelines	11400 South	No	No	Low	
	150th South	No	Yes	High[2]	Underground facility
	24 inch Cross Valley	No	Yes	Low[1]	Underground facility; approx. 1 mile from mountain front
	Central	Yes	No	Low	
	Creek Rd	No	No	Low	
Aqueducts	Jordan Reach 1	Yes	Yes	High[2]	Underground facility
	Jordan Reach 2	No	Yes	High[2]	Underground facility
	Jordan Reach 3	No	No	Low	
	Jordan Reach 4	Yes	Yes	High[2]	Underground facility

1 – These facilities have had development intersect the mapped debris flow path, significantly reducing the potential of having a debris flow reach the subject facility. For example, two travel paths of the Mountain View Corridor intersect the path between the source mountains and the JVWCD Facility.

2 – These facilities are buried structures where the debris flow impact will likely be limited to additional loading of the facility. A structural engineer should assess the impact of the additional loading on the.

References

Biek, R.F., 2005, Geologic Map of the Jordan Narrows Quadrangle, Salt Lake and Utah Counties, Utah, UGS Map 208.

Biek, R.F., 2003, Interim Geologic Map of the Lehi Quadrangle, Salt Lake and Utah Counties, Utah, UGS Map 416.

Biek, R.F., 2005, Lehi and Part of the Timpanogos Caves Quadrangle, Salt Lake and Utah Counties, Utah, UGS Map 210.

Biek, R.F., Solomon, B.J., Keith, J.D., and Smith T.W., 2008, Geologic Map of the Tickville Spring Quadrangle, Salt Lake and Utah Counties, Utah, UGS Map 214DM.

Biek, R.F., Solomon, B.J., Smith, T.W., and Keith J.D., 2007, Geologic Map of the Copperton Quadrangle, Salt Lake County, Utah, UGS Map 219.

Bowman, S.D., and Lund, W.R., 2020, Guidelines for Investigating Geologic Hazards and Preparing Engineering-Geology Reports, with a Suggested Approach to Geologic-Hazard Ordinances in Utah, Second Edition, UGS Circular 128.

Bryant, B., 2003, Geologic Map of the Salt Lake City 30' x 60' Quadrangle, North-Central Utah and Uinta County, Wyoming, UGS Map 190DM.

Castleton, J.J., Erickson, B.A., McDonald, G.N., and Beukelman, G.S., 2018, Geologic Hazards of the Tickville Spring Quadrangle, Salt Lake and Utah Counties, Utah, UGS Special Study 163.

Castleton, J.J., Elliot, A.H., and McDonald, G.N., 2014, Geologic Hazards of the Copperton Quadrangle, Salt Lake County, Utah, UGS Special Study 152.

Castleton, J.J., Elliot, A.H., and McDonald, G.N., 2011, Geologic Hazards of the Magna Quadrangle, Salt Lake County, Utah, UGS Special Study 137.

Christenson, G.E., Shaw, L.M., 2008, Geographic Information System Database Showing Geologic-Hazards Special Study Areas, Wasatch Front, Utah, UGS Circular 106.

Constenius, K.N., Clark D.L., King, J.K., and Ehler, J.B., 2011, Interim Geologic Map of the Provo 30' x 60' Quadrangle, Utah, Wasatch, and Salt Lake Counties, Utah, UGS Map 586DM.

Davis, F.D., 2000, Geologic Map of the Midvale Quadrangle, Salt Lake County, Utah, UGS Map 177.

Elliot, A.H., Harty, K.M., 2010, Landslide Maps of Utah, UGS Map 246DM.

Hylland, M.D., Hiscock, A.I., McDonald, G.N., Briggs, R.W., DuRoss, C.B., Mahan, S.A., Personius, S.F., and Reitman, N.G., 2017, Paleoseismic Investigation of the Taylorsville Fault, West Valley Fault Zone, Salt Lake County, Utah.

McDonald, G. N., Kleber, E.J., Hiscock, A.I., Bennet, S.E., and Bowman, S.D., 2020, Fault Trace Mapping and Surface-Fault-Rupture Special Study Zone Delineation of the Wasatch Fault Zone, Utah and Idaho, UGS Report of Investigation 280.

McKean, A.P., 2019, Interim Geologic Map of the Salt Lake City South Quadrangle, Salt Lake County, Utah, UGS Map 283DM.

McKean, A.P., 2018, Interim Geologic Map of the Sugar House Quadrangle, Salt Lake County, Utah, UGS Map 687DM.

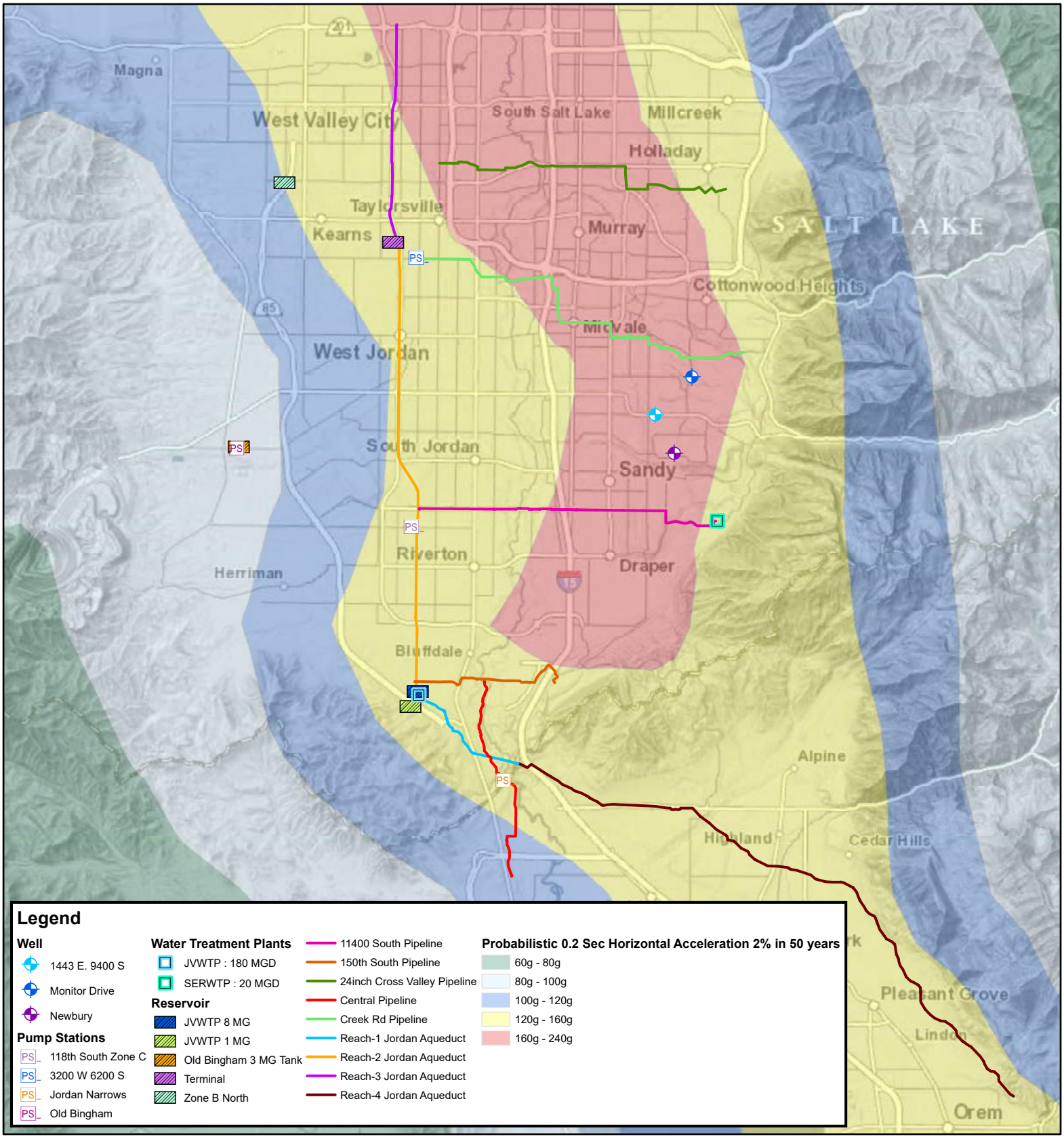
McKean, A.P., and Solomon, B.J., 2018, Interim Geologic Map of the Draper Quadrangle, Salt Lake and Utah Counties, Utah, UGS Map 683DM.

Olig, S.S., McDonald, G.N., Black, B.D., DuRoss, C.B., Lund, W.R., Hylland, M., Simon, D.B., Giraurd, R.E., and Christenson, G.E., 2011, Extending the Paleoseismic Record of the Provo Segment of the Wasatch Fault Zone, Utah, USGS National Earthquake Hazards Reduction Program, Award No. 02HQGR0109.

Solomon, B.J., Biek, R.F., and Smith, T.W., 2007, Magna Quadrangle, Salt Lake County, Utah, UGS Map 216.

Solomon, B.J., Constenius K.K., and Machette, M.N., 2010, Interim Geologic Map of the Orem Quadrangle, Utah County, Utah, UGS Map 567.

Wong, I., Lund, W., DuRoss, C., Thomas, P., Arabasz, W., Crone, A., Hylland, M., Luco, N., Olig, S., Pechman, J., Personius, S., Peterson, M., Schwartz, D., Smith, R., and Bowman, S., 2016, Earthquake Probabilities for the Wasatch Front Region in Utah, Idaho, and Wyoming, UGS Miscellaneous Publication 16-3.



0 7,500 15,000 30,000 45,000 Feet

1:215,000

Basemap:
Basemap and Geologic Hazard Data provided by the State of Utah AGRC.

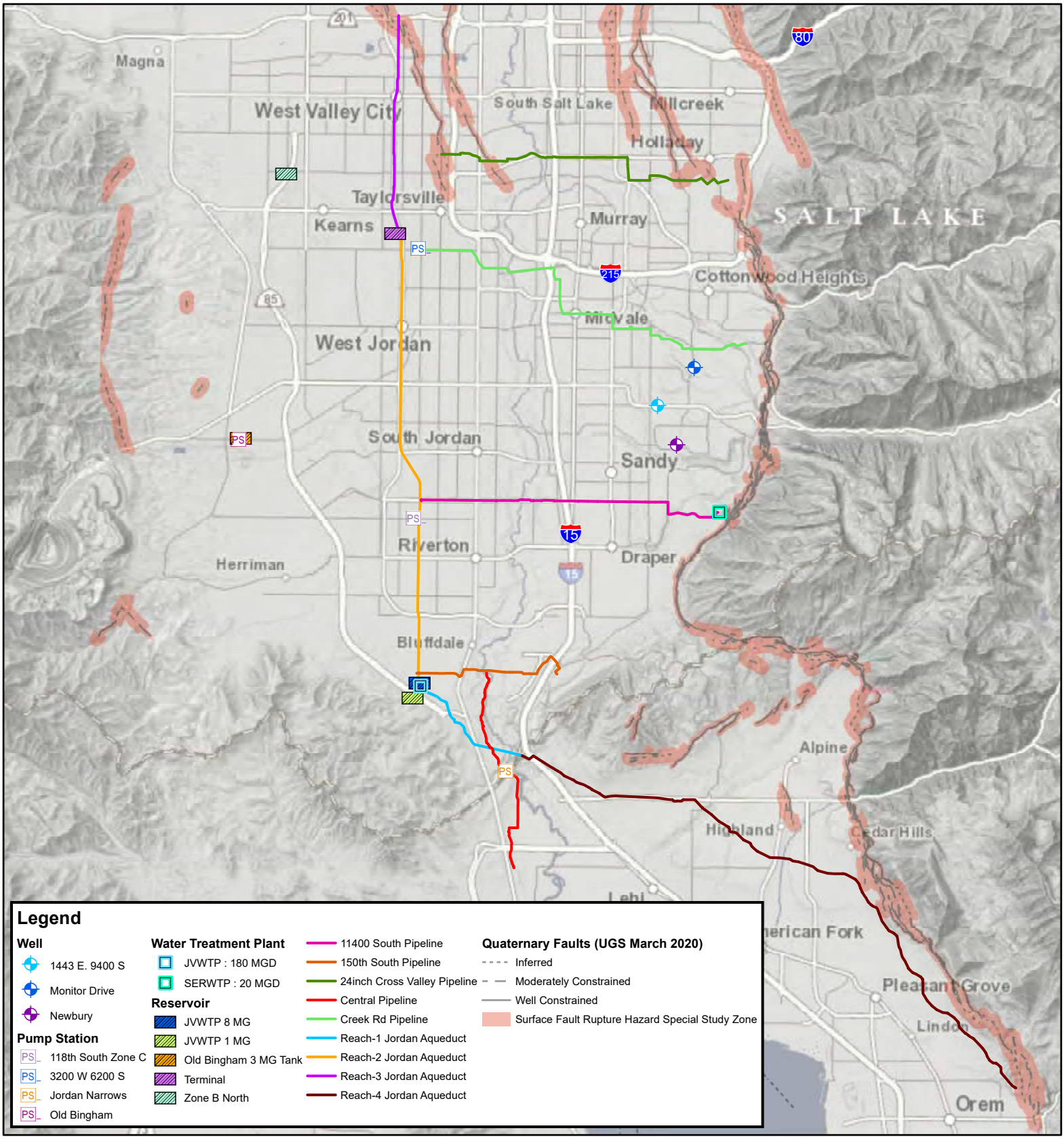
N

GeoStrata

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Ground Shaking Hazard
Probablistic 0.2 Second Horizontal Acceleration 2% in 50 yrs

Plate
G-1



0 7,500 15,000 30,000 45,000 Feet

1:215,000

Basemap:
Basemap and Geologic Hazard Data provided
by the State of Utah AGRC. Assets provided by the Client.

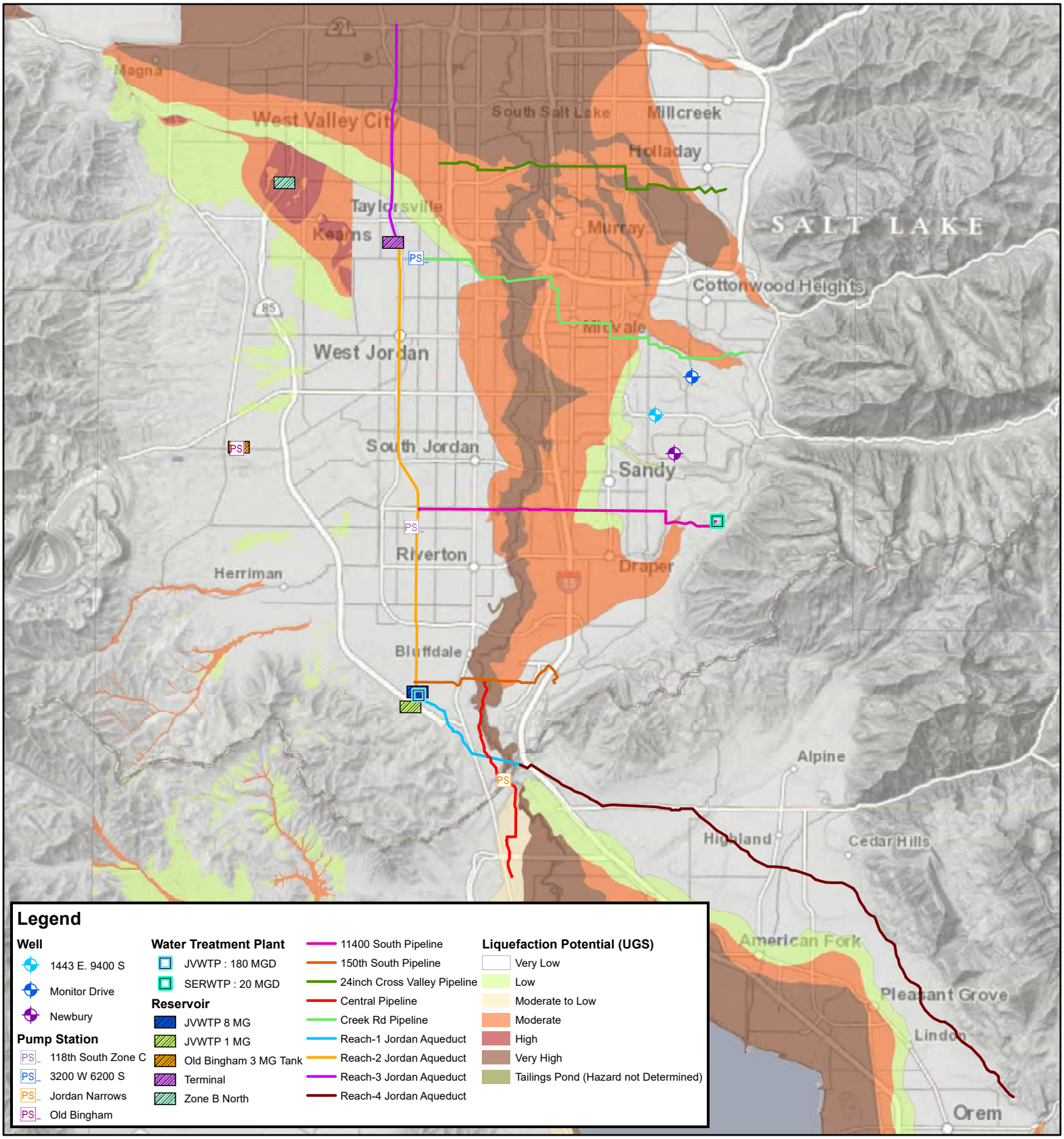
N

GeoStrata

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Surface Fault Rupture Hazard

Plate
G-2



0 7,500 15,000 30,000 45,000 Feet

1:215,000

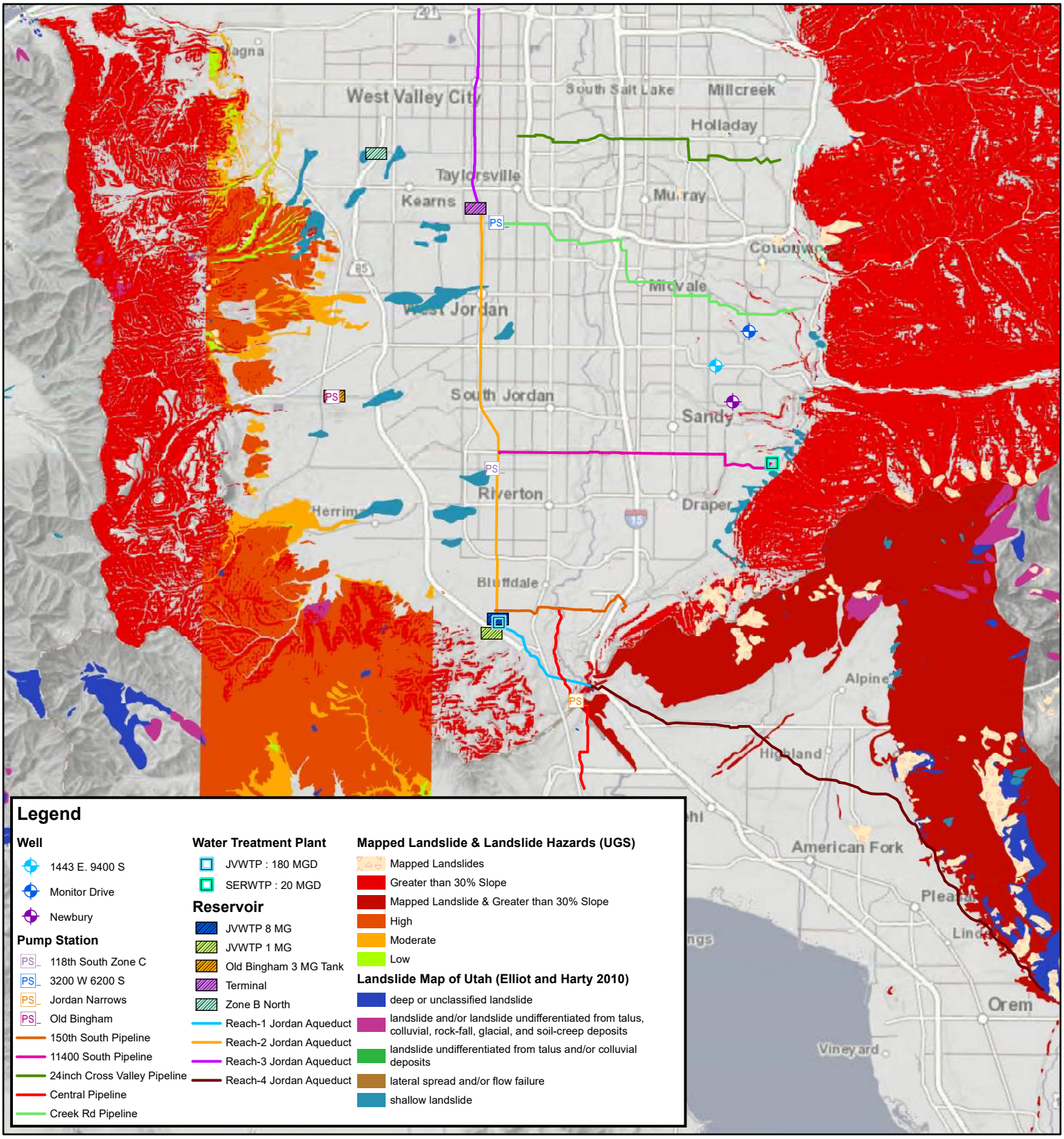
Basemap:
Basemap and Geologic Hazard Data provided by the State of Utah AGRC. Assets provided by the Client.

N

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Liquefaction Potential

Plate
G-3



0 1,000 2,000 4,000 6,000 Feet

1:28,079

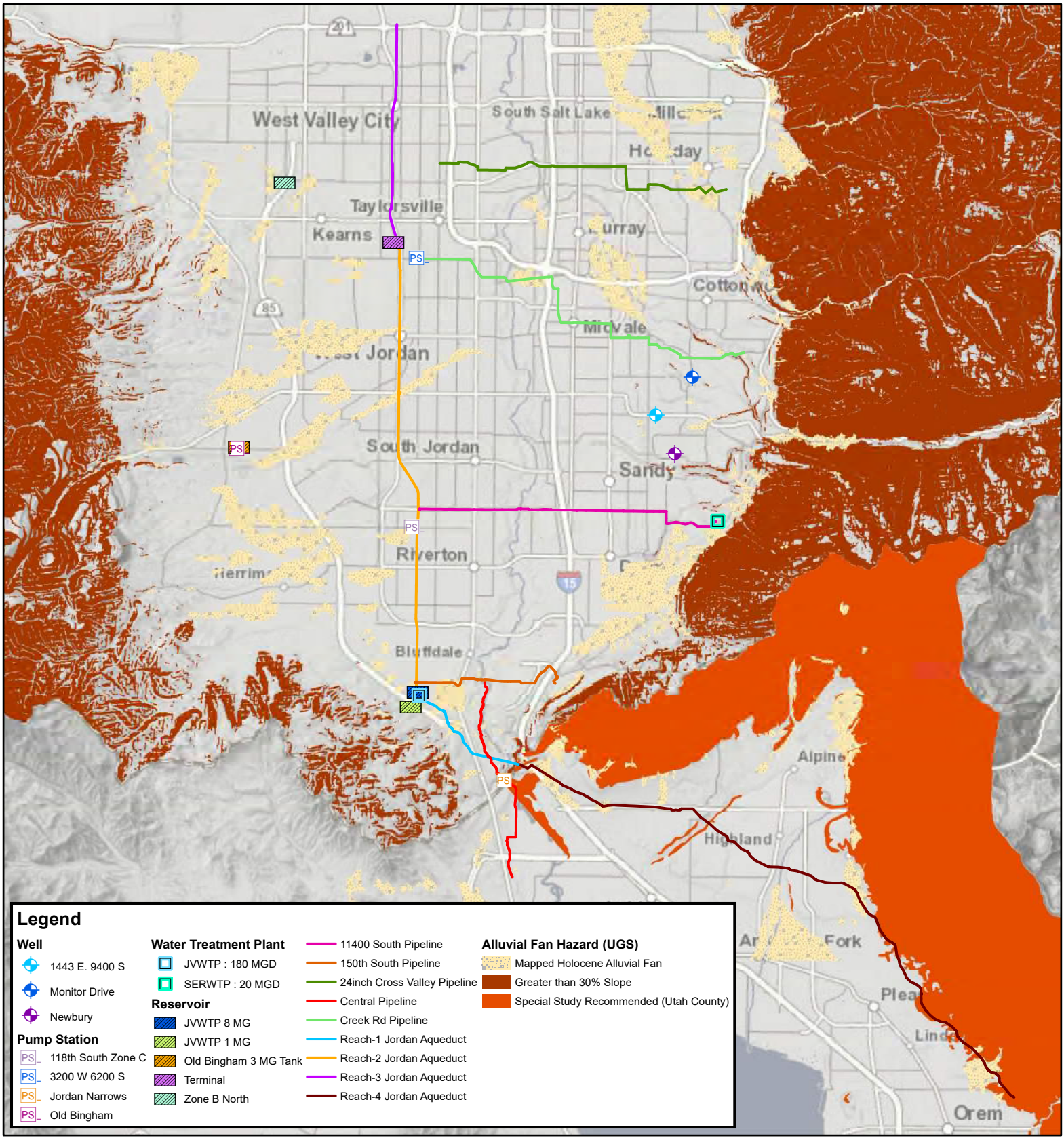
Basemap:
Basemap and Geologic Hazard Data provided by the State of Utah AGRC. Assets provided by the Client.

N

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Landslide Hazard

Plate
G-4



Legend

Well
- 1443 E. 9400 S
- Monitor Drive
- Newbury

Pump Station
- PS 118th South Zone C
- PS 3200 W 6200 S
- PS Jordan Narrows
- PS Old Bingham

Water Treatment Plant
- JVWTP : 180 MGD
- SERWTP : 20 MGD

Reservoir
- JVWTP 8 MG
- JVWTP 1 MG
- Old Bingham 3 MG Tank
- Terminal
- Zone B North

- 11400 South Pipeline
- 150th South Pipeline
- 24inch Cross Valley Pipeline
- Central Pipeline
- Creek Rd Pipeline
- Reach-1 Jordan Aqueduct
- Reach-2 Jordan Aqueduct
- Reach-3 Jordan Aqueduct
- Reach-4 Jordan Aqueduct

Alluvial Fan Hazard (UGS)
- Mapped Holocene Alluvial Fan
- Greater than 30% Slope
- Special Study Recommended (Utah County)

0 5,500 11,000 22,000 33,000 44,000 Feet

1:215,000

N

Basemap:
2018 1m NAIP aerial imagery and Geologic Hazard Data provided by the State of Utah AGRC. Assets provided by the Client.

Geologic Hazards Assessment
Jordan Valley Water Conservatory District

Debris Flow Hazard

Plate
G-5

Appendix H: Mitigation Cost Estimates

Mitigation Project #1 – Jordan Aqueduct Reaches 1, 3 & 4 Project Scoping

Mitigation Project #2 – JVWTP Sed Basins 1&2 Seismic, Drought, and Wildfire Resilience Upgrade

Mitigation Project #3 – JVWTP 1 MG Tank Seismic Mitigation

Mitigation Project #4 – Old Bingham 3 MG FWR Seismic Mitigation Project

Mitigation Project #5 – JVWTP 8 MG FWR Seismic, Wildfire, and Water Quality Improvement Project

Estimate for: Mitigation Project #1
Jordan Aqueduct Reaches 1, 3, & 4 Project Scoping

Project Scope: Perform detailed desktop and field-level geohazard analysis; perform site-specific geotechnical investigations to define and quantify geohazards; develop mitigation strategies and prepare cost estimates for an implementation plan.

Prepared by: Hyrum Alba, Geostrata **Date** 7/2/2021
Reviewed by: Jeremy Williams, Brown and Caldwell **Date** 8/22/2021

Description	Quantity	Unit Price	Total
Geotechnical			
Fault Investigations	1	$ 101,700	$ 101,700
Liquefaction Investigations	1	$ 16,300	$ 16,300
Landslide Investigations	1	$ 57,300	$ 57,300
Subtotal			$ 175,300
Engineering			
Project Management	1	$ 15,000	$ 15,000
Mitigation Development	1	$ 90,500	$ 90,500
Cost Estimating	1	$ 21,500	$ 21,500
Subtotal			$ 127,000
Project Total			$ 302,300

Estimate for: Mitigation Project #2
JVWTP Sed Basins 1&2 Seismic, Drought, and Wildfire Resilience Upgrade

Project Scope: Remove conical-bottom sedimentation basin slabs with unreinforced joints, including center divider wall; excavate for the deeper double-mat foundation slab; place foundation, place sister walls, place interior walls and beams; install mechanical equipment; construct cover over new equipment.

Prepared by: Doug Gabbard, Brown and Caldwell **Date** 6/21/2021
Reviewed by: Jeremy Williams, Brown and Caldwell **Date** 8/22/2021

Description	Quantity	Unit Price	Total
Construction			
Demolition	1	$ 1,740,000	$ 1,740,000
Civil	1	$ 380,000	$ 380,000
Structural	1	$ 3,980,000	$ 3,980,000
Mechanical	1	$ 3,300,000	$ 3,300,000
Electrical & Instrumentation	1	$ 15,700,000	$ 15,700,000
Cover	1	$ 1,300,000	$ 1,300,000
Contractor O&P, general conditions, are included in the above line items			
Subtotal			$ 26,400,000
Engineering, Admin, & Legal			
Design		8%	$ 2,200,000
Construction Administration		5%	$ 1,300,000
Legal		2%	$ 500,000
Subtotal			$ 4,000,000
Project Total			$ 30,400,000

Estimate for: Mitigation Project #3
JVWTP 1 MG Tank Seismic Mitigation

Project Scope: Construct a new two-celled process-water tank to eliminate the single point of failure in the existing deficient tank. Remove the existing tank from service after the new tank is online, and demolish the existing tank.

Prepared by: Jeremy Williams, Brown and Caldwell **Date** 7/12/2021
Reviewed by: Jeremy Williams, Brown and Caldwell **Date** 8/22/2021

Description	Quantity	Unit Price	Total
Construction			
Demolition	1	$ 80,000	$ 80,000
Civil	1	$ 240,000	$ 240,000
Structural	1	$ 710,000	$ 710,000
Mechanical	1	$ 120,000	$ 120,000
Electrical & Instrumentation	1	$ 150,000	$ 150,000
Contractor O&P, general conditions, are included in the above line items			
Subtotal			$ 1,300,000
Engineering, Admin, & Legal			
Design		12%	$ 160,000
Construction Administration		8%	$ 100,000
Legal		4%	$ 50,000
Subtotal			$ 310,000
Project Total			$ 1,610,000

Estimate for: Mitigation Project #4
Old Bingham 3 MG FWR Seismic Mitigation Project

Project Scope: Remove the roof with failing post-tensioned tendons; place a coating on the tank interior to mitigate corrosion; construct a new roof; install flexible connections on all yard-piping connections to the tank.

Prepared by: Jeremy Williams, Brown and Caldwell **Date** 8/15/2021
Reviewed by: Jeremy Williams, Brown and Caldwell **Date** 8/22/2021

Description	Quantity	Unit Price	Total
Construction			
Demolition	1	$ 260,000	$ 260,000
Civil	1	$ 180,000	$ 180,000
Structural	1	$ 1,300,000	$ 1,300,000
Mechanical	1	$ 60,000	$ 60,000
Electrical & Instrumentation	1	$ 40,000	$ 40,000
Contractor O&P, general conditions, are included in the above line items			
Subtotal			$ 1,840,000
Engineering, Admin, & Legal			
Design		4%	$ 70,000
Construction Administration		4%	$ 70,000
Legal		1%	$ 20,000
Subtotal			$ 160,000
Project Total			$ 2,000,000

Estimate for: Mitigation Project #5
JVWTP 8 MG FWR Seismic, Wildfire, and Water Quality Improvement Project

Project Scope: Demolish the existing 8 MG FWR and construct a new 12.5 MG FWR

Prepared by: Jeremy Williams, Brown and Caldwell **Date** 8/14/2021
Reviewed by: Jeremy Williams, Brown and Caldwell **Date** 8/22/2021

Description	Quantity	Unit Price	Total
Construction			
Demolition	1	$ 350,000	$ 350,000
Civil	1	$ 550,000	$ 550,000
Structural	1	$ 10,500,000	$ 10,500,000
Mechanical	1	$ 2,500,000	$ 2,500,000
Electrical & Instrumentation	1	$ 1,200,000	$ 1,200,000
Contractor O&P, general conditions, are included in the above line items			
Subtotal			$ 15,100,000
Engineering, Admin, & Legal			
Design		3.5%	$ 530,000
Construction Administration		3.5%	$ 530,000
Legal		1%	$ 150,000
Subtotal			$ 1,210,000
Project Total			$ 16,310,000

Appendix I: Mitigation Benefits

Mitigation Benefits Table

Hazard Mitigation Plan

Hazard	Asset	Deficiency Type	Deficiency	Building/Structure and Nonstructural Item(s) Replacement Value or Pipeline Per Repair Section Replacement Value	Estimated *BASELINE* Building/Structure or Nonstructural Items Damage State after Scenario Hazard Event: Damage Level	Damage Scenario Description	Estimated Damage ($)	Population Serviced by Asset (potable & ag water users)	If *BASELINE* Damage State Occurs, Estimated Baseline System Functional Downtime: Potable Water: # Days of Complete Loss of Water Service	Potable Water: # Days of Water that is "Unsafe for Drinking"	Secondary Water: # Days of Complete Loss of Water Service	Mitigation Measure	Estimated *UPGRADED* Building/Structure or Nonstructural Items Damage State after Scenario Hazard Event: Damage Level	Damage Scenario Description	Estimated Damage ($)	If *UPGRADED* Damage State Occurs, Estimated Upgraded System Functional Downtime: Potable Water: # Days of Complete Loss of Water Service	Potable Water: # Days of Water that is "Unsafe for Drinking"	Secondary Water: # Days of Complete Loss of Water Service	Total Present Value Benefits (Net)	Mitigation Cost	A/P= 0.0725: Benefit Cost Ratio B/C	Total Annualized Present Value Benefits	B/C Annualized
Earthquake	JVWTP - Sed Basins 1&2	S	Sed Basins #1 &2 constructed in early 1970s and subject to failure with ground shaking	$30,000,000	Complete Repair	Initial damage state takes JVWTP offline for 7 days impacting a Population of approximately 605,000 before remaining Floc/Sed basins could be utilized. The District then performs workarounds for two summers to reconstruct Sed Basins 1&2, which would impact approx. 54,337 Population for 39 days each year for 2 years or 78 days total. The combination of the Inital damages & Workarounds are combined for determining the B/C in the fifth row of calculations.	$30,000,000	624,000	7			Seismic upgrade of Sed Basins 1&2 by replacing under-slab unrestrained cast-iron soil pipe with seimically resilient piping, replacing basins' cone bottoms w/flat bottoms, constructing sister walls around perimeter and divider walls, and installing a dowelled connection between flocculation & sedimentation.	Light-Moderate	Basins drained for inspection after the event. Minor crack repair using epoxy injection, reset weirs, fix minor non-structural items (small-diameter piping, electrical conduits)	$4,500,000	3			$310,044,000	$ 30,400,000.00	10.2	$ 22,478,190.00	0.7
		S	Sed Basins #1 &2 constructed in early 1970s and subject to failure with ground shaking	$30,000,000	Moderate	475 yr Earthquake = 88 yr RI	$9,000,000	624,000	7			Same as above	Light	Basins inspected after the event. Reset weirs, fix minor non-structural items (small-diameter piping, electrical conduits)	$1,500,000	1			$434,316,000	$ 30,400,000.00	14.3	$ 31,487,910.00	1.0
		S	Same as above, but for Workaround damages		None	2475 yr Earthquake = 116 yr RI	$0	54,337	78			Same as above	None	No workaround damages expected after mitigation.	$0	0			$483,164,604	$ 30,400,000.00	15.9	$ 35,029,433.79	1.2
		S	Same as above, but for Workaround damages		None	See workaround scenario described above. 475 yr Earthquake = 88 yr RI	$0	54,337	39			Same as above	Light-Moderate	No workaround damages expected after mitigation.	$0	0			$241,582,302	$ 30,400,000.00	7.9	$ 17,514,716.90	0.6
			Same as above, but for Combined damages			See combined damage scenario description above.						Same as above		Same as above combination of two damage states.					$1,469,106,906	$ 30,400,000.00	48.3	$ 106,510,250.69	3.5
Earthquake	JVWTP - 1 MG Reservoir	S	Circular conventional reinforced concrete tank subject to failure of unreinforced floor joints from resulting differential settlement, causing leakage and catestrophic failure of tank.	$2,000,000	Complete Repair	Tank develops slow leak in all floor joints, downhill side gives way causing debris flow over Mountain View Corridor. Entire JVWTP is shut down for a 7-days with no process water. Temporary workaround fails intermittently (1-day per month)until permanent solution is designed/installed 9 months later.	$2,000,000	624,000	7			Construct a new 2-celled tank with seismically-resilient yard piping.	Light	Only light damages (if any) expected after seismic mitigation implemented.	$100,000	1			$428,716,000	$ 1,610,000.00	266.3	$ 31,081,910.00	19.3
		S	Circular conventional reinforced concrete tank subject to failure of unreinforced floor joints from resulting differential settlement, causing leakage and catestrophic failure of tank.	$2,000,000	Moderate-Severe	475 yr Earthquake = 88 yr RI	$1,000,000	624,000	7			Same as above	Light	Only light damages (if any) expected after seismic mitigation implemented.	$100,000	1			$427,716,000	$ 1,610,000.00	265.6621118	$ 31,009,410.00	19.3
		NS	Piping connections to reservoir are rigid and subject to failure with ground shaking. Same as above, but for Workaround damages		None	Ductile iron piping breaks with failure of tank 2475 yr Earthquake = 116 yr RI	$0	624,000	9			Same as above	None	No workaround damages expected after mitigation.	$0	0			$640,224,000	$ 1,610,000.00	397.6546584	$ 46,416,240.00	28.8
		NS	Same as above, but for Workaround damages		None	475 yr Earthquake = 88 yr RI	$0	624,000	4			Same as above	None	No workaround damages expected after mitigation.	$0	0			$284,544,000	$ 1,610,000.00	176.7354037	$ 20,629,440.00	12.8
			Same as above, but for Combined damages			See combined damage scenario description above.								Same as above combination of two damage states.					$1,781,200,000	$ 1,610,000.00	$ 1,106.34	$ 129,137,000.00	80.2
Earthquake	Old Bingham 3 MG Tank	S	Failing post-tensioned roof tendons fail catastrophically, tank is a total loss	$5,000,000	Complete Repair	Failure of post-tensioned tendons cause roof to collapse, damaging columns, walls, and foundation, leading to catestrophic failure of tank. Service area experiences loss of supply for short time (3-days) and intermittent supply and pressure issues until the tank is replaced. The temporary workaround is expected to require increased maintenance with brief intermittent shutdowns (assume 1-day per quarter) until a new tank is designed/installed approximately 18 months later.	$5,000,000	46,700	3			Replace the tank roof and install a liner inside the tank. Install seismically-resilient yard piping with restrained flexible connections to the tank.	Light-Moderate	Tank drained for inspection after the event. Minor crack repair using epoxy injection, repair liner, fix minor non-structural items (small-diameter piping, electrical conduits)	$750,000	1			$14,897,600	$ 2,000,000.00	7.4	$ 1,080,076.00	0.5
		S	Piping connections to reservoir are rigid and subject to failure with ground shaking.	$5,000,000	Moderate-Severe	Approx. half the damages of larger earthquake. 475 yr Earthquake = 88 yr RI	$2,500,000	46,700	3			Same as above	Light	Only light damages expected after seismic mitigation implemented.	$250,000	1			$12,897,600	$ 2,000,000.00	6.4	$ 935,076.00	0.5
		NS	Same as above, but for Workaround damages		None	Cast iron piping breaks, contributing to failure 2475 yr Earthquake = 116 yr RI	$0	15,360	6			Same as above	None	No workaround damages expected after mitigation.	$0	0			$10,506,240	$ 2,000,000.00	5.3	$ 761,702.40	0.4
		NS	Same as above, but for Workaround damages		None	475 yr Earthquake = 88 yr RI	$0	15,360	3			Same as above	None	No workaround damages expected after mitigation.	$0	0			$5,253,120	$ 2,000,000.00	2.6	$ 380,851.20	0.2
			Same as above, but for Combined damages			See combined damage scenario description above.								Same as above combination of two damage states.					$43,554,560	$ 2,000,000.00	21.8	$ 3,157,705.60	1.6
Earthquake, Wildfire	JVWTP - 8 MG Reservoir	S	Rectangular conventional reinforced concrete tank subject to failure of unreinforced floor, wall, and roof joints from resulting differential settlement, causing leakage and catestrophic failure of tank.	$10,000,000	Complete Repair	Tank develops slow leak in all floor and wall joints, downhill side gives way causing debris flow and flood surge into the nearby Welby-Jacob Canal. Finished water line fills with contaminated water causing boil order and 5-day shutdown to drain, flush, and refill the lines. JVWTP capacity is reduced for lack of disinfection volume. Plant feeds higher chlorine dose than needed until permanent solution is designed/installed 18 months later.	$10,000,000	624,000	5			Replace the existing hopper-bottom tank with a flat-bottom tank to maximize volume in the same footprint. Install seismically-resilient yard piping with restrained flexible connections to the tank.	Light-Moderate	Tank drained for inspection after the event. Minor crack repair using epoxy injection, fix minor non-structural items (small-diameter piping, electrical conduits)	$1,500,000	1			$293,044,000	$ 16,310,000.00	18.0	$ 21,245,690.00	1.3
		S	Same as above	$10,000,000	Moderate-Severe	475 yr Earthquake = 88 yr RI	$5,000,000	624,000	5			Same as above	Light	Only light damages (if any) expected after seismic mitigation implemented.	$500,000	1			$289,044,000	$ 16,310,000.00	17.7	$ 20,955,690.00	1.3
		NS	Same as above, but for Workaround damages		None	2475 yr Earthquake = 116 yr RI	$0	62,400	18			Same as above	None	No workaround damages expected after mitigation.	$0	0			$128,044,800	$ 16,310,000.00	7.9	$ 9,283,248.00	0.6
		NS	Same as above, but for Workaround damages		None	See workaround damage scenario described above. 475 yr Earthquake = 88 yr RI	$0	62,400	9			Same as above	None	No workaround damages expected after mitigation.	$0	0			$64,022,400	$ 16,310,000.00	3.9	$ 4,641,624.00	0.3
			Same as above, but for Combined damages			See combined damage scenario description above.								Same as above combination of two damage states.					$774,155,200	$ 16,310,000.00	47.5	$ 56,126,252.00	3.4
																						$ 3,157,705.60		

Legend:
G = Geologic
NS = Nonstructural
S = Structural
P= Pipeline

P=Benefits --> Annualized

Addendum #1 – JVWCD Plan Adoption and FEMA Approval