ENVIRONMENTAL ASSESSMENT

FOR THE JORDAN VALLEY WATER CONSERVANCY DISTRICT GROUNDWATER EXTRACTION AND TREATMENT REMEDIAL PROJECT IN THE SOUTHWEST JORDAN VALLEY

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SUMMARY

The purpose of this environmental assessment is to determine what environmental consequences would result from the construction and operation of a reverse-osmosis (RO) water treatment plant, extraction wells, and pipelines by the Jordan Valley Water Conservancy District (JVWCD). JVWCD has proposed and implemented the development and construction of a groundwater extraction and treatment project (the Project) with groundwater remedial functions that will provide 4,735 acre-feet/year (AFY) of treated municipal-quality water to the public in the southwestern Jordan Valley, Utah, together with 3,500 AFY of municipal-quality water from Kennecott Utah Copper Corporation (KUCC) for a total of 8,235 AFY. The Project integrates the CERCLA remedial response for the Bingham Creek acid and elevated sulfate plume with the actions required to satisfy the 1995 Natural Resource Damage Consent Decree entered in Civil Action No. 86-C-0902G in the United States District Court for the District of Utah. As part of the Project, JVWCD seeks to restore the damaged groundwater resource using the trust fund set up under the consent decree. Certain elements of the Project have been completed or are under construction. Eight deep water wells and two shallow water wells have been drilled as of May 2009. The groundwater collection pipeline was completed in August 2009. The RO Treatment Plant, by-product pipeline, and treated water pipeline have been completed as of April 2013. The Project will be completed using a combination of funds provided by the State of Utah and KUCC from the consent decree (approximately $38,000,000), bonds issued by JVWCD (approximately $20,000,000), and special appropriations grants (three grants totaling approximately $1,029,000) provided through the Environmental Protection Agency (EPA). As a result of this environmental assessment, the EPA will decide whether or not to release the grant funds to JVWCD for the purpose of Project completion.

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1 PURPOSE AND NEED

1.1 Introduction

The Jordan Valley Water Conservancy District (JVWCD) provides municipal and industrial (M&I) water to most areas of Salt Lake County that lie outside of the Salt Lake City, Utah service area and to parts of northern Utah County, Utah. JVWCD provides water under wholesale water purchase contracts to 19 member agencies, including cities, improvement districts, state agencies, and private companies. JVWCD also provides and distributes water to individual homes and businesses on a retail basis in areas where no viable retail agency exists. Wholesale service includes delivery to High Country Estates Phase II Homeowners Association. Additionally, JVWCD treats and transports water to the Metropolitan Water District of Salt Lake City and Sandy, Utah.

JVWCD operates a raw water collection system that collects water from local mountain streams in Salt Lake Valley, Utah and imports water from the Weber, Provo, and Duchesne rivers. JVWCD operates two water treatment plants and one treated water transmission system in the Salt Lake Valley. The system contains hundreds of miles of aqueduct, transmission, and distribution pipelines and can convey water from any source to virtually any point in the Salt Lake Valley. The system also involves wells, booster pump stations, and treated water storage reservoirs.

1.2 History and Background

The JVWCD groundwater extraction and remedial treatment project will treat one of two contaminated groundwater plumes that encompass 50 square miles in the southwestern Salt Lake Valley of Utah (Appendix A, Figure A1). The Project is a joint effort between JVWCD, the Department of Environmental Quality (UDEQ) and Kennecott Utah Copper Corporation (KUCC). The purpose of the project is to prevent contaminated groundwater plumes from expanding, to remediate contamination of the aquifer, and to produce municipal quality water for the public in the affected areas of West Jordan, South Jordan, Riverton, and Herriman, Utah. The history of the Project and key Project components are outlined in the following bullets:

- Groundwater was contaminated by 100 years of copper mining activity in the southwestern portion of Salt Lake County. Two plumes are contaminated by calcium sulfate: Zone A plume and Zone B plume (see Appendix A, Figure A1). Due to the concentration of metals, the Zone A plume falls under the jurisdiction of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).
- In 1986, the Utah Department of Health filed a complaint under the provisions of CERCLA seeking damages from KUCC for injury to, destruction of, and loss of natural resources. Appropriate CERCLA documents have been prepared and approved, and a management plan is active. The Zone A plume is not a part of the Project addressed in this document. Due to lower metals concentrations, the Zone B plume (addressed in this document) did not require any CERCLA action.
- A natural resource damage (NRD) consent decree was reached between the UDEQ, KUCC, and JVWCD to contain the contamination, remediate the aquifer, and provide drinking water to member agencies affected by the plumes. JVWCD is responsible for remediating groundwater in Zone B, whereas Zone A is actively being remediated by KUCC. Zone B encompasses approximately the eastern half of the total affected area and includes areas affected by the former evaporation ponds in South Jordan. The Zone B Project is funded mostly by KUCC through the NRD Consent Decree, which provides approximately 80% of the Zone B costs.

- The Zone A plant was completed by KUCC in 2007 and is currently operational. The plant is located south of Copperton, Utah. The Zone A plant provides 3,500 AFY of potable drinking water to JVWCD, and the remaining by-product is added to the Kennecott Process Water for use in its mining operations.
- This environmental assessment (EA) covers the impacts of JVWCD's remediation of groundwater in Zone B and the use of the treated groundwater for water supply.
- The Zone B Project consists of the following components: 1) deep wells to intercept and extract contaminated water from the plume in the deep confined aquifer, 2) pipelines to collect the well water, 3) a reverse osmosis (RO) Treatment Plant to treat the water, 4) a finished water pipeline to distribute the potable water to the affected cities in the affected area, and 5) a 21-mile by-product pipeline to pump the concentrate to Great Salt Lake. Most of the Project is under construction and was operational by May 2013 (Table 1-1). Approximately 80% of the water is recovered through the treatment process.
- The Lost Use component of this Project consists of using uncontaminated, shallow, unconfined aquifer water to replace water lost in the RO treatment process (approximately 20% of the deep well water becomes by-product holding nearly 100% of the solids). This unconfined aquifer discharges to the Jordan River (gaining stream). The shallow groundwater will also undergo RO treatment to meet drinking water standards. These shallow wells will be pumped at a flow rate slightly higher than the treatment process occurs in order to meet the minimum cross flow velocities required by the RO treatment process; any extra shallow groundwater is to be discharged into the Jordan River.

Table 1.1. Jordan Valley Water Conservation District Zone B Project Components Timeline

Project Component	Location	Construction Completed	Under Construction	Under Bid	Available for EPA Funding
Deep Well Drilling	1300 West and 2700 West	May 2009			
Groundwater Collection Pipelines	Treatment Plant, 1300 West and 2700 West	August 2009			
By-product pipeline Phase I	1300 West to Great Salt Lake	August 2011			
Treated Water Pipeline	Treatment Plant to 3200 West Pipeline (7800 South 3200 West)	October 2011			
Treatment Plant	1300 West	November 2011			
Well Equipping	1300 West and 2700 West, RO Treatment Plant	November 2011			
By-product Pipeline Phase II	1300 West to Great Salt Lake	May 2013			
Two shallow wells	RO Treatment Plant	2008 and 2009			
By-product Pipeline Extension to Great Salt Lake	Great Salt Lake				Available
Four additional shallow wells drilling and construction	RO Treatment Plant				Available

1.2.1 Natural Resource Damage Claim and Consent Decree (UDEQ)

In 1986 the Utah Department of Health filed a complaint under the provisions of CERCLA seeking damages from KUCC "for injury to, destruction of, and loss of natural resources." The Utah Department of Health was acting as the CERCLA trustee in making this claim. The claim pertained to injury to surface and groundwater resulting from the release of pollutants and hazardous substances from milling and mining activities by KUCC and its predecessors in the southwestern part of the Salt Lake Valley. Specifically, the impacts to groundwater resources from mining operations resulted in: 1) increased levels over baseline of total dissolved solids (TDS), including sulfates, 2) pH levels lower than baseline, 3) metals concentrations exceeding baseline, or 4) solid phase contamination in the aquifer that can be re-dissolved in the future. An amount of $12 million was proposed to settle the NRD claim. CERCLA actions were to be addressed outside of the NRD claim. Due to concern the proposed settlement was too low, and at the request of its member agencies (the affected municipalities), JVWCD requested and was allowed to intervene in the federal court legal action.

In 1990 the UDEQ, the successor trustee, arrived at a NRD settlement with KUCC. A consent decree was proposed to the United States District Court for the District of Utah. The JVWCD (then the Salt Lake County Water Conservancy District) petitioned the court to allow JVWCD to intervene, claiming that the proposed consent decree was insufficient to address damages to the groundwater aquifer. Following a hearing in 1991 the District Court allowed JVWCD to intervene, finding JVWCD uniquely situated to contribute to resolving the underlying factual and legal issues associated with the UDEQ claim. The court did not approve the consent decree proposed in 1991. An appeal to the 10th Circuit Court of Appeals followed, which was dismissed for lack of jurisdiction. The subsequent petition for a writ of certiorari to the United States Supreme Court was also denied.

The three parties (KUCC, UDEQ, and JVWCD) then entered into negotiations for a revised settlement. Numerous technical discussions were held regarding potential remedial responses. These discussions resulted in a proposed consent decree dated May 30, 1995. In August 1995 the District Court approved and entered the final consent decree. The 1995 NRD Consent Decree (hereafter referred to as the consent decree) required KUCC to complete all source control efforts it had been pursuing since 1990. It also created various trust funds for completion of projects and administration by the state CERCLA trustee for NRD. The trust funds total was $28 million. KUCC has now completed all source control work.

The trustee used the cost of restoration methodology in computing the amount of damage. The value of the settlement was based on the cost of a possible alternative for returning the volume of contaminated water (8,235 acre-feet/year [AFY]) to beneficial use. This method is to extract water through wells and to build and operate a treatment plant to produce municipal-quality water. It was calculated that a treatment plant using nanofiltration or RO technology would have an 85% net output of municipal-quality water. This equates to 7,000 acre-feet of water as provided for in the consent decree, with a loss of 1,235 acre-feet of water in the treatment process.

The treatment system concept used for damage calculation requires extraction wells and related facilities, collection pipelines, a treatment plant, a brine discharge pipeline, and a distribution pipeline. The costs of producing 7,000 acre-feet of water annually for 50 years in 1995 dollars was calculated to be $4,000 per acre-foot. The $4,000 per acre-foot cost of treatment includes the capital costs of construction of a treatment plant (40%) and the cost to operate, maintain, and replace facilities over an estimated life of 50 years (60%). The present value of funding for such a project was estimated at $28 million in 1995 dollars.

The consent decree required that KUCC provide funding for a NRD trust fund with two components. First, KUCC provided the irrevocable letter of credit (ILC) in the amount of $28 million, escalating annually at 7%. The $28 million was equivalent to the present value of the cost of restoring the

groundwater through the restoration methodology described above. Second, the trust fund included a cash payment of $9 million that was provided to the state trustee. The $9 million was estimated as the cost of replacing that amount of groundwater that would be lost in the by-product from the treatment process and is sometimes referred to as the "lost use" component of the NRD trust fund. The consent decree provides that the $9 million "shall be expended only to restore, replace or acquire the equivalent of the surface or groundwater resources for the benefit of the public in the affected area…" The $9 million has been invested by the State of Utah and has increased in value. This portion of the trust fund, also sometimes referred to as the cash portion, is to be used for the lost use component of the Project or Lost Use Facilities.

The consent decree acknowledges the separate CERCLA remedial action process by the Environmental Protection Agency (EPA). The consent decree contemplates the likelihood of formulating a remedial response for the NRD that would correlate with the remedial response required by EPA under federal CERCLA requirements. Because of this, the consent decree requires that "the Trustee shall not expend funds secured by the letter of credit until the earlier of 1) two years after the issuance of the record of decision (ROD – EPA 2000) or 2) July 1, 2000, unless the trustee determines that there exists a direct and immediate threat to the public health or the environment that necessitates expenditures to restore, replace, or acquire the equivalent of the resource."

Prior to the expenditure of such funds, KUCC can obtain a reduction in the amount of the ILC if KUCC provides and delivers municipal-quality water through treatment of contaminated water to a system of a purveyor of M&I water in a manner that is acceptable to the trustee, and in a manner that meets the specific requirements of the credit provisions. "Municipal Quality Water" is defined in the consent decree as water originating west of the Welby Canal with TDS concentration of 500 mg/L (and 250 mg/L sulfate), and water originating east of the Welby Canal with 800 mg/L TDS (and 250 mg/L sulfate).

Allocation of the right to use surface or groundwater resources "shall be by the Utah State Engineer pursuant to Utah water law." The other requirements that KUCC must satisfy to receive the reduction described above consist of the following:

1. The water must be accepted by the M&I purveyor with the water right to put the water to beneficial use, in exchange for which the purveyor is to pay KUCC no more than the operation and maintenance costs absent the contamination up to $49 per acre-foot in 1995 dollars.
2. The extraction of the contaminated water must proportionately prevent or reduce the spread of aquifer contamination.
3. The municipal-quality water must be a sustainable water supply of 40 years or more.
4. KUCC's project cannot increase materially the trustee's unit cost to produce the remainder of the 7,000 AFY of municipal-quality water.

As indicated above, two years after the issuance of the ROD (December 13, 2000) or July 1, 2000, whichever is later, the ILC portion of the trust fund not allocated for a KUCC project may, at the trustee's option, be converted to cash which shall be used by the trustee to restore, replace or acquire the equivalent of the natural resource for the benefit of the public in the affected area. KUCC asked JVWCD to consider a team approach in proposing a project that would meet the objectives of the ROD using the trust funds and additional funds from each party. This proposal underwent several iterations and public hearing processes. The final agreed-upon project required KUCC to address the Zone A plume and JVWCD to address the Zone B plume. For the 40-year life of the project, KUCC's total financial contribution (including trust funds) equaled approximately $80 million. JVWCD's contribution equaled $20 million.

Under the approved proposal and agreements, JVWCD and KUCC have each constructed wells, pipelines, a treatment plant, and by-product disposal pipelines, with JVWCD responsible for Zone B and

KUCC responsible for Zone A. The JVWCD project addressed in this document is specific to the Zone B Project.

The Project outlined in this document seeks to use one half of the ILC for a KUCC project and a combination of one half of the ILC and the cash portion of the trust fund for a JVWCD Project. The KUCC project is generally referred to as the "Zone A Plant" and the JVWCD Project is generally referred to as the "Zone B Facilities," which are described in detail in Chapter 2 under the action alternatives, including the Proposed Action.

1.2.2 Federal CERCLA Requirements Design (EPA)

Substantial commencement of remedial studies under the federal requirements of CERCLA (also known as Superfund) followed the approval of the consent decree. The main concern of the CERCLA process is the protection of human health and the environment.

In 1995 the EPA remedial project manager of Region VIII formed a technical review committee (TRC) to oversee the remedial studies. Represented on the TRC are UDEQ, EPA, Utah Department of Natural Resources, Utah State Engineer, Salt Lake City-County Health Department, JVWCD, U.S. Geological Survey (USGS), University of Utah, local municipalities, a local chapter of the Sierra Club, FRIENDS of Great Salt Lake, and other community stakeholders.

From 1995 to 1998 KUCC conducted many studies as part of a remedial investigation/feasibility study (RI/FS). The TRC provided oversight during this process. Much information and data were produced and provided by KUCC regarding the characteristics of the affected area, including hydrogeology, groundwater quality, groundwater recharge sources, a well inventory, and future groundwater and contaminant movement in the affected area.

The feasibility study portion of the RI/FS included groundwater modeling by KUCC to project various scenarios of future groundwater and contaminant movement. This modeling involved groundwater flow modeling, particle tracking, and solute transport modeling. Various scenarios of remedial action were modeled, addressing future time periods of 25, 50, and 150 years. A groundwater model provided by the USGS served as the basis of this modeling, and the final results were reviewed and approved by the USGS. A summary of this modeling is located in Appendix A of the NRD Joint Proposal dated July 11, 2004.

The final draft RI/FS reports were issued by KUCC in March 1998. In March 2000 KUCC formulated a remedial response that correlates with the consent decree requirements and presented this response to the EPA, UDEQ and TRC. The EPA remedial project manager accepted this proposed remedial action plan and submitted the integrated remedial response program to the National Remedy Review Board for their consideration and approval in May 2000. The next steps in the federal CERCLA process involved public hearings and ultimately issuance of a ROD by EPA, on December 13, 2000 (EPA 2000).

Following the issuance of the ROD, KUCC prepared a remedial design work plan, preliminary design, and final remedial design and submitted these to EPA and the State of Utah. The final remedial design (December 2002) details the technical and operating design of the groundwater remediation program, including the Zone A Plant discussed in Section 5 below. The final remedial design also includes a groundwater monitoring plan and third party mitigation plan in the event of quantity or quality related issues at third party sites. This document is available at the West Jordan City Hall or at UDEQ offices.

As a result of details presented in the final remedial design, EPA issued a draft "Explanation of Significant Differences" dated June 23, 2003, for the selected remedy in the ROD (EPA 2000). Generally, the differences do not change the overall approach, which uses barrier wells to prevent the spread of

contamination; treatment and beneficial use of the sulfate contaminated water; and extraction of the low pH plume.

The KUCC Zone A plant and extraction wells have been operating successfully since 2007. KUCC is currently and will continue to extract groundwater from the Zone A plume until the final clean-up levels are achieved. KUCC is conducting water quality monitoring on the Zone A wells to measure progress toward final clean-up levels. Included in this monitoring is compilation of an annual report, which includes information on monitoring, remedial activities, and remedial progress. KUCC submits annual reports to EPA and UDEQ.

1.2.3 KUCC/JVWCD Study and Conceptual Design

KUCC and JVWCD jointly commissioned a study to determine the best method of accomplishing the goals of the consent decree and federal CERCLA remedial requirements for contaminated groundwater in the southwestern Salt Lake Valley. KUCC and JVWCD retained the firm of Camp Dresser and McKee (CDM) to perform this study, which resulted in a conceptual design for an extraction well and treatment project that meets state and federal expectations. The conceptual design will produce 7,000 AFY of municipal-quality water, as was contemplated for the treatment component of the state consent decree. It also provides for additional replacement of water beyond that contemplated by the consent decree, including the 1,235 AFY of water otherwise lost in the treatment process. This “lost use” water will result from treatment of shallow groundwater using JVWCD water rights. This is further described in Chapter 2.

KUCC and JVWCD requested that CDM consider a 50-year operating period for the Project. CDM has shown net present value of costs for construction and 50 years of operation, maintenance, and replacement for the Project. This exceeds the 40-year operation period specifically required in the consent decree. Some costs based on the 40-year period will exceed the trust fund amounts. JVWCD will provide additional funds to make up this difference for the Zone B Facilities.

1.2.4 Zone B Project Construction History

Certain components and phases of the Zone B portion of the Project have been completed, are under construction by JVWCD, or are under bid (see Table 1.1). Those components of the Project that have not been implemented are available for EPA funding. All components and phases of the Project are described in detail in Chapter 2.

1.3 Purpose and Need

1.3.1 Purpose

The purpose of the proposed Zone B JVWCD Project is to construct facilities designed to meet the intent of the consent decree, the requirements and intent of the federal CERCLA process, as well as JVWCD purposes. These purposes are described below in sections 1.3.1.1, 1.3.1.2, and 1.3.1.3, respectively.

1.3.1.1 Meet the Requirements and Intent of the Consent Decree

With respect to meeting the requirements and intent of the consent decree the purposes of the proposed Project are to

- reduce the spread of aquifer contamination through extraction of contaminated water that will proportionately prevent or reduce the spread of contamination;
- restore the groundwater resource by treating contaminated water and providing drinking quality water for the public in the affected area; and

- remediate the aquifer over the long term.

1.3.1.2 Meet the Intent and Remedial Requirements of CERCLA

The ROD (EPA 2000) details the preferred remedy addressing groundwater contamination in the southwestern Jordan Valley. The preferred remedy includes groundwater treatment and is intended to work in conjunction with the Preferred Alternative. The Project includes the following elements outlined in the ROD and reconfirmed in the draft "Explanation of Significant Differences" (June 23, 2003).

1. Protect human health and the environment.
2. Withdraw and treat the heavily contaminated waters from the core of the sulfate plume in Zone A.
3. Install barrier wells at the leading edge of the contamination (1,500 ppm sulfate or less) and pump and treat the waters to prevent further plume movement.
4. Provide RO treated water for municipal use.
5. Monitor the plume.
6. Dispose of treatment by-products in a pipeline used to slurry tailings to an effluent point discharging into the KUCC tailings impoundment that has occasional discharges to Great Salt Lake.

Drilling and development of eight deep water wells (1300 W. and 2700 W.) and one shallow water well (RO Treatment Plant) were completed in May 2009. There is also one previously-drilled shallow water well at the RO Treatment Plant site which was used for pilot testing of the RO system. The groundwater collection pipelines were completed in August 2009. The RO Treatment Plant, by-product pipeline phase I and treated water pipeline are under construction. Deep well equipping and by-product pipeline phase II were awarded in January 2011 with completion in May 2013. Construction and equipping of four additional shallow wells has not been implemented, nor has the by-product pipeline extension into Great Salt Lake. In all, 15 or more shallow water wells are planned over the life of the Project. All components and phases of the Project are described in detail in Chapter 2.

1.3.1.3 JVWCD Purposes

The JVWCD has additional purposes that will benefit the public beyond the requirements of the consent decree or federal CERCLA requirements. These purposes are to

1. implement a Project that is comprehensive and efficient in groundwater development, water delivery, and operation, and that addresses public concerns;
2. improve the treated water quality delivered to JVWCD beyond the 500–800 mg/L TDS level contemplated in Section I.D. of the consent decree, to 250 mg/L TDS; and
3. restore and replace groundwater from the affected area (see Figure A1, all figures are in Appendix A) that is lost as a by-product stream resulting from membrane treatment processes. JVWCD proposes a shallow groundwater membrane treatment project using its own water rights to accomplish this purpose, which is contemplated in the consent decree.

1.3.2 Need

Milling and mining activities conducted by KUCC and its predecessors in the southwestern part of the Salt Lake Valley resulted in impacts to groundwater resources consisting of: 1) increased levels over baseline of TDS, including sulfates, 2) pH levels lower than baseline, 3) metals concentrations exceeding baseline, or 4) solid phase contamination in the aquifer that can be re-dissolved in the future. Taken together these impacts render the groundwater in the affected area un-useable by the public. The EPA and the UDEQ have determined that the groundwater plumes containing sulfate concentrations greater than

1,500 mg/L sulfate or acid constitute a risk to human health and the environment that requires remedial actions (KUCC and JVWCD 2004). Implementation of the Project would constitute the remedial actions necessary to alleviate the problem.

To satisfy the purposes stated above, JVWCD would develop and construct a groundwater extraction and treatment project with groundwater remedial functions that would provide treated municipal-quality water to the public in southwestern Salt Lake Valley. The Proposed Action would include the construction and operation of extraction wells, collection pipelines, discharge pipelines, water conveyance pipelines, and one RO water Treatment Plant (see Figure A1). The Project would provide 4,735 AFY of municipal-quality water to the public in the affected area.

The area affected by contamination of groundwater caused by KUCC's mining and leaching operations is located in the Salt Lake Valley. The affected area is divided into two distinct zones: Zone A and Zone B. JVWCD would be responsible for remediation of groundwater in Zone B (see Figure A1). Zone B encompasses approximately the eastern half of the total affected area (Zones A and B) and includes areas affected by the former evaporation ponds in South Jordan. It includes the majority of the area referred to by the TRC as the "sulfate plume."

The proposed facilities that are the subject of this EA are referred to as Zone B Facilities and Lost Use Facilities. JVWCD would proceed with the Zone B Facilities and Lost Use Facilities either as separate operations (the Separate Design) or as an integrated operation (the Minimum Integrated Design). A detailed description of the alternatives is provided in Chapter 2.

1.3.3 Decisions to be Made/Special Appropriations Grant

As a result of this EA process the EPA will make decisions regarding the release of special appropriations grant funds allocated in FY 2004 and FY 2005. Three grants were allocated to JVWCD under #XP988754-01 in the amounts of $679,000, $250,000, and $100,000. EPA will decide:

- whether or not to release these grant funds to JVWCD for purposes of Project construction; and
- what, if any, mitigation measures will be required as grant conditions or integral parts of the Project.

1.4 The NEPA Process

The JVWCD has prepared this EA in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This EA discloses the direct, indirect, and cumulative environmental impacts that would result from the Proposed Action and alternatives. An EA is a disclosure rather than a decision document. Its primary purpose is to provide environmental analysis to inform the public and to assist the EPA in reaching a decision. This decision is documented in a finding of no significant impact (FONSI) to approve a Proposed Action or an alternative to it.

The information in this document must be made available to federal, state, and local agencies; organizations; and individuals that may be interested in or affected by the Proposed Action. Opportunities to review and comment on this information must be provided before decisions are made or actions are taken on public lands. This EA is being prepared in response to these requirements. If significant environmental impacts (40 CFR 1508.27) are identified at any point in this EA process, the EA will be discontinued and an environmental impact statement (EIS) will be prepared.

Following publication of an EA, public and agency comments will be accepted for 30 days. Subsequently, the EPA will review comments and respond to them as appropriate, either in a separate document or in a revised EA. If no significant impacts have been identified, the agency will prepare a FONSI documenting

this finding. The notice of the FONSI will then be published, followed by a 30-day period, during which the agency's decision can be administratively appealed in accordance with procedures outlined in 40 CFR 6.

Selection of the No Action Alternative on the part of the EPA would not mean that the Project would not be constructed and operated. Due to the agreements JVWCD has entered into with UDEQ and KUCC, JVWCD is required to construct and operate the Project regardless of EPA's decision. Certain elements of the Project have already been completed or are under construction (see Table 1.1).

1.5 Public Involvement

The NRD Joint Proposal was submitted to the Utah trustee for NRDs (trustee) and the EPA on August 7, 2003. Public hearings and a public comment period on the August 7, 2003 proposal were held between August and November of 2003. Some members of the public expressed opposition to the portion of the proposal providing for discharge of by-products from the Zone B Facilities to the Jordan River. The principal objections related to the presence of selenium and elevated TDS in the by-product stream from the deep and shallow groundwater aquifers to be treated by the Zone B Facilities. Due to that opposition, JVWCD withdrew its discharge permit and adjusted its plans for disposal of by-products.

The August 7, 2003 proposal and the corresponding Project Agreement and State Agreement have now been updated to reflect these adjustments to the proposed Project as described in the 2004 NRD Joint Proposal. The adjustments include options for providing water for the Lost Use Facilities from the Zone B deep groundwater and the shallow aquifer and options for by-product disposal.

The concepts of the Project have been presented to the governing organizations of Herriman City, Riverton City, South Jordan City, and West Jordan City and a technical review committee comprising representatives from various federal, state, and county governmental agencies, as well as representatives from local municipalities and local residents.

In addition, the following public involvement activities have taken place since 2003:

- A stakeholder's forum comprising area well owners, environmental representatives, local, state and federal agencies, JVWCD and KUCC has been held twice a year from 2004 to 2010 (http://www.deq.utah.gov/Issues/nrd/prior_meetings.htm).
- Neighbor meetings have been held at well sites from 2003 to 2005.
- A Utah Pollutant Discharge Elimination System (UPDES) permit informational meeting was held in 2009 and again in 2013. UPDES permits are administered by the Utah Division of Water Quality (UDWQ) to control the discharge of pollutants from point sources into waters of the U.S.
- Landowners adjacent to the by-product pipeline alignment were notified of alignment construction in 2010.

1.6 Relationships to Statutes, Regulations, or Other Plans

The Proposed Action is consistent with federal, state, and local laws, regulations, and plans to the maximum extent possible.

The Proposed Action is consistent with federal laws, regulations, and plans. The Proposed Action would be initiated and maintained as mandated by the following federal laws, statutes, and regulations:

- The Endangered Species Act of 1973 (P.L. 85-624; 16 U.S.C. 661, 664 1008)
- The National Environmental Policy Act of 1969 (NEPA, P.L. 91-190; 42 U.S.C. 4321)

- The Clean Air Act (as amended by P.L. 92-574; 42 U.S.C. 4901)
- Section 404, Federal Water Pollution Control Act/Clean Water Act of 1972 (P.L. 92-500; 33 U.S.C. 1344, as amended)
- Section 303, Title 49 U.S. Code (formerly known as Section 4(f) of the Department of Transportation Act of 1966)
- Farmland Protection Policy Act (P.L. 97-98 and 7 CFR Part 658)
- Section 201(a), Federal Land Policy and Management Act of 1976 (P.L. 94-579; 43 U.S.C. 1701 et seq.)
- The Land and Water Conservation Fund Act (P.L. 88-578)
- Section 106, National Historic Preservation Act of 1966 (P.L. 89-665; 16 U.S.C. 407(f))
- American Indian Religious Freedom Act (920 Stat. 469; U.S.C. 1996)
- The Archaeological and Historic Data Preservation Act of 1974 (P.L. 86-253, as amended by P.L. 93291; 16 U.S.C. 469)
- Native American Graves Protection and Repatriation Act (P.L. 101-601)
- Migratory Bird Treaty Act of 1918
- CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), 42 U.S.C. §§ 9601 et. seq.
- National Contingency Plan (NCP), 40 C.F.R. Part 300
- Executive Order 11988, Floodplain Management (43 CFR 6030)
- Executive Order 11990, Protection of Wetlands
- Executive Order 123772, Intergovernmental Review of Federal Programs
- Executive Order 11514, Protection and Enhancement of Environmental Quality
- Executive Order 11296, Flood Hazard Evaluation Guidelines
- Executive Order 11593, Protection and Enhancement of the Cultural Environment
- Executive Order 12898, Federal Actions to address Environmental Justice in Minority Populations and Low-Income Populations
- Executive Order 13007, Indian Sacred Sites
- 40 CFR Parts 1500-1508, CEQ implementation of NEPA
- 36 CFR Part 800, as amended, Protection of Historic Properties
- 7 CFR Part 658, as amended, Prime and Unique Farmlands
- 43 CFR Part 2800, as amended, Rights-of-way Principles and Procedures.1.6.2 State Laws and Statutes
- Title R317 – Environmental Quality, Water Quality
- Utah Safe Drinking Water Act, Title 19, Chapter 4
- Title 9, Chapter 8 – Antiquities, Historic Sites, Historical Preservation Act

2 ALTERNATIVES

In this EA, three alternatives are analyzed in detail: the No Action Alternative (Alternative 1), the Preferred Alternative (Alternative 2), and the Minimum Integrated Design Alternative (Alternative 3).

Note to the reader: NEPA documents usually contain discussion of elements of the proposed project that *would* or *could* occur under the No Action and action alternatives. However, because some elements of the Project described in this EA have already been implemented or completed, and because all elements of the Project will be constructed and operated regardless of the EPA's decision, this EA may describe what *has* occurred or *will* occur under the alternatives and the impacts associated with each alternative.

2.1 Alternative 1: No Action

NEPA requires a No Action Alternative, which is defined in CEQ regulations as a continuation of present conditions (40 CFR 1502.14). Under the No Action Alternative, JVWCD would issue bonds (approximately $20,000,000) and use funds provided by the State of Utah and KUCC from the consent decree (approximately $38,000,000) to construct a groundwater extraction and treatment project with groundwater remedial functions in southwestern Jordan Valley, Utah. However, to complete the Project they would not use funds allocated in FY 2004 and FY 2005 under three special appropriations grants in the amount of $679,000, $250,000, and $100,000 each ($1,029,000 total). Instead, they would require approximately $1,029,000 in additional funds, which would come from either bonds or revenue.

Selection of the No Action Alternative on the part of the EPA would not mean that the Project would not be constructed and operated. Due to the agreements JVWCD has entered into with UDEQ and KUCC, JVWCD is required to construct and operate the Project regardless of EPA's decision. Certain elements of the Project have already been completed or are under construction (see Table 1.1 and Table 2.1).

The Project under Alternatives 2 and 3 is described in detail in Sections 2.2 and 2.3, respectively.

2.2 Alternative 2: Preferred Alternative

Under Alternative 2 (the Preferred Alternative), JVWCD would issue bonds (approximately $20,000,000), use funds provided by the State of Utah and KUCC from the consent decree (approximately $38,000,000), and use approximately $1,029,000 in grants allocated in FY 2004 and FY 2005 to construct the Project.

JVWCD proposes to develop and construct a groundwater extraction and treatment project with groundwater remedial functions that would provide treated municipal-quality water to the public in southwestern Jordan Valley, Utah. The Preferred Alternative would include the construction and operation of extraction wells, collection pipelines, a by-product discharge pipeline, water conveyance (treated water delivery) pipelines, pump stations, and a RO water treatment plant. The proposed locations of the facilities, excluding the pipelines, are shown in Table 2.1. The pipeline alignments (collection, treated water, and by-product) are shown in Figure A1 and Figure A2 (Maps 1–9).

The Project would provide 4,735 AFY of municipal-quality water to the public in the affected area, remediate the contaminated portions of the aquifer, and curtail the spread of the contaminated aquifer.

Table 2.1. Completed, Implemented, and Proposed Locations of Facilities, Excluding Pipelines

Facility*	Approximate Location in Salt Lake County	Status
RO Treatment Plant	8300 South 1000 West (JVWCD Headquarters)	Completed
By-product Pump Station	8300 South 1000 West (JVWCD Headquarters)	Completed
Deep Well 1	8773 South 1300 West	Completed
Deep Well 2	1324 West Polo Lane (9340 South)	Completed
Deep Well 3	9824 South 1300 West	Completed
Deep Well 4	10621 South 1300 West	Completed
Deep Well 5	11059 South 1300 West	Completed
Deep Well 6	9911 South 2700 West	Completed
Deep Well 7	10940 South 2700 West	Completed
Deep Well 8	8300 South 1000 West (JVWCD Headquarters)	Completed
Shallow Wells 1 and 2	8300 South 1000 West (JVWCD Headquarters)	Completed
Shallow Wells 3, 4, 5, and 6	8300 South 100 West (JVWCD Headquarters)	Proposed
Extension of the By-product Pipeline to the Great Salt Lake		Proposed

* Any additional shallow wells are to be located near 8300 South 1000 West (JVWCD Headquarters).

JVWCD is responsible for remediation of groundwater in Zone B, whereas Zone A (see Figure A1) is actively being remediated by KUCC (please refer to the consent decree dated August 21, 1995 for additional information). Zone A is the western half of the affected area and includes a sulfate plume with low pH and the area commonly referred to as the acid plume. Zone B encompasses approximately the eastern half of the total affected area (Zones A and B) and includes areas affected by the former evaporation ponds in South Jordan. It includes the majority of the area referred to by the TRC for the joint proposal (TRC; KUCC and JVWCD 2004) as the "sulfate plume."

The proposed facilities that would be constructed are referred to as Zone B Facilities and are outlined in the June 11, 2004 proposal. Under the Preferred Alternative, the Zone B Facilities would produce 3,500 AFY of treated water from the contaminated deep aquifer and 1,235 AFY of treated water from the shallow aquifer. By-product water would be conveyed together to Great Salt Lake for disposal (965 AFY). See Figure A3 for a diagram of the treatment process under the Preferred Alternative.

2.2.1 Groundwater Extraction

2.2.1.1 Deep Water Wells

The Project includes groundwater extraction from eight wells in the principal aquifer for treatment at the RO Treatment Plant (see Figure A3). Seven of these wells are in the contaminated area (Zone B.) Drilling began in fall 2006 and the eight deep wells were completed in May 2009 (see Figure A2 [Maps 7–9]).

The construction of each new well created approximately one-third (0.33) acre of temporary surface disturbance per well resulting in approximately 2.6 acres of temporary surface disturbance for deep well

construction. If an additional deep well is constructed it would result in approximately one-third (0.33) acre of temporary surface disturbance for almost 3.0 acres of temporary surface disturbance for deep well construction. The footprint of each well site is approximately 100 square feet, resulting in approximately 800 square feet of permanent disturbance for eight deep wells. Six of the completed wells will be accompanied by an underground valve vault. The final two wells are accompanied by an aboveground building. For each completed well the area used for construction will be reclaimed with landscaping and some asphalt. Native, drought-tolerant plants with gravel and bark will be used in the landscaped areas for the well sites.

Under this alternative, the deep-water wells would produce approximately 4,300 AFY of water.

2.2.1.2 Shallow Aquifers Wells

Whether JVWCD proceeds with the Lost Use Facilities using the Preferred Alternative or an Integrated Design basis (as in Alternative 3), JVWCD would produce some water from the shallow aquifer (an unconfined aquifer above the deeper principal confined aquifer) to make up for the lost use of the by-product water produced by the RO treatment process (approximately 20% of the well water). Under the Preferred Alternative, the shallow aquifer wells will provide 1,400 AFY that would enter into the Lost Use Facilities for treatment. The new RO Treatment Plant contains three treatment trains: two for the Zone B deep groundwater and one for the Lost Use shallow groundwater. Lost Use Facilities include the shallow wells, pipelines from wells to the treatment plant, the portion of the treatment plant treating shallow aquifer water, and the portion of the by-product pipeline required to convey shallow groundwater by-product to Great Salt Lake. Five new shallow wells will be drilled and used for that purpose (see Figure A3). The construction of each new shallow water well will create approximately 1 acre of temporary surface disturbance. One shallow water well was completed in 2008; because this area was previously developed as a paved parking area, there was no temporary or permanent disturbance. Collectively, approximately 5 acres of temporary surface disturbance will occur during construction of the shallow water wells. Permanent disturbance of each wellhead will be no more than 100 square feet per wellhead and accompanying valve vault. However, the area used for construction of each of the shallow wells will be replaced with an asphalt working surface of 500 square feet. Total permanent disturbance for each wellhead will therefore be approximately 600 square feet (0.014 acres) for a total of 3,000 square feet (0.07 acres) of permanent disturbance for five shallow water wells.

JVWCD will monitor metals in the shallow aquifer wells. This monitoring will be done on a quarterly basis for five years and on a yearly basis thereafter. These results will be reported to UDEQ on an annual basis showing the trends of all previous data collection. These data will enable the tracking of potential metals migration into JVWCD's shallow wells. Two shallow wells have been completed at the RO Treatment Plant as of May 2009 (including the well completed in 2008). Four additional shallow wells are proposed, but have not been put up for bid. The purpose of additional shallow wells is to maintain consistent flow of water required for the operation of the RO plant. An additional volume of water would not be withdrawn with the addition of more shallow wells. The shallow wells will be pumped at a higher rate than required to insure the minimum cross flow velocity is met in the reverse membranes. If the quantity of water available for proper RO plant operation is less than needed, one train of the treatment plant must be shut down. In order to prevent a continuous on/off operation, the shallow wells will run slightly above the needed flow to make up for variability in flow rates coming from the wells. The excess will be discharged to the Jordan River. The shallow water is comparable in water quality to the Jordan River. For example, the shallow water wells have a TDS concentration of 1,160 mg/L, and the Jordan River has an irrigation standard of 1,200 mg/L, though the concentration varies by month and has exceeded 1,200 mg/L.

2.2.2 Water Treatment Plant and Process

JVWCD has completed pilot/demonstration RO plants for the deep and shallow aquifers over the last five years. Results from these pilot plant studies have demonstrated the technical and economic feasibility for the use of RO technology as proposed in this document. The pilot plant produced permeate (treated water) for several months, the quality of which was better than primary drinking water standards. The pilot study report is attached as Appendix H in the NRD Joint Proposal (KUCC, JVWCD 2004). This report recommended that the RO plant be constructed in a modular fashion (i.e., larger RO plants require additional banks of membranes and additional pumps to feed them).

Thus, as part of the Project, JVWCD will construct and operate an RO water treatment plant that will encompass a separate treatment process for the deep wells and shallow aquifer wells. The RO water treatment plant is being constructed on land owned by JVWCD at 8300 South 1000 West (JVWCD headquarters location). The RO Treatment Plant is currently under construction with projected completion in November 2011. The location of the water treatment plant building is shown in Figure A1 and Figure A2 (see Figure A2 [Map 7]). Construction will create approximately 5 acres of total surface disturbance. Approximately 3.5 acres will be permanently impacted by the water treatment plant. The remaining 1.5 acres will be restored with native landscaping.

Water from Zone B deep wells (4,300 AFY) will enter into the RO process and produce both permeate and by-product water. Permeate will be blended with shallow well treated water from the filtration/disinfection process to reach TDS concentration of 250 mg/L, and will then be ready to enter into the distribution system (3,500 AFY). The by-product will be piped to Great Salt Lake for discharge (800 AFY). See Figure A3 in Appendix A for a diagram of this process.

Water from the shallow aquifer wells (1,400 AFY) will enter into the treatment plant and split into an RO process and a filtration/disinfection process. Permeate from the RO process will be blended with shallow well-treated water from the filtration/disinfection process to reach TDS concentration of 250 mg/L, and will then enter the distribution system (1,235 AFY). By-product water (165 AFY) from the RO process will be piped to Great Salt Lake for discharge. Filtration membranes will be disposed of in a landfill. See Figure A3 in Appendix A for a diagram of this process. As described in Section 2.2.1.2, there will be continuous discharge of untreated shallow well water to the Jordan River. The shallow well water discharge is not contaminated and will meet UPDES permit limits.

The Project includes the construction of 41,000 feet of new collection pipelines within a 4- to 6-foot-wide corridor on existing public rights-of-way (ROWs) and along some private easements (e.g., vacant land). Ranging in diameter from 8 to 24 inches, these pipelines will be used to collect water from the extraction wells and convey it to the RO Treatment Plant. Collection pipelines for the Project are shown in Figure A1. Construction and installation of the collection pipelines was completed in August 2009. The pipeline corridor will be restored to its pre-construction condition (e.g., asphalt, road base, and field).

2.2.3 Treated Water Deliveries

Treated water will be conveyed westward from the RO water treatment plant to JVWCD's water transmission system via a 4.4-mile-long treated water pipeline. The connection point is located at 7800 South 3200 West through a newly constructed 24-inch diameter pipe (see Figure A1). The new 24-inch pipeline is currently under construction within a 4- to 8-foot-wide corridor in an existing public ROW. After the pipeline is completed (completion is projected for October 2010), the disturbed area will be restored to its original condition.

2.2.4 By-product Disposal

Under this alternative, by-product from the RO treatment process of both the deep well and shallow well water, which would total 965 AFY, will be discharged to Great Salt Lake. Under this scenario, the by-product will be conveyed through a newly constructed by-product pipeline approximately 21 miles in length (see Figure A1). The pipeline alignment follows 1300 West north from the treatment plant (see Figure A2 [Map 7]), then follows the Utah and Salt Lake Canal access road for approximately 10.5 miles northwest (see Figure A2 [Maps 3–6]), then crosses approximately 5.6 miles of KUCC property (see Figure A2 [Maps 1–3]). The outfall enters the Great Salt Lake approximately 1.25 miles northeast of the Route 202-Interstate 80 (I-80) interchange (see Figure A2 [Map 1]). The remainder of the by-product pipeline is on Utah Department of Transportation ROWs. The by-product pipeline is under construction with completion projected for August 2011. The pipeline is being constructed in a 3- to 6-foot-wide corridor with four staging and construction areas approximately 2 acres each in size. Approximately 55 acres of temporary surface disturbance will occur during pipeline construction. Following installation of the pipeline, the disturbed areas would be restored to pre-construction condition (e.g., asphalt driveways and roadways, roadbase shoulders of public ROWs).

During initial start-up, all water except treated water and excess shallow well water will be pumped via the by-product pipeline to Great Salt Lake.

2.2.5 Mitigation and Control Measures

Baseline mitigation measures for minimizing the extent and duration of Project-related disturbance will include the following:

- Standard construction best management practices (BMPs) would be implemented.
- In compliance with the Section 404 general permit, standard U.S. Army Corps of Engineers procedures would be implemented for wetland and waterbody construction and mitigation.
- General BMPs for soils would include a fugitive dust control plan; a stormwater pollution prevention plan; soil stabilization and erosion control measures; avoidance of soil compaction, particularly during wet or soft soil conditions; avoidance of mixing of soil horizons; and avoidance of soil stockpiling for long periods (+/- six months).
- Construction equipment would be cleaned using BMPs prior to entering and leaving the Project Area to minimize the spread and establishment of non-native invasive plant species.
- Removal and disturbance of vegetation would be kept to a minimum.
- Reclamation would be accomplished with native seeds representative of indigenous plant communities. Rationale for seeding with selected non-native species would be documented, such as the use of non-native species as temporary cover crops to out-compete weeds during native seed establishment.
- BMPs for raptors and other mitigation measures would be applied as necessary to mitigate adverse impacts on nesting raptors.
- All construction equipment and vehicles would be maintained in good operating condition to minimize exhaust emissions.

In addition to mitigation measures, control measures would limit impacts from project activities. Control measures consist of a UPDES permit for discharges from the RO water Treatment Plant (Appendix B), a formal agreement with FRIENDS of Great Salt Lake related to the UPDES permit (Appendix C), and compliance with the consent decree under CERCLA.

A UPDES permit was issued to the JVWCD on March 7, 2014, authorizing discharges from two outfalls associated with the RO water Treatment Plant (Permit No. UT0025836). Outfall 001 consists of by-product stream and excess untreated groundwater from the deep aquifer containing concentrated dissolved salts and trace metals; it discharges through the 21-mile pipeline to the transitional waters[1] and to Gilbert Bay of Great Salt Lake. Outfall 002 comprises excess, untreated, shallow groundwater discharges to the Jordan River. The UPDES permit establishes discharge limitations and monitoring requirements, recordkeeping and reporting requirements, and compliance responsibilities. Required monitoring samples for Outfall 001 will be taken at the RO water Treatment Plant before any effluent enters the by-product pipeline. Outfall 002 will be monitored before any of its discharges mix with any receiving water. Permit effluent limitations for both outfalls are presented in Tables 2.2 and 2.3. Table 2.4 summarizes the reporting requirements of the UPDES permit.

Table 2.2. UPDES Effluent Limitations for Outfall 001

Parameter	Outfall 001 Effluent Limitations				
	Maximum Monthly Average	Maximum Weekly Average	Daily Minimum	Daily Maximum	Annual Maximum
Total Flow (MGD)	3.0	–	–	–	–
Total Selenium (mg/L)	–	–	–	0.054	–
Total Selenium (kg/year)	–	–	–	–	224
Selenium (in bird egg tissue)	Selenium water quality standard for Gilbert Bay of Great Salt Lake is 12.5 mg/kg.				
Total Suspended Solids (mg/L)	25	35	–	70	–
Mercury (kg/yr)	–	–	–	–	0.38
Oil and Grease (mg/L)	–	–	–	10	–
pH (standard units)	–	–	6.5	9.0	–
Whole Effluent Toxicity, Chronic Biomonitoring, both species	–	–	–	Pass IC_{25} (end of pipe)	–

Source: UPDES Permit No. UT0025836

Notes: IC_{25} (inhibition concentration 25) = the concentration of toxicant that would cause a 25% reduction in mean young per female, or a 25% reduction in overall growth for the test population; MGD = millions of gallons per day; mg/L = milligrams per liter; kg/yr = kilograms per year

[1] According to the Utah Water Quality Standards (R317-2-6), *Transitional Waters* along the shoreline of Great Salt Lake (Class 5E) are defined as "all waters below approximately 4,208 feet in elevation to the current lake elevation of the open water of Great Salt Lake receiving their source water from naturally occurring springs and streams, impounded wetlands, or facilities requiring a UPDES permit."

Table 2.3. UPDES Effluent Limitations for Outfall 002

Parameter	Outfall 002 Effluent Limitations				
	Maximum Monthly Average	Maximum Weekly Average	Daily Minimum	Daily Maximum	Annual Maximum
TDS (mg/L)	–	–	–	1,200	–
Total Selenium (mg/L)	–	–	–	0.027	–
Total Selenium (kg/year)	–	–	–	–	26.4
Total Suspended Solids (mg/L)	25	35	–	70	–
Oil and Grease (mg/L)	–	–	–	10	–
pH (standard units)	–	–	6.5	9.0	–
Whole Effluent Toxicity, Acute Biomonitoring, both species	–	–	–	Pass LC_{50} (end of pipe)	–

Source: UPDES Permit No. UT0025836

Notes: LC_{50} (lethal concentration 50) = the concentration of toxicant that would cause a 50% reduction of the test population in a specified period; mg/L = milligrams per liter; kg/yr = kilograms per year.

Table 2.4. UPDES Self-Monitoring and Reporting Requirements

Parameter	Outfall 001		Outfall 002	
	Frequency	Sample Type	Frequency	Sample Type
Total Flow (MGD)	Daily or continuous	Measured	Daily or continuous	Measured
Total Selenium (mg/L)	2x weekly	Composite or grab	2x weekly	Composite or grab
Total Selenium (kg/year)	Monthly	Calculated	Annually	Calculated
Selenium (mg/kg)	Annually	Bird eggs	N/A	N/A
Total Suspended Solids (mg/L)	2x weekly	Composite or grab	2x weekly	Composite or grab
Total Dissolved Soils (mg/L)	N/A	N/A	2x weekly	Composite or grab
Total Mercury (kg/yr)	Monthly	Calculated	N/A	N/A
Total Mercury (ng/L)	Monthly	Composite or grab	Monthly	Composite or grab
Oil and Grease (mg/L)	Monthly, if sheen observed	Grab	2x weekly, if sheen observed	Grab
pH (standard units)	Monthly	Grab	2x weekly	Grab
Whole Effluent Toxicity, Chronic Biomonitoring (pass/fail)	Quarterly, alternating species	Composite	N/A	N/A
Whole Effluent Toxicity, Acute Biomonitoring (pass/fail)	N/A	N/A	Quarterly, both species	Composite

Source: UPDES Permit No. UT0025836

Notes: IC_{25} (inhibition concentration 25) is the concentration of toxicant that would cause a 25% reduction in mean young per female, or a 25% reduction in overall growth for the test population; N/A = not applicable; MGD = millions of gallons per day; mg/L = milligrams per liter; kg/yr = kilograms per year; mg/kg = milligrams per kilogram; ng/L = nanograms per liter

Monitoring results will be reported on a monthly basis. In addition to water samples, sampling of bird eggs, macroinvertebrates, sediments, and brine shrimp is required. Bird surveys are also required between April 15 and June 30 of each year.

To decrease uncertainty regarding potential selenium and mercury impacts, a comprehensive sampling and analysis plan for bird egg, macroinvertebrates, water, and sediment was developed. JVWCD will be required to perform the following monitoring activities:

1. Bird Egg Sampling: Collect eight bird eggs during the nesting season (April 15–June 30) near Outfall 001 (if eggs are available). Samples will be analyzed for selenium and total mercury.

2. Macroinvertebrate, Water, and Sediment Sampling: Collect co-located macroinvertebrate, water, and sediment samples from six locations as close in time as practical to the bird egg sampling. All samples will be analyzed for selenium. Biota, sediment, and water samples will also be analyzed for total mercury; water samples will additionally be analyzed for methyl mercury.

3. Brine Shrimp and Water Sampling in Gilbert Bay: Collect co-located brine shrimp and water samples twice per year in the open waters of Gilbert Bay near Outfall 001. Water samples will be analyzed for total and methyl mercury and selenium. Brine shrimp samples will be analyzed for total mercury and selenium.

4. Bird Survey: Perform a bird survey four times per nesting season to document abundance, diversity, and use of the Outfall 001 habitat.

Additional information on these requirements can be found in the UPDES permit in Appendix B (specifically page 9). JVWCD will endeavor to partner with other facilities that discharge in the same delta to avoid needless duplication of effort.

To address concerns expressed during the EA public involvement process and the UPDES permit approval process by the non-profit organization FRIENDS of Great Salt Lake, JVWCD and UDWQ entered into an agreement with the group on March 6, 2014. The agreement with FRIENDS of Great Salt Lake outlines additional steps that will be taken in conjunction with the UPDES requirements. The steps are as follows:

- Form a technical review committee to annually review the permit monitoring information, composed of one representative from each party.

- Hold a public meeting to review the permit monitoring information as soon as practicable, but no later than 45 days following its receipt by UDWQ.

- Have the review committee evaluate the following:

    - Whether there have been any material, negative changes to the beneficial uses of the transitional waters or Gilbert Bay, including alterations to habitat, water quality, macroinvertebrates, and bird use

    - Whether any water quality standards have been violated in the transitional waters or Gilbert Bay

    - Whether the data suggest any negative or positive trends with respect to beneficial uses or water quality standards (even if beneficial uses have not been impaired and water quality standards have not been violated)

- Information regarding the cause(s) of any negative changes, water quality standard violations, or trends
- Whether the committee as a whole will recommend any permitting actions that the UDWQ director should take
- Whether the committee as a whole will recommend any adjustments to the sampling and analysis plan

The intent is for the three parties to reach a consensus about interpretation of the data and about the appropriate course of action that should be recommended, if any, to the UDWQ director. Disputes would be resolved through mediation.

2.2.6 Potential Projects Funded by the EPA Grant

The following projects have not been implemented and potentially may be funded by the EPA grant:

- Four Additional Shallow Well Drilling: bids in 2015, estimated cost of $900,000 ($225,000/well)
- Construction of the 4 Additional Shallow Wells: bids in 2015, estimated cost of $1,000,000 ($250,000/well)
- Extension of the By-product Pipeline to Great Salt Lake: bids in 2015, estimated cost of $400,000

2.3 Alternative 3: Minimum Integrated Design

Under Alternative 3 (Minimum Integrated Design), JVWCD would issue bonds (approximately $20,000,000), use funds provided by the State of Utah and KUCC from the consent decree (approximately $38,000,000), and use approximately $1,029,000 in grants allocated in FY 2004 and FY 2005 to construct the Project.

The locations of the proposed facilities and pipelines would be the same for this alternative as for Alternative 2 (see Figure A1 and Figure A2 [Maps 1–9]).

Under this alternative, JVWCD would continue its integrated operations with water from the deep and shallow aquifers. JVWCD would integrate deep and shallow aquifer treatment processes, using water from the deep wells for RO feed water and water from the shallow wells for filtration/disinfection feed water, for a combined production of 4,195 AFY of treated water (and 855 AFY of by-product). Of the treated water, 3,500 AFY would be attributable to the deep aquifer wells and 695 AFY would be attributable to the shallow aquifer wells (see Figure A4). JVWCD has acquired the remainder 540 AFY from other sources available to it to satisfy its obligation to provide 4,735 AFY of treated water. See Figure A4 for a diagram of the process.

2.3.1 Groundwater Extraction

2.3.1.1 Deep Water Wells

The method of construction, location, and number of new deep-water extraction wells would be the same as the Preferred Alternative. Under this alternative, the deep-water wells would provide 4,300 AFY that would enter into the Zone B Facilities for treatment.

2.3.1.2 Shallow Aquifer Wells

The method of construction, location, and number of new shallow water extraction wells would be the same as the Preferred Alternative. Under this alternative, the shallow aquifer wells would provide 750

AFY that would enter into the Lost Use Facilities for filtration/disinfection treatment. JVWCD would monitor metals as described under the Preferred Alternative.

2.3.2 Water Treatment Plant and Process

The facility would be constructed and located as described under the Preferred Alternative. Under this alternative, water from the deep wells would enter into the RO process and produce both permeate (3,500 AFY) and by-product water (855 AFY). Permeate would be blended with shallow well-treated water to reach a TDS concentration of 250 mg/L. The combined treated water would then be ready to enter into the distribution system (4,195 AFY). See Figure A4 for a diagram of this process.

Water from the shallow wells would enter into a filtration/disinfection process only. Treated water (695 AFY) would be blended and combined with deep well permeate to reach a TDS concentration of 250 mg/L (as described above), and would then enter the distribution system. Filtration membranes would be disposed of properly in a landfill. See Figure A4 for a diagram of this process.

2.3.3 Collection Pipelines

The location and length of collection pipelines would be the same as described for the Preferred Alternative.

2.3.4 Treated Water Deliveries

Treated water deliveries would be the same as for the Preferred Alternative.

2.3.5 By-product Disposal

By-product disposal would be the same as for the Preferred Alternative.

2.3.6 Mitigation and Control Measures

Mitigation and control measures would be the same as for the Preferred Alternative.

2.3.7 Potential Projects Funded by the EPA

Potential projects funded by the EPA would be the same as for the Preferred Alternative.

2.4 Summary Comparison of Alternatives

Table 2.5 contains a summary comparison of the key components of the No Action Alternative, the Preferred Alternative (Alternative 2), and the Minimum Integrated Design Alternative (Alternative 3).

Table 2.5. Summary Comparison of Key Components of the No Action Alternative, the Preferred Alternative, and the Minimum Integrated Design Alternative

Component	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3: Minimum Integrated Design
Implement Project	Yes	Yes	Yes
Project Funding			
Bonds	$20,000,000	$20,000,000	$20,000,000

Table 2.5. Summary Comparison of Key Components of the No Action Alternative, the Preferred Alternative, and the Minimum Integrated Design Alternative

Component	Alternative 1: No Action	Alternative 2: Preferred Alternative	Alternative 3: Minimum Integrated Design
NRD Consent Decree	$38,000,000	$38,000,000	$38,000,000
Special Appropriations Grants	$0	$1,029,000	$1,029,000
Other (either additional bonds or revenue)	$1,029,000	$0	$0
Total	**$59,029,000**	**$59,029,000**	**$59,029,000**
Deep Wells			
Water Entering RO Treatment Facility (AFY)	4,300	4,300	4,300
M&I Water Produced (AFY)	3,500	3,500	3,500
By-product Water (AFY)	800	800	800
Shallow Wells			
Water Entering Lost Use Treatment Facility (RO process and filtration/disinfection process) (AFY)	1,400	1,400	750
M&I Water Produced (AFY)	1,235	1,235	695
By-product Water (AFY)	165	165	55
Total Wells			
Water Entering RO and Lost Use Treatment Facilities (AFY)	5,700	5,700	5,050
M&I Water Produced (AFY)	4,735	4,735	4,195
By-product Water (AFY)	965	965	855
Additional Water Rights Necessary (AFY)	0	0	540
Total M&I Water Delivered to System (AFY)	4,735	4,735	4,735
Surface Disturbance (Temporary)			
RO Treatment Plant (acres)	1.5	1.5	1.5
Deep Wells (acres)	2.6–3	2.6–3	2.6–3
Shallow Wells (acres)	1–5	1–5	1–5
Collection Pipelines (4- to 6-foot-wide corridor) (acres)	8.7–13.1	8.7–13.1	8.7–13.1
By-product Pipelines (acres)	55	55	55
Treated Water Pipelines (4- to 8-foot-wide corridor) (acres)	4.6–9.2	4.6–9.2	4.6–9.2
Total Temporary Surface Disturbance (acres)	**73.4–84.8**	**63.4–74.8**	**63.4–74.8**
Surface Disturbance (permanent)			
RO Treatment Plant (acres)	3.5	3.5	3.5
Deep Wells (acres)	0.018–0.021	0.018–0.021	0.018–0.021
Shallow Wells (acres)	0.014–0.07	0.014–0.07	0.014–0.07
Collection Pipelines (4- to 6-foot-wide corridor) (acres)	0	0	0
By-product Pipelines (acres)	0	0	0
Treated Water Pipelines (4- to 8-foot-wide corridor) (acres)	0	0	0
Total Permanent Surface Disturbance (acres)	**3.52–3.59**	**3.52–3.59**	**3.52–3.59**

2.5 Alternatives Eliminated from Detailed Analysis

Various treatment process and by-product disposal alternatives were considered in the process of Project planning and development. These were eliminated from detailed analysis for the reasons listed below.

2.5.1 Treatment Process

A number of treatment processes are available that remove suspended material and calcium hardness, but most of these processes would not remove the specific contaminants present in the groundwater plume to be remediated. Sulfate is the contaminant of concern in the plume, and RO, a treatment process using membranes, is ideally suited for removing dissolved minerals, such as sulfate, from water. Although other treatment processes exist that can remove sulfate, RO is the most cost-effective option at this scale. JVWCD performed pilot testing of the RO process to prove that it could work for this purpose.

2.5.2 By-product Disposal

A number of different options were explored for disposal of the concentrate from the RO Treatment Plant. The initial disposal option was to discharge the concentrate into the Jordan River near 7800 South. Due to public resistance, the plan was abandoned and alternatives were prepared that piped the concentrate to the Kennecott Tailings Pond and ultimately to the Great Salt Lake. A number of different routes were considered; some that followed canals to the lake and some using surface roads. The alternatives analysis recommended that the Utah and Salt Lake Canal access road be used as a pipeline route due to its shorter length and reduced cost (see Memo (7-21-06): By-product Disposal Alternatives). KUCC was only willing to accept concentrate from deep groundwater, so the pipeline ultimately had to discharge into the Great Salt Lake due to the shallow groundwater concentrate also present.

3 AFFECTED ENVIRONMENT

3.1 Summary of Resources

This Affected Environment section identifies the existing resource values and uses in the Project Area that would be affected by the No Action Alternative (Alternative 1), the Preferred Alternative (Alternative 2), and the Minimum Integrated Design Alternative (Alternative 3). The existing resource conditions presented here establish a resource baseline against which the effects of the alternatives can be evaluated. These impacts are discussed under the following resources: groundwater resources, surface water, wetlands, soils, vegetation, wildlife, air quality, cultural resources, paleontological resources, noise, public health, and socioeconomic resources.

3.2 Groundwater

Groundwater resources located in the Project Area can be divided into deep and shallow resources. Extensive studies of groundwater contamination and movement have been completed as part of KUCC's and JVWCD's proposal (KUCC and JVWCD 2004). Existing conditions of groundwater in Zone B are documented in KUCC's *Final Design for Remedial Action at South Facilities Groundwater* and NRD Joint Proposal reports. Methods for ongoing monitoring of groundwater resources are also contained in these reports.

The bedrock of the Oquirrh Mountains provides recharge to the groundwater in the western part of the southwestern Jordan Valley and then travels eastward into the basin. Contaminated recharge from KUCC's waste rock dumps has been eliminated using cutoff walls keyed into bedrock. Aquifer recharge is now greater in the eastern part of the southwestern Jordan Valley and in the Herriman area due to recharge from surface water (KUCC and JVWCD 2004).

An average of approximately 14,000 to 15,000 AFY is extracted from the principal aquifer for M&I uses (KUCC and JVWCD 2004). Groundwater recharge to the principal and shallow unconfined aquifers in the southwestern Jordan Valley is from precipitation, bedrock aquifer, irrigation canals, irrigated fields, lawns and gardens, stream and channel fill, and reservoirs and evaporation ponds. The primary sources of groundwater losses are from well extraction, evapotranspiration, and head dependent boundaries (such as losing streams) (KUCC and JVWCD 2004). However, current unpublished studies indicate that the levels of shallow groundwater at the JVWCD headquarters site, which is the proposed location for the RO treatment facility and five shallow wells, are approximately 4 to 10 feet. Groundwater levels on this site are primarily controlled by the water level of the Jordan River. Average horizontal groundwater velocities are estimated by KUCC to be from 500 to 650 feet per year (KUCC and JVWCD 2004).

In Zone B (see Figure A1), located at and downgradient from the old KUCC evaporation ponds in South Jordan, the groundwater contaminant of concern is sulfate, which is present at concentrations that average less than 1,500 mg/L but above the State Drinking-Water Primary Standard of 500 mg/L. Of major concern is the proximity of mining-affected groundwater to municipal well fields of West Jordan and Riverton (KUCC and JVWCD 2004).

The flow of mine-impacted effluents in the groundwater flow system produced plumes of contaminated groundwater within the aquifer in the Southwestern Jordan Valley. The Remedial Investigation (KUCC 1998) showed that there are about 171,000 acre-feet of groundwater that exceed appropriate water-quality criteria. The EPA and the UDEQ have determined that the groundwater plumes containing sulfate

concentrations greater than 1,500 mg/L sulfate or acid constitute a risk to human health and the environment a that they require remedial actions (KUCC and JVWCD 2004).

3.3 Surface Water

3.3.1 Jordan River

The Jordan River traverses approximately 30 miles of Salt Lake County from the Utah–Salt Lake County line north to the Great Salt Lake. The Jordan River drainage produces approximately 178,000 AFY of surface water, 97% of which originates in the Wasatch Mountains and the Utah Lake Drainage (Utah Division of Water Resources [UDWtR] 1997a, 1997b). Seven major streams and 19 smaller streams flow into the Jordan River from the Wasatch Mountains on the east and the Oquirrh Mountains on the west (UDWtR 1997a, 1997b). Major streams include City Creek, Parley's Creek, Big Cottonwood Creek, Little Cottonwood Creek, Mill Creek, Red Butte Creek, and Emigration Creek. In recent years, the Jordan River drainage has experienced a decrease in irrigation water use and an increase in M&I water use. In an average water year, current surface water usage rates total 308,000 AFY of water from the Jordan River, 173,400 AFY from Wasatch Mountain streams, and 4,400 AFY from Oquirrh Mountain streams, with an additional 170,700 AFY imported from outside the drainage (UDWtR 1997a, 1997b). At present, relationships between groundwater, subsurface recharge, and surface water in the Jordan River drainage are not clearly understood. In addition, groundwater, subsurface and surface water recharge varies with annual snowmelt and rainfall in the region.

The major water users in the Jordan River Basin are municipalities and industry, with irrigation and recreational uses representing a smaller proportion of water use. Historically, the Jordan River corridor contained marsh areas and riparian habitats that supported a diversity of wildlife and fish (UDWtR 1997a, 1997b). Today, land use adjacent to the river corridor is almost exclusively residential and industrial. As a result of ongoing development and river channelization, wetland and riparian habitats have been altered or lost. The Jordan River is listed as Category 5A in Utah's 2006 and 2008 303(d) lists (UDWQ 2006, 2008). Three segments (4, 5 and 6) of the Jordan River within the Jordan Valley catchment are listed as impaired, including the stretch between 7800 South and 11400 South (Segment 6) where high TDS water as a result of well start up would be discharged into the Jordan River. The Jordan River is listed as impaired for the following:

- Non-support of the secondary contact recreation beneficial use (2B) for *E. coli* exceedances (maximum of 940 cfus/100mL, geometric mean of 206 cfus/100mL) (Segment 5)
- Non-support of cold-water game fish and other cold-water aquatic life (3A) for temperature exceedances (maximum of 20°C) (Sections 5 and 6) and for benthic macroinvertebrate assessment impairment (Segment 6)
- Non-support of agricultural uses (4) for exceedances in TDS (TDS, salinity and chlorides; maximum of 1,200 mg/L) (Segments 4 and 5) (UDWQ 2008)

3.3.2 Great Salt Lake

The Great Salt Lake is a terminal basin that covers 1,700 square miles at its historic average surface elevation of 4,200 feet, and is relatively shallow with an average depth of about 35 feet. The majority of the water flowing into the lake comes from three primary tributaries: the Bear River, the Weber River, and the Jordan River. Additional inputs come from smaller tributaries, groundwater seepage, and irrigation drainage water. The Great Salt Lake is a complex and dynamic system that has been subject of recent ecological studies (e.g., Stephens and Birdsey 2002, Naftz et al. 2008, Johnson et al. 2008, Belovsky et al. 2011) because of its importance to resident and migratory birds, local recreation, and the brine shrimp and mineral industries (UDEQ 2008). Because the Great Salt Lake has no outlet, the fate of

pollutants in the Lake, its sediments, and in its wildlife and plants, is of particular focus. The only mechanisms for removal of a pollutant once it has entered the lake are commercial extraction (through brine shrimp or mineral harvest) or ingestion and storage in transient animal tissues (e.g., migratory birds). Uptake and storage by plants can temporarily remove pollutants from water and sediments but does not remove pollutants from the lake system (SWCA 2005).

The beneficial uses for the Great Salt Lake (primary and secondary contact recreation, aquatic wildlife, and mineral extraction (Class 5)) are currently protected under the narrative standard in the state water quality standard (State of Utah, R317-2-7). The State of Utah has developed a selenium standard of 12.5 mg/kg dry weight in bird egg tissue that is a geometric mean over the nesting season for Gilbert Bay of Great Salt Lake (EPA 2011). The EPA chronic freshwater exposure criterion for selenium is 5.0 µg/L and the State of Utah water quality criterion in freshwater systems is 4.6 µg/L. Mining and other industrial activities in the southwestern Salt Lake Valley have resulted in elevated levels of sulfate in groundwater that threaten the municipal water supply (UDEQ 2008). Because the proposed RO Treatment Plant would pipe concentrated by-product water to the Great Salt Lake for discharge, the short- and long-term fates of mercury, sulfate, and selenium discharged to the Lake are of concern.

3.3.2.1 Mercury

Mercury is heavy metal that is a potent neurotoxin that can cause adverse or lethal effects on the health and behavior of humans and wildlife. Mercury occurs in very low concentrations in sea water and soils, but the major source of environmental contamination is from atmospheric deposition from coal-fired power plants and waste incinerators. Volatilized mercury, or methylmercury (CH_3Hg:Hg), is particularly toxic due to its ability to cross the blood-brain barrier and bioaccumulate in living tissues, which can have potentially fatal consequences to adult animals and developing offspring. The high rates of sulfate reduction (see Section 3.3.2.2. Sulfate, below), size, and chemistry of Great Salt Lake create ideal conditions for the deposition and volatilization of mercury (Naftz et al. 2005). EPA data from the 1990s indicate mercury deposition levels to Great Salt Lake from 3 to 30 µg/m^2. Recent studies of Great Salt Lake (Ingvorsen and Brandt et al. in Gwynn 2002) indicate that rates of volatilization of mercury from its elemental form (Hg) to methylmercury (CH_3Hg) in Great Salt Lake are among the highest reported in a natural system (6000 nmoles/cm^3/day). Migratory bird species have been found to possess elevated levels of methylmercury in their organ tissues due to bioaccumulation during fall feeding on brine shrimp (EPA 1997). The highly elevated ratios of CH_3Hg:Hg in the Great Salt Lake ecosystem are of particular concern due to methylmercury's potential to cause reproductive failure in adult birds and its toxicity to developing offspring. Based on data collected by the USGS (Naftz et al. 2009), the total annual mercury load for Great Salt Lake is approximately 38 kilograms (kg) (32 kg from atmospheric sources and 6 kg from riverine sources).

3.3.2.2 Sulfate

Groundwater in the aquifers below South Jordan contains high concentrations of sulfate and TDS (SWCA 2005). The EPA and the UDEQ have determined that ground-water plumes containing sulfate concentrations greater than 1,500 mg/L sulfate or acid constitute a risk to human health and the environment (KUCC, JVWCD 2004). Sulfate in drinking water currently has a secondary maximum contaminant level of 250 mg/L, based on aesthetic effects (i.e., taste and odor). Water column sulfate concentrations in Great Salt Lake average 6,000 mg/L. Chemical reduction of selenium by sulfate-reducing bacteria or due to high levels of sulfate can reduce selenium to non-toxic levels (Hockin and Gadd 2006). Reduced sulfate and some anaerobic bacteria convert inorganic mercury to organic (bioavailable) methylmercury that is highly toxic to humans and wildlife (see Section 3.3.2.1 Mercury).

3.3.2.3 Selenium

Selenium is a naturally occurring mineral element and an essential trace nutrient, but it can be either beneficial or toxic depending on its chemical form and concentration (Ohlendorf 2003). High concentrations of bio-available forms of selenium, such as selenate, are extremely toxic. Selenium is often present in small quantities in mixed metal-polluted wastes, where it can have disproportionate negative effects due to its extreme toxicity (Hockin and Gadd 2006). Insoluble selenium (Se) predominates in anaerobic environments, while the toxic anionic forms of the element selenate (SeO_4^{2-}) and selenite (SeO_3^{2-}) dominate in aerobic environments (Hockin and Gadd 2006). The fate and transport of selenium is determined by chemical interactions between water, soil and sediments, and plant and animal life. Selenium is transported by three primary pathways: 1) ingestion or absorption by organisms; 2) binding to particulate matter, or 3) dissolution in solution (Lemly 2002). Most selenium accumulates in upper layers of sediment, where it can be immobilized by burial under sediment layers (Lemly 2002). Because inflows into Great Salt Lake have been selenium enriched since approximately the early 1990s (Naftz et al. 2008), immobilization of selenium under clean sediments in the Lake is not a viable mechanism for immobilization. The major mechanism of selenium removal from Great Salt Lake is volatilization, or evaporation of dissolved selenium to the atmosphere, which removes between 1,380 to 3,210 kg/yr (Johnson et al. 2008).

The total estimated selenium load to Great Salt Lake was 1,480 kg for the period from May 2006 to April 2007, with most of the selenium entering the lake as dissolved selenate (Naftz et al. 2008). The greatest proportion of selenium loads were from the KUCC outfall and Goggin Drain (27% each). However, measured influent loads do not explain the total average waterborne selenium concentration measured during the study (Naftz et al. 2008). There was a net increase in selenium concentrations during the study period, but comparison of expected versus measured selenium influx from tributaries indicated that an unmeasured source of selenium is contributing an additional 1,500 kg of selenium to the south arm of Great Salt Lake (Naftz et al. 2008). Additional selenium sources potentially include: unmeasured surface flows, groundwater discharges, diffusion from lake sediment pore water, and wind-blown particulate (Naftz et al. 2008). Atmospheric deposition was estimated to potentially contribute up to 596 kg of selenium to the lake per year (Naftz et al. 2008). There is potential for submarine groundwater discharge to Great Salt Lake (UDEQ 2008). Groundwater in the aquifers below South Jordan contains high concentrations of TDS that include low concentrations of dissolved selenium (SWCA 2005). Average selenium concentrations in the Jordan River from 1996 to 2003 were 2.12 µg/L (EPA STORET data, 1996 to 2003), which is about half of the EPA chronic freshwater exposure criterion of 5.0 µg/L and the State of Utah water quality criterion for selenium in freshwater systems of 4.6 µg/L. Monitoring of groundwater in the Salt Lake Valley by USGS in 1999 identified a mean selenium concentration of 2.4 µg/L, with one well location with an observed concentration of 13.0 µg/L. A tissue-based water quality standard for selenium of 12.5 mg/kg (for bird eggs) has been established for Gilbert Bay of Great Salt Lake to prevent impairment to aquatic wildlife (EPA 2011). See additional discussion of selenium and wildlife in Section 3.7.2.4.

3.4 Wetlands

Jurisdictional wetland determinations are made based on the presence of characteristic wetland vegetation, evidence of wetland hydrology, and indicators of wetland soil. Much of the Project Area comprises urban and suburban development. Those areas that have the greatest potential to support jurisdictional wetlands lie at the JVWCD headquarters property at 1300 West (see Figure A1 and Figure A2 [Maps 1 and 7]), which is where the RO and filtration/disinfection treatment facilities and five shallow wells are located, and along the proposed by-product pipeline alignment to the north where the by-product pipeline enters the Great Salt Lake.

The easternmost portion of the JVWCD headquarters property lies on the historic floodplain of the Jordan River (see Figure A1 and Figure A2 [Map 7]). Wetlands in the historic Jordan River floodplain have become disconnected from their water sources as a result of land use changes, historic flood control projects, and channel stabilization work along the Jordan River. Wetlands have also been altered by being drained and/or filled as a result of agricultural practices and urbanization. These practices have resulted in losses of native vegetation, invasion of exotic plants such as tamarisk and Russian olive, and the associated loss and degradation of wildlife habitat.

Informal wetland assessments were conducted for the JVWCD headquarters property and the remainder of the Project Area in 2002. A wetland assessment does not use the same criteria as a jurisdictional delineation to determine if a wetland exists. Instead of determining if wetland vegetation is dominant, hydrology is present, and if hydric soils exist for a given area as is done for a jurisdictional delineation, the predominance of wetland vegetation and presence of hydrology is used to suggest that a given area is likely a wetland. In addition, topographical maps, National Wetland Inventory (NWI) maps, and hydric soils data can be used to determine those areas that are likely to have characteristics that may support a wetland.

The JVWCD headquarters property was evaluated for wetlands on May 3, 2002. The site survey concluded that wetland plants do not dominate any sites on the property. Additionally, the control of the river to prevent flooding has lowered the groundwater elevation and restricted spring overbank flooding. No wetland hydrology indicators were observed on the parcel. Soils with hydric indicators occur as inclusions on the site and may have formed under wetland conditions. The lack of wetland vegetation and hydrology indicate that the site is not presently a wetland.

A formal jurisdictional wetland delineation was conducted in the Project Area as part of the Clean Water Act Section 404 regulatory process in October 2010 (SWCA 2014; Appendix D). The delineation included an approximately 407-acre study area consisting of a linear section in which the by-product pipeline was later installed and a wetland focus area adjacent to Great Salt Lake (the site of the proposed pipeline outfall structure). The by-product pipeline was installed within the ROW of local residential and commercial streets south of 6500 South. North of 6500 South, the pipeline alignment follows the access road for the historic Utah and Salt Lake Canal and was installed within this corridor. The wetland focus area comprises the small, terminal, northern portion of the by-product pipeline (the by-product pipeline extension to Great Salt Lake), and is near the Saltair beach along the southeastern shoreline of Great Salt Lake.

Although the entire study area was surveyed for potential wetlands, delineation activities were only necessary in the wetland focus area. Potential jurisdictional waters of the U.S. were located within the wetland focus area. As part of Jordan Valley's construction of the existing portion of the reject water pipeline, potential jurisdictional waters of the U.S. were evaluated including ditches, canals, pipeline, and streams crossed by the pipeline, and stormwater ponds and channels through the study area.

In the wetland focus area, three potential jurisdictional waters were delineated: approximately 1.49 acres of lacustrine littoral unconsolidated shore wetland (characterized as a slope mudflat), 1.02 acres of palustrine emergent marsh, and 0.60 acre of drainage ditch with emergent vegetation. Twenty feet of discharge canal were also observed in the wetland focus area. The dominant plant species identified at sampling points in the study area consisted of cheatgrass (*Bromus tectorum*), foxtail barley (*Hordeum jubatum*), burning bush (*Kochia scoparia*), and Utah swampfire (*Salicornia utahensis*). Construction of the extension of the by-product pipeline into Great Salt Lake is estimated to temporarily disturb 0.35 of the 3.11 acres of wetlands identified in the wetland focus area. No permanent impacts to wetlands and waters of the U.S. are anticipated in the wetland focus area. Wetland impacts will be controlled and mitigated through compliance with a Nationwide Section 404 Permit under the Clean Water Act issued by

the U.S. Army Corps of Engineers. The applicant applied for a Nationwide Permit Pre-Construction Notification on August 22, 2014.

The Utah Department of Natural Resources, Division of Forestry, Fire and State Lands (FFSL) issues leases, permits, and easements for surface uses on sovereign lands in Utah, which include Great Salt Lake and the Jordan River. The implementation of any of the three alternatives would require an application for a general permit on sovereign land from the FFSL, which is typically issued for a term of one to 30 years. JVWCD submitted the general permit application in June 2014. No construction will occur until the permit has been issued.

3.5 Soils

Given the severely modified nature of most of the Project Area, the natural state of soils is difficult to determine. Many of the soils in the Project Area have been altered by road and railroad construction, agriculture, urban development, or by a combination of these developments.

The sediments of the Salt Lake Valley have been generally formed as a result of the activity of former Lake Bonneville and its successor, the Great Salt Lake. The lakebed deposits typically comprises an upper layer of desiccated clay crust underlain by soft clay and interbedded clay and sand lenses. The sediments in the Wasatch Front valleys are classified as Mollisols, Alfisols, or Aridisols. Mollisols are a thick, dark, relatively fertile surface soil, rich in humus, and tend to occur where average annual precipitation exceeds 12 to 14 inches and elevations are mainly above 5,000 feet (Wahlquist 1981). Mollisols are usually formed under grassland or prairie conditions. Alfisols are lighter colored soils that usually form in forested areas, with strongly alkaline horizons as a result of the influences of the water table and sodium. Aridisols occur in areas of little annual precipitation (less than 12 to 14 inches), such as sagebrush, saltbrush, and desert-like communities. Table 3.1 describes the major soil types in the Project Area in the three major soil groups discussed above.

Table 3.1. Project Area Major Soil Types

Soil Type	Soil Symbol	Description	Farmland Classification	Acres in Project Area
Bluffdale	BIB, BnA, BnB	Sandy loam, Silty clay loam on 1% to 3% slopes	Irrigated farmland	11.92
Pharo	PfC	Coarse sandy loam, 2% to 6% slopes	Irrigated farmland	9.82
Hillfield	HfC, HIA, HIB, HIC, HtF2	Sandy loam, Loam on 0% to 6% slopes	Irrigated farmland	8.40
Bramwell	BsA, BsB	Strongly alkaline silt loam, Silty clay loam on 0% to 3% slopes	Irrigated farmland	8.19
Harrisville	HcB	Silty clay loam, 1% to 3% slopes	Irrigated farmland	7.61
Taylorsville	TaA, TaB, TaC	Silty clay loam on 0% to 6% slopes	Irrigated farmland	6.88
Mine wash	Mn	NA	NA	5.36
Lasil	LdB, LE	Silt loam 0% to 2% slopes, Silt loam drained 0% to 1% slopes	Irrigated farmland	3.62
Bingham	BhA, BhB	Gravelly loam, 1% to 6% slopes	Non-irrigated farmland and range	2.56
Parleys	PeA	Silt loam, 0% to 3% slopes	Irrigated farmland	2.53

Table 3.1. Project Area Major Soil Types

Soil Type	Soil Symbol	Description	Farmland Classification	Acres in Project Area
Pleasant Grove	PhB	Gravelly loam, 2% to 6% slopes	Irrigated and non-irrigated farmland	2.51
Saltair	SPL	Silty clay loam	Irrigated farmland	2.12
Made land	Ma	No interpretations available, too variable	Industrial uses	1.72
Sandy borrow pits	Se	No interpretations available, too variable	Mostly used for range	1.25
Kidman	KdB	Very Fine Sandy Loam on 0% to 3% slopes	Irrigated farmland	1.12
Red Rock	Re	Silt loam	Irrigated and non-irrigated farmland	0.66
Gullied land	GU	NA	NA	0.56
Timpanogos	TtA	Sandy loam, 1% to 3% slopes	Irrigated and non-irrigated farmland	0.55
Stony terrace escarpments	SP	NA	Non-irrigated farmland	0.52
Welby	WmB	Silty loam on 0% to 3% slopes	Irrigated farmland	0.49
Gravel pits	Gp	NA	NA	0.38
Chipman	Ck	Silty clay loam, saline alkali	Non-irrigated farmland and range	0.33
Playas	PU	NA	NA	0.24
Hans	HaB	Silt loam, 1% to 3% slopes	Irrigated and non-irrigated farmland	0.23
Butterfield	BuE	Stony loam, 0% to 25% slopes	Non-irrigated farmland and range	0.20
Clayey terrace escarpment	CA	No interpretations available, too variable	Mostly used for range	0.18
Preston	PrD	Sand, 1% to 10% slopes	Irrigated farmland	0.04
Total Acres				**80.0**

Source: U.S. Department of Agriculture (1974).

3.6 Vegetation

3.6.1 General Vegetation

Most of the land cover in the Project Area is high and low intensity developed land uses (84%) and agricultural lands (15%). Only a very small proportion of the Project Area contains native vegetation communities (1%). The vegetation communities identified in Table 3.2 were identified using Southwest ReGAP (GAP) data (USGS 2004). Two native vegetation types occur in the Project Area: intermountain basins playa (0.4 acres) and North American arid west emergent marsh (0.1 acres). Table 3.2 shows acreages of vegetation and other land cover types in the Project Area.

Table 3.2. Vegetation and Land Cover Types and Acreages

Vegetation Type	Acres (approximate)
Developed, Medium – High Intensity	39.1
Developed, Open Space – Low Intensity	28.1
Agriculture	12.1
Intermountain Basins Playa	0.4
North American Arid West Emergent Marsh	0.1
Open Water	0.2
Total	**80.0**

Source: USGS (2004).

The Project Area was visited in September 2004 to obtain more detailed descriptions of the location of vegetation communities. The lands adjacent to the JVWCD headquarters property (RO Treatment Plant and 2 shallow wells; see Figure A2 [Map 7]) are predominantly low-density urban and agricultural lands. These land parcels are mostly vacant of structures, and may contain some weedy pastures (*Bromus tectorum*, *Cardaria draba*, *Helianthus* spp., *Cirsium* spp., *Poa* spp. *Agropyron* spp.). Parcels with homes on them are dominated by residential landscaping. Well sites for the deep wells are generally located on weedy vacant parcels that may have some pasture use. Pipelines alignments south of 1300 South and west toward the KUCC tailings impoundment are located along existing ROWs (see Figure A2 [Map 1]). Weeds and some perennial grasses dominate the sides of the existing ROWs. The area north of the tailings pond comprises upland/playa habitat with salt desert scrub (see community description, below), cheatgrass (*B. tectorum*) and intermediate wheatgrass (*Thinopyrum intermedium*) understory (see Figure A2 [Map 1]). Some playa wetlands are fringed with saltgrass.

Most of the land surrounding the Project Area has been disturbed by agricultural and suburban development. As a result, disturbance of native vegetation communities is widespread throughout the area and native habitats are mostly remnants of historically larger vegetation complexes. The area north of KUCC tailings impoundments is minimally impacted by development and contains intact upland/playa habitat. This area is also connected to the lake and other conservation parcels, and therefore has higher habitat values for wildlife. The vegetation community types that occur in the Project Area are described below.

3.6.1.1 Agriculture

Agricultural lands in the Project Area consist of row crops, irrigated pasture hay fields, and dry farm crops.

3.6.1.2 North American Arid West Emergent Marsh

This marsh community occurs in depressional areas, river meanders, or adjacent to existing waterbodies (e.g., Jordan River). The vegetation is characterized by emergent vegetation comprising common reed (*Phragmites australis*), cattail (*Typha latifolia*), salt grass, and Baltic rush (*Juncus arcticus*).

3.6.1.3 Intermountain Basins Playa

This wetland community comprises barren and sparsely vegetated playas (generally <10% plant cover). Principle species are iodine bush (*Allenrolfea occidentalis*), greasewood (*Sarcobatus vermiculatus*), pickleweed (*Salicornia utahensis*), saltgrass, and shadscale (*Atriplex confertifolia*).

3.6.1.4 Greasewood and Salt Desert Shrub

In addition to SWReGAP vegetation types, a greasewood and salt desert shrub vegetation community was identified during field surveys of the Project Area. This community type may occur as a mosaic with the above wetland vegetation types and in open space portions of developed areas and agricultural lands. Plant species commonly associated with both the greasewood and salt desert shrub vegetative communities include shadscale, Indian ricegrass (*Achnatherum hymenoides*), galleta grass (*Pleuraphis* sp.), sand dropseed (*Sporobolus cryptandrus*), and black greasewood (*Sarcobatus vermiculatus*).

3.6.2 Threatened, Endangered, and Special Status Plant Species

SWCA sent a letter to the U. S. Fish and Wildlife Service (USFWS) on November 4, 2004 requesting the names of federally listed plant species potentially occurring in the Project Area. A response on December 2, 2004 listed two species with the potential to occupy habitats in the Project Area: Ute ladies'-tresses (*Spiranthes diluvialis*; Threatened) and slender moonwort (*Botrychium lineare*; Candidate).

Ute Ladies'-tresses is a perennial, terrestrial orchid that forms a single stem 8 to 20 inches tall with white or ivory-colored flowers arranged in a spike. The current distribution of this species in Utah consists of Duchesne, Tooele, Uintah, Utah, and Wayne counties. Ute Ladies'-tresses is found in palustrine and riparian habitats from 4,300 to 7,000 feet. There is no suitable riparian habitat for Ute Ladies'-tresses in this elevation range in the Project Area. Ute ladies'-tresses has therefore been eliminated from further analysis.

In December 2007, slender moonwort was removed as a Candidate for listing as Endangered or Threatened (USFWS 2007). The species was removed from the candidate list because currently available information does not support a proposed listing: slender moonwort is more abundant or widespread than previously believed, it is not subject to the degree of threats sufficient to warrant continuing candidate status, and there is insufficient information on biological vulnerability and threats to support listing. Slender moonwort has therefore been eliminated from further analysis.

3.7 Wildlife

3.7.1 General Wildlife

Wildlife species common to the Project Area include big game, primarily mule deer and antelope, and a variety of small mammals and birds found along the Wasatch Front and urban/wildland transition areas. These species include, but are not limited to, raccoon (*Procyon lotor*), porcupine (*Erethizon dorsatum*), red fox (*Vulpes vulpes*), cottontail (*Sylvilagus* spp.), ground squirrel (*Citellus townsendi*), deer mouse (*Peromyscus maniculatus*), robin (*Turdus migratorius*), magpie (*Pica hudsonia*), western scrub jay (*Aphelocoma californica*), house sparrow (*Passer domesticus*), and several species of raptors (discussed below). Exponential losses of habitat, altered flyways, hunting, and trapping have reduced the populations of many wildlife species native to the area.

3.7.2 Threatened, Endangered, and Sensitive Wildlife Species

3.7.2.1 Federally Listed Species

SWCA sent a letter to USFWS on November 4, 2004 requesting the names of federally listed wildlife species potentially occurring in the Project Area. A response on December 2, 2004 listed two species with the potential to occupy habitats in the Project Area: the bald eagle (*Haliaeetus leucocephalus*) and the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*).

At the time of correspondence with USFWS, the bald eagle was listed as a threatened species. It has since been de-listed but retained for analysis. Bald eagle habitat is usually found near lakes, rivers, marshes, or other wetland areas that support the fish populations on which they feed. There is one nesting pair of eagles in neighboring Davis County, and individuals do pass through Salt Lake County during migration. However, there is little suitable perching and roosting habitat in the vicinity of the Project Area, which suggests that bald eagles are not likely to occur in the area except during seasonal migration. This species will be carried forth for analysis.

The western yellow-billed cuckoo is a candidate for federal listing. Yellow-billed cuckoo habitat is normally found near riparian areas. Currently, the only known breeding populations of the western yellow-billed cuckoo occur in California, Arizona, and New Mexico, and the poor quality of the riparian habitat in the Project Area suggests that this species is not likely to occur in the Project Area. It has therefore been eliminated from further analysis.

3.7.2.2 Utah State Listed Species

Recent records indicate the occurrence of Utah State Sensitive Species in Salt Lake County (Utah Division of Wildlife Resources 2009). However, a review of habitat preferences indicates that all species except those mentioned below are unlikely to occur in the Project Area, and therefore have been eliminated from further analysis. Those with the potential to occur in the northern half of the Project Area (particularly north of I-80) where there is intact wetland and/or upland habitat include: the bobolink (*Dolichonyx oryzivorus*), the grasshopper sparrow (*Ammodramus savannarum*), the American white pelican (*Pelecanus erythrorhynchos*), and the long-billed curlew (*Numenius americanus*).

3.7.2.3 Migratory Birds

The Migratory Bird Treaty Act (MBTA), as amended, was implemented for the protection of migratory birds. Unless permitted by regulations, MBTA makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. In addition to the MBTA, Executive Order 13186 sets forth the responsibilities of federal agencies to further implement the provisions of the MBTA by integrating bird conservation principles and practices into agency activities and by ensuring that federal actions evaluate the effects of actions and agency plans on migratory birds.

The Project Area is located along the Intermountain Migratory Bird Flyway. The Lee Kay Wildlife Management area and the south shore of the Great Salt Lake contain important habitat for migratory birds along this pathway. Numerous migratory bird species potentially occupy the habitats found in the Project Area and are identified below. The species are addressed according to the habitat type with which they are most often associated, although many of the species listed below occur in more than one habitat type throughout the Project Area. Some of the species breed in the Project Area during the spring and migrate south in the autumn; others are year-round or winter residents. Migratory bird species listed as federally endangered, threatened, or candidates, as well as migratory birds classified as Species of Special Concern, are addressed above in Sections 3.7.2.1 and 3.7.2.2.

Species that may use the habitats present in the Project Area include the following:

1. North American Arid West Emergent Marsh: sage sparrow, horned lark, sage thrasher, Brewer's sparrow, prairie falcon, Swainson's hawk, western kingbird, and Say's phoebe.
2. Intermountain Basins Playa/Greasewood and Salt Desert Shrub Habitat: horned lark, western kingbird, and sage sparrow.
3. Agricultural Habitat: ravens, crows, and red-tail hawks.

3.7.2.4 Selenium and Mercury Toxicity to Great Salt Lake Wildlife

Two critical endpoints have been identified for the protection of the aquatic wildlife beneficial use of Great Salt Lake: 1) reproductive success, and 2) body condition of birds using open waters (UDEQ 2008). Elevated concentrations of selenium and mercury have been found in bird blood and livers from Great Salt Lake (UDEQ 2008). No egg hatchability or deformities were observed in gulls, avocets, or stilts associated with Great Salt Lake in studies of selenium toxicity effects on wildlife (UDEQ 2008). The geometric mean selenium (Se) concentrations in gulls and shorebirds were 2.89 µg Se/g and 2.72 µg Se/g, respectively (UDEQ 2008). These values are consistent with a non-contaminated site (UDEQ 2008). More recent sampling conducted as part of UDWQ's ongoing Great Salt Lake monitoring indicated a mean egg selenium concentration of 1.46 µg/g at one study site in Gilbert Bay and 1.51 µg/g at a second study site in Gilbert Bay, well below the established 12.5 µg/g standard. Mean egg mercury concentrations were 0.516 µg/g at the first study site and 0.439 µg/g at the second study site. Eggs were collected in June 2012 from black-necked stilts (*Himantopus mexicanus*) and American avocets (*Recurvirostra americana*) (Cavitt et al. 2012).

Selenium and mercury are of concern because of the potential for bioaccumulation[2] through the food chain (e.g., algae, brine shrimp) which, when combined with biomagnification[3], can result in consumers (e.g., fish, birds, mammals) accumulating toxic levels of selenium and mercury through their diets even when observed water column concentrations are very low (Lemly 2002). Brine fly larvae were found to be the most likely food chain link for selenium in Great Salt Lake for shorebirds, with a mean selenium concentration of 1.7 µg/g (UDEQ 2008). Brine shrimp are the most likely food chain link for mercury in Great Salt Lake, with existing concentrations of approximately 0.007–0.045 µg/g in Gilbert Bay (Naftz et al 2008).

3.8 Air Quality

National Ambient Air Quality Standards (NAAQS) have been established by the EPA that limit the amount of pollutants that can be present in the atmosphere. The EPA uses six criteria pollutants as indicators of air quality and has established for each a maximum concentration above which adverse effects on human health could occur. These criteria pollutants are: lead (Pb), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM10 and PM2.5 [particles with a diameter less than or equal to 10 microns or 2.5 microns, respectively]), and carbon monoxide (CO) (EPA 2003). The State of Utah has adopted the same air quality standards as the EPA, and the Utah Division of Air Quality (UDAQ) is responsible for monitoring air quality. Areas that do not meet the pollutant standards (i.e., that are not in compliance) for NAAQS pollutants are called "non-attainment" areas and are routinely monitored. Salt Lake County is designated as non-attainment for PM10, PM2.5, and SO_2 (UDAQ 2009). A maintenance area is an area that was once designated as non-attainment that has subsequently demonstrated that it has attained and maintained a particular standard for 10 years. All of Salt Lake

[2] Bioaccumulation is where a living organism like algae or brine shrimp accumulates a contaminant so that concentrations within the organism are higher than the concentrations that are present in water and food sources.

[3] Biomagnification is the increase in concentration within the food chain from one species consuming another; for example, fish eating zooplankton and aquatic insects, then waterfowl eating the fish.

County is designated as a maintenance area for O_3 and portions of the county are designated as maintenance area for CO (UDAQ 2009). The Utah Air Conservation R307-309 Fugitive Emissions and Fugitive Dust Rules require control of fugitive dust. The R307-309 Rule applies to areas designated as "non-attainment" for particulates less than 10 microns in size (PM10). Because an area >0.25 acre will be cleared or leveled for the Project, a fugitive dust plan is required (UDAQ 2004).

3.9 Cultural Resources

A pre-fieldwork search of relevant files, databases, documents, and literature was conducted to identify cultural resources located within 1 mile of the Area of Potential Effects (APE). The APE was defined as a 50-foot-wide area along the entire 29-mile-long proposed linear pipeline, and 10 block inventory areas for seven deep wells, two pump stations, and one RO Treatment Plant. The proposed Project corridor extends through the cities of South Jordan, West Jordan, Kearns, and West Valley City, Utah. Forty-seven archaeological sites were identified in this search area. Sixteen of these are previously recorded linear historic sites that cross the APE. A file search by the Utah Geological Survey (UGS) found two paleontological localities recorded in the 1-mile buffer area. Between February 5 and February 23, 2009, cultural resource inventories were completed for the entire APE using a combination of intensive pedestrian inventories and windshield surveys. All Class I sites, General Land Office features, and Salt Lake County linear sites identified as potentially crossing the APE were visited. All cultural resources identified in the Project Area are listed in Table 3.3.

Table 3.3. Smithsonian Site Numbers, Site Names, Site Types, and Eligibility Recommendations for All Cultural Resources Identified in the JVWCD Project Area

Site Number	Segment	Site Name (if applicable)	Site Type	Eligibility Recommendation
42SL000267		C-7 Canal	Historic canal	Recommended ineligible
42SL000291	1	South Jordan Canal	Historic canal	Determined eligible
42SL000291	2	South Jordan Canal	Historic canal	Determined eligible
42SL000291	3	South Jordan Canal	Historic canal	Determined eligible
42SL000291	4	South Jordan Canal	Historic canal	Determined eligible
42SL000295	1	Utah and Salt Lake Canal	Historic canal	Determined eligible
42SL000295	2	Utah and Salt Lake Canal	Historic canal	Determined eligible
42SL000295	3	Utah and Salt Lake Canal	Historic canal	Determined eligible
42SL000306		Salt Lake, Garfield, and Western Railroad	Historic railroad	Recommended eligible
42SL000335		Historic Bingham Branch of the D&RGW Railroad	Historic railroad	Determined eligible
42SL000342		Historic North Jordan Canal	Historic canal	Determined eligible
42SL000387		Terminal to Garfield Transmission Line	Historic transmission line	Recommended eligible
42SL000541		Victory Highway	Historic highway	Recommended eligible
42SL000630		N/A	Road alignment	Recommended ineligible
42SL000631		N/A	Structural remains	Recommended ineligible

Source: Spurling et al. (2009).
Note: N/A = Not applicable.

The 2009 cultural resource inventory resulted in the update of 16 previously recorded historic sites. Seven of these sites are still present in the APE (42SL000267, 42SL000291, 42SL000295, 42SL000306, 42SL000335, 42SL000342, and 42SL000387), eight have been destroyed where they would have crossed the APE (42SL000054, 42SL000333, 42SL000337, 42SL000344, 42SL000351, 42SL000385, 42SL000510, and 42SL000541), and one (Site 42SL000297) had no visible segments in the APE and is not analyzed further. Two new historic sites (42SL000630 and 42SL000631), two isolated occurrences, and five isolated features were also documented in the APE. Approximately 10.5 miles of the Project corridor is located alongside a historic canal, the Utah and Salt Lake Canal (42SL000295). Approximately 9 miles of the Project corridor is located in Utah Department of Transportation ROW in modern constructed roadway prisms covered with asphalt and concrete. An additional 5.6 miles of the pipeline alignment is located on KUCC land.

3.10 Paleontological Resources

SWCA consulted with Ms. Martha Hayden of the UGS about the probability of encountering localities with paleontological resources in the Project Area. The results of her file search indicate that:

> There are no paleontological localities recorded in our files for this Project Area. Surficial deposits exposed over most of this project ROW consist of Quaternary alluvial deposits (Qlcs, Qlc, Qay, Qas) that have a low potential for yielding significant fossil localities. However, there may be Lake Bonneville constructional lakeshore deposits, which have some potential for yielding significant vertebrate fossil localities. If these deposits are disturbed as a result of any planned construction activities, please be aware of possible impacts to paleontological resources. Unless fossil localities are discovered as a result of construction activities, this project should have no impact on paleontological resources. (personal communication, Martha Hayden 2005)

3.11 Noise

Noise is generally described as unwanted sound, and noise intensity (or loudness) measured as sound pressure in units of decibels (dBs). The dB scale is a logarithmic scale because the range of sound that can be detected by the human ear is so great that it is convenient to compress the scale to encompass all the sounds that need to be measured. Each 20-unit increase in the dB scale increases the sound loudness by a factor of 10. For example, the sound level of normal conversational speech is approximately 60 dB, a vacuum cleaner at a distance of 6 feet from a listener is approximately 70 dB, and a concrete mixer at a distance of 50 feet from a listener is approximately 80 dB.

Sound levels have been calculated for areas that exhibit typical land uses and population densities. In general, the Project Area would be located in a developed portion of the valley, bounded on the east by the Jordan River and I-15, and on the west by the foothills of the Oquirrh Mountain Range and the Kennecott Copper processing complex. The area is predominantly zoned as urban residential, with potential noise sources that include dense vehicular traffic associated with an urban/suburban environment, and airplane traffic in the Salt Lake City International Airport flight path that overlies the Project Area. Based on these predominant land uses, the estimated ambient sound/noise levels in the Project Area range from approximately 40 to 60 dB (Bell 1973; Cunniff 1977; Singal 2005).

3.12 Public Health

The principal aquifer underlying the southwestern Jordan Valley is contaminated with elevated levels of sulfate (SO4) and TDS associated with past mining practices. Sulfate is a substance that occurs naturally in drinking water, but health concerns regarding sulfate in drinking water have been raised because of reports that diarrhea may be associated with the ingestion of water containing high levels of sulfate. Of particular concern are groups in the general population that could be at greater risk from the laxative effects of sulfate when they abruptly change from drinking water with low sulfate concentrations to drinking water with high sulfate concentrations. Sulfate in drinking water currently has a secondary maximum contaminant level (SMCL) of 250 mg/L, based on aesthetic effects (i.e., taste and odor). This SMCL is not a federally enforceable standard but is provided as a state and public water systems guideline. Sulfate is one of the 50 chemical and 10 microbiological contaminants/contaminant groups included on the Drinking Water Contaminant Candidate List last updated on March 2, 1998 (EPA 2008).

Groundwater transport modeling data suggest that the groundwater sulfate plume in Zone B is migrating generally eastward toward the Jordan River, and threatening to contaminate groundwater used by Salt Lake Valley groundwater rights holders (KUCC 2004). Of primary concern with respect to public health is the protection of groundwater users and prevention of further migration of existing contamination. Much of the affected aquifer is on KUCC property where KUCC can control groundwater development. KUCC is particularly concerned about future groundwater development along the outskirts of South Jordan and West Jordan cities, and in the Town of Herriman. Privately owned water rights exist in those areas, and the communities may require diversion of external water rights to the areas as part of development requirements. Unrestricted use of these water rights could draw elevated sulfate and TDS water into the currently clean aquifer, causing damage to the water users and exacerbating groundwater contamination (KUCC 1999).

3.13 Socioeconomic Resources

The Project would be located in several small- to medium-sized cities on the west side of Salt Lake Valley in Salt Lake County. The water treatment plant would be located in the eastern portion of West Jordan and the deep wells would be located in South Jordan City. The by-product disposal pipeline would cross land in the Salt Lake Valley suburban cities of West Jordan, Taylorsville, West Valley City, and Magna, Utah.

The population of Salt Lake County is approximately 925,000, with a labor force of approximately 545,000. The current (June 2009) unemployment rate in Salt Lake County is approximately 5.6% (Utah Department of Workforce Services 2009). The major employment sectors in the county include: services (52%), construction and manufacturing (26%), trade (16.5%), and government (5.8%) (City of West Jordan 2009).

In general, the area surrounding the treatment plant and pipelines is residential, and land use in these areas is typical of suburban residential areas: predominantly single-family dispersed housing with schools, parks, and shopping centers. JVWVD currently provides water to municipalities at a wholesale rate ranging between $307.92 and $490.02 per acre-foot (depending on location of meter).

4 ENVIRONMENTAL CONSEQUENCES

Note to the reader: NEPA documents usually contain discussion of elements of the proposed Project that *would* or *could* occur under the No Action and action alternatives. However, because some elements of the Project described in this EA have already been implemented or completed, and because all elements of the Project will be constructed and operated regardless of the EPA's decision, this EA may describe what *has* occurred or *will* occur under the alternatives and the impacts associated with each alternative.

4.1 Summary of Issues

A number of environmental issues were identified during the environmental impacts analysis that would likely result from all of the alternatives. These issues are as follows:

- Potential Impacts to Water Resources: Negative impacts due to reduction of groundwater and lowering of water table. Positive impacts to groundwater quality are likely to be realized. Jurisdictional wetlands may be temporarily impacted by construction of the by-product pipeline. TDS concentrations in the Jordan River would temporarily increase as a result of untreated discharges to the river at well start-up. Selenium, sulfate and mercury discharges to Great Salt Lake would increase as a result of RO Treatment Plant discharges, although selenium and mercury concentrations in the lake are not expected to increase.
- Potential Impacts to Soils: Soils would be adversely impacted by the construction of the water treatment plant and associated pipelines.
- Potential Impacts to Vegetation: Noxious weeds are found in the Project Area. Construction activities could accelerate the spread of noxious weeds in the Project Area.
- Potential Impacts to Wildlife: Wildlife could be temporarily impacted by noise and human presence during construction. Temporary and permanent loss of wildlife habitat could also occur where construction activities result in habitat loss or degradation. Wildlife could be impacted by changes to lake chemistry due to increased selenium, sulfate, and mercury discharges.
- Potential Impacts to Air Quality: Air quality could be affected by construction activities that produce fugitive dust from construction sites, staging areas, and/or unpaved access roads.
- Potential Impacts to Cultural Resources: Cultural resources are located in the Project Area and could be impacted by construction.
- Potential Impacts to Paleontological Resources: No known paleontological resources are located in the Project Area, but the Project has potential to uncover new localities during construction.
- Potential Impacts to Public Health: Public health would be positively impacted by the remediation of contaminated groundwater and distribution of municipal-quality water to local residents.
- Potential Impacts to Socioeconomic Resources: New, short-term employment would be available during construction of the water treatment plant and associated pipelines. The water treatment plant would offer new, long-term employment opportunities. Under the No Action Alternative water rates may increase slightly for consumers (depending on the funding mechanism chosen by JVWCD) to provide the funds necessary for Project completion.

4.2 Mitigation and Control Measures

Baseline mitigation measures for minimizing the extent and duration of Project-related disturbance will include standard construction BMPs, standard FERC procedures, general soil BMPs, the limiting of vegetative disturbance, and raptor BMPs. Section 2.2.5 contains a detailed list of mitigation measures.

Control measures will also be implemented to limit Project-related impacts. Control measures consist of the UPDES permit, the formal agreement with FRIENDS of Great Salt Lake, and the consent decree under CERCLA. These measures are discussed in detail in Sections 1.2.1 (consent decree) and 2.2.5 (UPDES permit and FRIENDS of Great Salt Lake agreement).

4.3 Groundwater

4.3.1 Alternative 1: No Action Alternative

Impacts to groundwater resources would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD will construct and operate the Project as described under the Preferred Alternative.

4.3.2 Alternative 2: Preferred Alternative

Under the Preferred Alternative, direct impacts to deep groundwater resources will be long-term and beneficial from the removal of pollutants from contaminated groundwater, and long-term and negative due to groundwater withdrawals. Under this alternative, contaminated groundwater will be removed and treated, thereby shrinking the contaminant plumes and restoring the aquifer. This is especially important to prevent further migration of the plumes adjacent to municipal well fields, private wells, and to the Jordan River (UDEQ 2004). Under this alternative, 4,300 AFY will be withdrawn from the deep (contaminated) aquifer for treatment. Any direct impacts related to quantity and quality of private well water will be reviewed on a case-by-case basis.

A total of 1,400 AFY will be withdrawn from the shallow aquifer for treatment. Shallow groundwater will be impacted due to installation of five shallow groundwater wells on the JVWCD headquarters property.

Under this alternative, approximately 965 AFY of by-product will be released as a result of RO treatment of both deep and shallow aquifer water. The by-product TDS will be 8,150 mg/L. A UPDES permit has been issued by the UDWQ for this discharge. This permit requires that the Project meets the recently established tissue-based selenium standard for the Great Salt Lake, which was a result of studies overseen by the Great Salt Steering Committee and Science Panel and conducted by the UDWQ.

4.3.3 Alternative 3: Minimum Integrated Design Alternative

Under the Minimum Integrated Design Alternative, direct impacts to deep aquifer resources as a result of withdrawal will be the same as those under the No Action and Preferred alternatives. However, under this alternative less shallow groundwater would be withdrawn for treatment (750 AFY) than would occur under the No Action or Preferred alternatives (1,400 AFY). This action would have only a negligible difference from the No Action and Preferred alternatives in impacts to shallow groundwater.

4.3.4 Cumulative Impacts

Potential direct and indirect effects on groundwater resources would be negligible and are limited to spills of hazardous materials associated with construction equipment (e.g., fuel, oil, hydraulic fluid, etc.), and cumulative effects would include these direct/indirect effects in addition to other potential spills associated with other construction projects occurring in the cumulative effects area. Positive impacts to groundwater resources will occur from reduced migration of contaminant plumes into adjacent municipal well fields, private wells, and the Jordan River (UDEQ 2004). However, pumping of groundwater will result in some drawdown of the water table and reduction of groundwater resources. Other users are likely to contribute to cumulative drawdown of groundwater resources, but there are currently no data concerning the extent or degree of groundwater usage.

4.3.5 Additional Mitigation Measures

No mitigation measures beyond the construction techniques, BMPs, and other resource protection measures discussed in Sections 4.2 and 4.3 have been identified.

4.3.6 Unavoidable Adverse Impacts

The standard BMPs and erosion control measures discussed in Section 4.2 are expected to minimize negative effects to groundwater resources in the Project Area. There is limited potential for accidental releases of equipment fluids such as gas, oil, or hydraulic fluids during construction, but this would be reduced to a negligible level through the implementation of approved BMPs.

4.3.7 Short-term Use versus Long-term Productivity

Groundwater resources will be withdrawn, treated, and redistributed. In the short-term, there is limited potential for negative impacts to groundwater associated with construction activities and withdrawal. Over the long-term, the condition and integrity of water resources in the Project Area will be positively affected through treatment and curtailing migration of the sulfate plume preventing it from interacting with existing drinking water resources and/or the Jordan River.

4.3.8 Irreversible and Irretrievable Commitments of Resources

There will be irreversible commitments of groundwater resources under any of the alternatives. Groundwater will be withdrawn, treated, and redistributed for the life of the Project. No irretrievable impacts to groundwater resources are expected as a result of Project activities.

4.4 Surface Water

4.4.1 Alternative 1: No Action Alternative

Impacts to surface water resources will be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD will construct and operate the Project as described under the Preferred Alternative.

4.4.2 Alternative 2: Preferred Alternative

As discussed in Section 2.2.5, the UDWQ has issued a surface water discharge permit to JVWCD for discharges from the RO Treatment Plant (including overflow from the shallow groundwater wells and

start-up discharges from groundwater wells). The UPDES permit UT0025836 and Fact Sheet/Statement of Basis are included in Appendix B of this document.

4.4.2.1 Jordan River

The Project has the potential to affect surface water quality in the Jordan River both directly and indirectly. Direct effects are primarily related to the concentration of chemical constituents in groundwater flowing to the Jordan River. Withdrawal of groundwater before it reaches the river will result in removal of the associated pollutant loading. Indirect effects are those that are projected to occur due to reductions in instream flow resulting from groundwater withdrawal. All groundwater rights and diversion points to be used by JVWCD for the Project have been approved the state engineer.

Instream flow is expected to decrease as a result of the Project. The magnitude of the decrease would be generally proportional to the amount of groundwater withdrawn. The magnitude of overall water quality impacts will also be proportional to the relative amount of groundwater withdrawn. As stated previously, water quality effects are expected to be minor or immeasurable if the relative volume of groundwater withdrawn is small. Flow effects are expected to be most pronounced. Negative impacts on water quality will be the most substantial effects during summer months and dry years or low flow events because groundwater withdrawals at these times will represent a relatively larger proportion of instream flow.

The probable impacts to surface water quality that will occur as a result of groundwater withdrawal are summarized in Table 4.1, and discussed in detail below.

Table 4.1. Probable Effects of Groundwater Withdrawal on Jordan River Surface Water Quality

Water Quality Parameter	Probable Effects
Temperature	Small direct effect, increased summer water temperatures, most noticeable in dry years
Dissolved Oxygen	Small direct effect, lower dissolved oxygen in surface waters due to increased temperature, growth, deposition and decay, most noticeable in dry years
Specific Conductivity	Small, incremental decrease in specific conductivity, most noticeable in dry years
Dissolved Solids	Small, incremental decrease in dissolved solids concentrations, most noticeable in dry years
Turbidity	Small, incremental increase in turbidity in surface water, most noticeable in dry years
Dissolved Nutrients	Small, incremental decrease in dissolved nutrient concentrations, most noticeable in dry years

4.4.2.1.1 Temperature

Groundwater temperatures are generally lower than surface water, with groundwater having a cooling effect on the Jordan River during the summer. Reduced volume of groundwater recharge will potentially result in direct, incremental summer warming of surface water, especially in hot or dry years when surface water would be expected to be warmer and of lesser quantity. Because summer surface water temperatures are currently near maximum allowable levels, increases of 3 degrees Celsius or more may result in violation of Utah state water quality criteria. Warming may also result in indirect water quality effects including increased rates of algal growth and decay, poor aesthetics, and recreational conditions. Increased rates of metabolic activity contribute to low dissolved oxygen levels through increased oxygen consumption from plant and microbial respiration and sediment oxygen demand. Because water temperatures in Jordan River segments 5 and 6 have shown violations of state water quality criteria (<20 °C), temperature increases would need to be minimized. Warming effects are projected to be small to negligible in medium- to high-water years, and small to moderate in low-water years.

4.4.2.1.2 Dissolved Oxygen

Groundwater recharge is poorly oxygenated and acts as a neutral or decreased dissolved oxygen source to the Jordan River, especially during summer months. However, reduced groundwater recharge could indirectly impact dissolved oxygen concentrations in surface water due to increased temperatures, algal growth, and decomposition. As stated above, warming effects are projected to be negligible in medium- to high-water years and small to moderate in low-water years. Because summer dissolved oxygen concentrations in all Jordan River segments downstream of the Project area have shown violations of state water quality criteria, decreases in dissolved oxygen concentration would need to be minimized.

4.4.2.1.3 Specific Conductivity

Groundwater represents a neutral or slightly enriching source of specific conductivity to the Jordan River. A reduction in the volume of groundwater recharge will therefore potentially result in a small to negligible decrease in specific conductivity of surface water.

4.4.2.1.4 Dissolved Solids

Groundwater represents a neutral or slightly enriching source of dissolved solids to the Jordan River. A reduction in the volume of groundwater recharge will therefore potentially result in a small to negligible decrease in dissolved solids concentrations in surface waters. As summer dissolved solids concentrations in segments 4 and 5 of the Jordan River have shown violations of state water quality criteria, decreases in dissolved solids concentrations would represent an improvement in water quality.

Stagnant water high in TDS (between 1,200 ppm and 1,800 ppm) is expected to accumulate in newly created deep wells. This water will be discharged directly to the Jordan River at start-up of well operation. The discharge of additional TDS has the potential to contribute to existing impairments for TDS in portions of the Jordan River. Contributions to existing impairments of the Jordan River will be temporary since the discharge of high TDS water will occur only at well start-up. The UPDES permit states that "Based on wasteload analysis completed for each well location, it is expected that these discharges will not cause or contribute to a violation of water quality standards and therefore will not have effluent limits associated with the discharges" (see Appendix B). In general it is assumed that any permit issued to JVWCD would comply with state and federal water quality criteria.

The Jordan River is on the 2008 Utah 303(d) list of impaired water bodies for TDS (UDWQ 2008). Continuous discharges from shallow wells that meet state water quality criteria may offset impacts due to one-time sediment loading to the Jordan River. TDS in discharge to the Jordan River will be 1,100 mg/L per day during regular operations and at maximum discharge.

4.4.2.1.5 Turbidity

Groundwater inflow tends to reduce turbidity in the Jordan River. A reduction in the volume of groundwater recharge will therefore potentially result in increased turbidity in the Jordan River. Negative impacts are projected to be negligible in medium- to high-water years and slightly greater in hot or dry water years.

4.4.2.1.6 Dissolved Nutrients

Groundwater inflow acts as a neutral or slightly enriching source of dissolved nutrients to the Jordan River. A reduction in the volume of groundwater recharge could result in a small decrease in dissolved nutrient concentrations in surface water. Because summer dissolved nutrients concentrations in the Jordan River have been observed to be in excess of state water quality thresholds, decreases in dissolved nutrients concentrations represent an improvement in water quality, projected to be most noticeable in

low-water years because groundwater would represent a relatively larger portion of stream flows in low-water years.

Under this alternative, there would be direct, short-term, adverse impacts to surface water where pipeline construction would cross surface water features. Impacts to surface water quality specific to the extraction of Lost Use water for the Preferred Alternative (1,400 AFY) are projected to be small to negligible for medium- to high-water years for most water quality parameters. Measurable increases in water temperature may be possible in especially hot- or dry- water years as detailed in Section 4.5.2.1.1.

4.4.2.1.7 Mercury

Mercury daily discharge to the Jordan River during regular operations and at maximum discharge will be 0.008 µg/L. The Utah water quality standard aquatic wildlife for mercury is a 4-day average of 0.012 µg/L and 0.002 µg/L for domestic source drinking water. Ambient concentrations of mercury in the Jordan River are 0.1 µg/L.

4.4.2.1.8 Sulfate

Sulfate daily discharge to the Jordan River during regular operations and at maximum discharge will be 322 mg/L. Ambient concentrations of sulfate in the Jordan River are 377 mg/L.

4.4.2.1.9 Selenium

Selenium daily discharge to the Jordan River during regular operations and at maximum discharge will be 7.9 µg/L. The EPA chronic freshwater exposure criterion for selenium is 5.0 µg/L and the State of Utah water quality criterion in freshwater systems is 4.6 µg/L. Ambient concentrations of selenium in the Jordan River are 4.5 µg/L.

4.4.2.2 Great Salt Lake

The Project has the potential to affect surface water quality in the Great Salt Lake both directly and indirectly.

4.4.2.2.1 Dissolved Nutrients

Under this alternative, there would be direct, short-term, adverse impacts to surface water where pipeline construction impacts surface waters of the Great Salt Lake. Impacts to surface water quality in the Great Salt Lake may also occur due to discharge of RO by-product water into the lake. Discharge into the Great Salt Lake is estimated to contain 8,000 mg/L of TDS during regular operations and 11,000 mg/L of TDS during maximum discharge events (start-up).

4.4.2.2.2 Mercury

There is potential for short- and long-term adverse impacts to water quality and wildlife in Great Salt Lake from mercury in by-product water discharged to Great Salt Lake. The amount of mercury that would be removed from groundwater and discharged to Great Salt Lake is estimated to be 0.050 µg/L during regular operations and 0.070 µg/L during maximum discharge events. There is no mercury water quality standard for Great Salt Lake, but this level of discharge is considerably higher than the Utah 4-day average water quality standard for aquatic wildlife of 0.012 µg/L. However, JVWCD's UPDES permit will limit the effluent load of mercury to Great Salt Lake to no more than 1% (or 0.38 kg) of the estimated total annual load of 38 kg. UDWQ currently considers this value to be insignificant relative to other sources (see page 9 of the Fact Sheet/Statement of Basis for the UPDES permit in Appendix B).

4.4.2.2.3 Sulfate

There is potential for short- and long-term adverse impacts to water quality from sulfate in by-product water discharged to Great Salt Lake. The amount of sulfate that would be removed from groundwater and discharged to Great Salt Lake is estimated at 2,568 mg/L during regular operations and 4,537 mg/L during maximum discharge events. There are no Utah water quality standards for sulfate and this level of discharge is considerably lower than the 7,000 mg/L ambient concentration of sulfate in Great Salt Lake.

4.4.2.2.4 Selenium

The proposed RO Treatment Plant would pipe by-product water from the plume to Great Salt Lake for discharge. There is potential for short- and long-term adverse impacts to water quality from selenium in by-product water discharged to Great Salt Lake. Recently measured annual inputs of selenium from the south arm of Great Salt Lake are estimated at 1,480 kg, 54% of which comes equally from the KUCC outfall and Goggin Drain (Naftz et al. 2008). Groundwater sources in the Jordan Valley may represent all or part of an unknown source of selenium that contributes an additional 1,500 kg of selenium annually to the south arm of Great Salt Lake (Naftz et al. 2008) for a total estimated annual load of 2,980 kg. The amount of selenium that would be removed in groundwater withdrawals and discharged to Great Salt Lake is estimated at 44.7 µg/L during regular operations and 55.0 µg/L during maximum discharge events. This represents a daily load of approximately 0.2 to 0.5 kg, respectively or approximately 75 kg to 185 kg per year. (The greater figure of 185 kg per year conservatively assumes continuous maximum discharge.) Based on the estimated current load of approximately 2,980 kg of selenium per year, and assuming inputs of by-product water from treating the groundwater plume would represent additional selenium loads to the lake, discharges of by-product water would increase annual selenium loading to the Great Salt Lake by approximately 3% to 6%. However, because the unknown source of selenium likely includes the groundwater plume being treated the load of approximately 1,500 kg per year may decrease over time as a result of withdrawal and treatment of that water.

KUCC studies from 2000 to 2002 recommended a site-specific chronic water quality standard for selenium in Great Salt Lake of 27.0 µg/L (Brix et al. 2004). The UDWQ has adopted a tissue based numeric standard of 12.5 mg/kg dry weight for selenium in Gilbert Bay of Great Salt Lake (Utah Administrative Code R317-2-14. Numeric Criteria). This standard uses the complete egg/embryo of aquatic dependent birds using Gilbert Bay based upon a minimum of five samples over the nesting season. The following assessment procedures are part of the standard.

- Below 5.0 mg/kg egg concentration: Routine monitoring with sufficient intensity to determine if selenium concentrations within the Great Salt Lake ecosystem are increasing.
- 5.0 mg/kg egg concentration: Increased monitoring to address data gaps, loadings, and areas of uncertainty identified from initial Great Salt Lake selenium studies.
- 6.4 mg/kg egg concentration: Initiation of a Level II Antidegradation review (procedures referenced at R317-2-3.5.C) by the State for all discharge permit renewals or new discharge permits to Great Salt Lake. The Level II Antidegradation review may include an analysis of loading reductions.
- 9.8 mg/kg egg concentration: Initiation of preliminary TMDL studies to evaluate selenium loading sources.
- 12.5 mg/kg egg concentration and above: Declare impairment. Formalize and implement TMDL.

UDWQ has issued a UPDES permit (selenium discharge limit of 54 µg/L) to govern the discharge of by-product water from treating the plume.

Because Great Salt Lake has no outlet, the only mechanisms for removal of a pollutant once it has entered the lake are commercial extraction (through brine shrimp or mineral harvest) or ingestion and storage in transient animal tissues (e.g., migratory birds). Uptake and storage by plants can temporarily remove pollutants from water and sediments, but does not permanently remove pollutants from the lake system (SWCA 2005). Volatilization (evaporation of dissolved compounds) has been identified as a major mechanism of selenium removal in Great Salt Lake (1,380 to 3,210 kg/yr; UDEQ 2008).

4.4.3 Alternative 3: Minimum Integrated Design Alternative

Impacts to surface water quality specific to the disposal of by-product water under the Minimum Integrated Design Alternative (855 AFY) are projected to be less than those projected for the No Action and Preferred alternatives. Measurable increases in water temperature may be possible in especially hot- or dry-water years as detailed for the Preferred Alternative. Impacts to waters of the Great Salt Lake would be similar to those described under the Preferred Alternative, though 110 fewer (11% less) AFY of by-product would be transmitted to the Great Salt Lake under this alternative compared to the No Action and Preferred alternatives.

4.4.4 Cumulative Impacts

4.4.4.1 Jordan River

Impacts to surface water quality would be directly proportional to the amount of groundwater withdrawn as compared to total instream flow. Thus, if the volume of groundwater withdrawn represents only a small fraction of the total instream flow, the projected effects on surface water quality would also be minor. As the relative proportion of groundwater withdrawn increases proportional to instream flow, the magnitude of water quality effects projected would also increase. Currently 481,000 AFY of groundwater and surface water are in use in the Jordan River basin and 170,700 AFY are imported to the basin each year. The Project will increase the water use in the basin by 5,700 AFY. All conclusions summarized in this assessment should be viewed and interpreted in this context because existing and future surface and groundwater conditions would continue to vary and would be influenced by factors that are outside of the scope of this analysis. Negative cumulative impacts to water quality in the Jordan River could also occur due to discharges and other inputs of pollutants from non-Project related sources that could increase the concentration of pollutants and/or the degree of water quality impairments due to the flow reductions discussed above.

4.4.4.2 Great Salt Lake

Similarly, impacts to surface water quality in the Great Salt Lake would be proportional to the volume of groundwater withdrawal and concentration of contaminants in by-product effluent. Flow reductions that result from groundwater withdrawals have the potential to negatively impact water quality by concentrating pollutants and increasing temperatures in Great Salt Lake. In addition, selenium and mercury concentrated in by-product water, in combination with known and unknown cumulative selenium and mercury inputs to Great Salt Lake from elsewhere, could cause impairments based on current or future selenium and mercury concentration thresholds. Detrimental impacts to Great Salt Lake water quality could be compounded by the combined effects of reduced flows in combination with increased selenium and mercury inputs in addition to other types of water pollutant inputs from the basin. However, the total effluent loads of selenium and mercury would contribute approximately 2.5%–6.2% (approximately 75–185 kg annually) and 1% (approximately 0.38 kg annually), respectively, to the total estimated annual loads of 2,980 kg selenium and 38 kg mercury.

4.4.5 Additional Mitigation Measures

In addition to the BMPs and other resource protection measures discussed in Sections 4.2 and 4.3, warming and reduced dissolved oxygen concentrations in surface waters could be mitigated by shading from increased streamside vegetation and instream flows on the Jordan River.

4.4.6 Unavoidable Adverse Impacts

Impacts to surface water flow and water quality from groundwater withdrawal are unavoidable in treatment of the Zone B sulfate plume. Erosion control measures and other BMPs (discussed in Section 4.2) would likely minimize negative effects to surface water resources from sediment. In addition, accidental releases of equipment fluids such as gas, oil, or hydraulic fluids could occur during construction, but would be reduced to a negligible level through the implementation of approved BMPs. However, groundwater withdrawals under any of the alternatives have the potential to cause temporary unavoidable adverse impacts to water quality. Additional mitigation measures to protect surface waters and riparian zones would minimize the extent and duration of water quality impacts.

4.4.7 Short-term Use versus Long-term Productivity

Surface water features may be temporarily disturbed during construction due to crossings, or water quality may be temporarily impacted by increases in water-borne sediment. The long-term condition and integrity of water resources in the Project Area would be positively affected. However, surface water resources may be negatively impacted in the long-term by reduced groundwater flow and associated reductions in water quality.

4.4.8 Irreversible and Irretrievable Commitments of Resources

There would be intermittent and minor, irretrievable commitments of surface water resources, under any of the alternatives. Surface water features, including wetlands (discussed below), would be temporarily disturbed during construction and for short periods during maintenance activities. Potential irretrievable impacts to water quality include erosion and sedimentation as a result of vegetation clearing and soil disturbance and reductions in water quality as a result of reduced flow. There is potential for irretrievable impacts to surface water flows and water quality from groundwater withdrawals.

4.5 Wetlands

4.5.1 Alternative 1: No Action Alternative

Impacts to wetland resources would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD would construct and operate the Project as described under the Preferred Alternative.

4.5.2 Alternative 2: Preferred Alternative

Under the Preferred Alternative, there may be temporary impacts to wetlands immediately north of the KUCC tailings impoundment and I-80 where the by-product pipeline enters Great Salt Lake (see Figure A2 [Map 1]). There are approximately 1.49 acres of lacustrine littoral unconsolidated shore wetland, 1.02 acres of palustrine emergent marsh, and 0.60 acre of vegetated drainage ditch in this area. Where the by-product pipeline intersects ditches, canals, pipeline, and stream crossings, potential jurisdictional waters of the U.S. may be impacted. EPA funding is not planned for the by-product pipeline. Excavation of a

trench for pipeline installation is likely to channelize water flow and disrupt wetland hydrology. These impacts would be temporary and areas would be reclaimed after construction. However, in Salt Lake County, playa wetlands are of particular importance given the difficulty in mitigating these types of waters of the U.S. Attempts to recreate the wetland hydrology and soil chemistry fundamental to these systems have met with limited success (see 4.5.5 Additional Mitigation Measures, below). Project implementation would be subject to federal wetland permitting currently in progress. Based on the temporary nature of the impact and limited area of potential wetlands that would be affected, permitting requirements are likely to be limited to a Nationwide Permit.

All of the remaining components of the Project, including treatment facilities, wells, and pump stations would be in uplands, existing roads, and ROWs, and therefore are not expected to impact wetlands.

4.5.3 Alternative 3: Minimum Integrated Design Alternative

Impacts to wetlands specific to the disposal of by-product water under the Minimum Integrated Design Alternative (855 AFY) are projected to be less than those projected for the No Action and Preferred alternatives. Reduced surface water flows could impact wetland resources, especially during hot or dry years as detailed for surface water resources, above. Impacts to waters of the Great Salt Lake would be similar to those described for surface water resources, though 110 fewer (11% less) AFY of by-product would be transmitted to the Great Salt Lake under this alternative compared to the No Action and Preferred alternatives.

4.5.4 Cumulative Impacts

Wetlands are protected under Section 404 of the Clean Water Act and by Executive Order 11990. Because all of the alternatives would avoid wetland impacts wherever possible, and any other projects in the cumulative effects area would require similar avoidance and minimization measures as outlined in Section 404, cumulative effects to wetlands in the cumulative effects area are unlikely.

4.5.5 Additional Mitigation Measures

In addition to the BMPs and other resource protection measures listed in Section 4.2, the following additional mitigation measures may be required. Prior to construction of the selected alignment, JVWCD would conduct a wetland delineation in compliance with Section 404 of the Clean Water Act. Most of the wetland delineation has been conducted, and coordination with the U.S. Army Corps of Engineers is currently in process. The type(s) and total acreage of jurisdictional wetlands identified during this process will determine the type and amount of mitigation required to offset impacts to waters of the U.S. Mitigation may include creation of new wetlands from uplands, restoration of wetlands in areas that have become uplands, or enhancement and/or preservation of existing wetlands. Typical acreage-based mitigation ratios of mitigated area: impact area used by the U.S. Army Corps of Engineers' Utah regulatory office for these activities are 2:1, 1.5:1, 5:1, and 10:1 for creation, restoration, enhancement, and preservation, respectively. These ratios have been determined based on the likelihood of success and compliance with the federal policy of "no net loss of wetlands." Because playa wetlands are unique systems that are difficult to recreate, mitigation to protect and avoid these wetland communities would reduce impacts and potentially reduce wetland mitigation requirements.

4.5.6 Unavoidable Adverse Impacts

Wetland loss is unavoidable but is expected to be temporary under all of the alternatives and would be limited to wetland areas located along the pipeline corridor and the JVWCD headquarters property.

4.5.7 Short-term Use versus Long-term Productivity

Any wetland areas that are temporarily disturbed during construction would experience short-term loss of productivity due to surface disturbance and/or temporary increases in sedimentation. The long-term productivity and integrity of wetland resources would not be affected by construction activities where appropriate resource protection measures and site reclamation activities are implemented. However, reduced surface water flow has the potential to negatively impact wetland hydrology and, thereby, wetland functioning over the long-term as a result of reduced water volume and associated reductions in water quality.

4.5.8 Irreversible and Irretrievable Commitments of Resources

There would be intermittent and minor, irretrievable commitments of wetland resources under any of the alternatives. Wetlands would be temporarily disturbed during construction and for short periods during maintenance activities. Potential irretrievable impacts to wetlands include filling, erosion and sedimentation as a result of vegetation clearing and soil disturbance during construction.

4.6 Soils

4.6.1 Alternative 1: No Action Alternative

Impacts to soil resources would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD would construct and operate the Project as described under the Preferred Alternative.

4.6.2 Alternative 2: Preferred Alternative

Under the Preferred Alternative, there would be both short-term and long-term impacts to soils caused by soil-disturbance related to the construction of well heads, the RO treatment facility, pump stations, and pipelines. Short-term, adverse impacts to soils would include areas around well heads, pumping stations, the treatment facility, and along pipeline ROWs that would be disturbed during construction; however, these areas would be reclaimed after construction is completed. Long-term, adverse impacts to soils would result from the irretrievable loss of soil productivity and soil development in those areas where Project facilities would be constructed and remain in operation during the lifetime of the Project (3.52–3.59 acres). Short-term temporary impacts to soils would occur on approximately 80 acres. Table 4.2 shows the acres of temporary disturbance for the major soil types presented in Section 3.5 that would be disturbed under this alternative.

Table 4.2. Temporary Disturbance (acres) to Major Soil Types in the Project Area

Soil Series	Collection Pipelines	Treated Water Pipelines	By-product Pipelines	Total Temporary Disturbance
Bingham	1.66	0.90		2.56
Bluffdale	4.53	7.38		11.92
Bramwell	7.15	--	1.04	8.19
Butterfield	--	0.20	--	0.20
Chipman	0.10	0.09	0.14	0.33

Table 4.2. Temporary Disturbance (acres) to Major Soil Types in the Project Area

Soil Series	Collection Pipelines	Treated Water Pipelines	By-product Pipelines	Total Temporary Disturbance
Clayey terrace escarpments	--	--	0.18	0.18
Gravel pits	--	0.26	0.12	0.38
Gullied land	--	--	0.56	0.56
Hans	0.23	--	--	0.23
Harrisville	--	2.86	4.75	7.61
Hillfield	2.83	0.81	4.76	8.40
Kidman	--	--	1.12	1.12
Lasil	0.70	--	2.93	3.62
Made land	--	--	1.72	1.72
Mine wash	--	0.18	5.18	5.36
Parleys	1.27	--	1.26	2.53
Pharo	--	--	9.82	9.82
Playas	--	--	0.24	0.24
Pleasant Grove	--	--	2.51	2.51
Preston	0.04	--	--	0.04
Red Rock	--	--	0.66	0.66
Saltair	--	--	2.12	2.12
Sandy borrow pits	--	--	1.25	1.25
Stony terrace escarpments	--	--	0.52	0.52
Taylorsville	1.06	1.04	4.78	6.88
Timpanogos	0.55	--	--	0.55
Welby	0.49	--	--	0.49
Open Water	0.04	--	--	0.04
Total Acres	**45.66**	**20.65**	**13.73**	**80.03**

4.6.3 Alternative 3: Minimum Integrated Design Alternative

Impacts to soils would be the same under the Minimum Integrated Design Alternative as under the No Action and Preferred alternatives.

4.6.4 Cumulative Impacts

Potential cumulative effects to soil resources include removal, compaction, covering, erosion, and loss of productivity. Impacts to soil resources from past, present, and reasonably foreseeable projects have been extensive in the Jordan Valley, but are likely to be localized and limited in the Project Area. The linear

nature of most of the Project features would generally have short-term negative effects under all alternatives. The potential for long-term negative cumulative effects on soils would be minimal.

4.6.5 Additional Mitigation Measures

In addition to the standard BMPs and other resource protection measures identified in Section 4.2, the following mitigation measures would reduce the potential for impacts to soil resources:

- All vehicle and equipment traffic associated with construction and maintenance activities will remain on established roads to the maximum extent practicable.
- Areas with highly erodible soils will be protected through the use of appropriate BMPs, such as straw bales, aggregate materials, and wetting compounds, to control erosion.
- A stormwater pollution prevention plan (SWPPP) will be prepared prior to construction activities, and BMPs described in the SWPPP will be implemented to reduce erosion.

4.6.6 Unavoidable Adverse Impacts

Localized soil erosion would occur under all alternatives at staging areas and construction sites. Creation and use of access roads would also cause increased erosion in those locations. Limited disturbances to pipeline corridor soils as a result of the construction would present unavoidable adverse impacts. Even with standard BMPs and the mitigation measures identified in Section 4.2, it is likely that some soil will be eroded and removed by runoff. Although the amount cannot be determined, it is not expected to be substantial, because standard BMPs have proven to be effective in minimizing erosion.

4.6.7 Short-term Use versus Long-term Productivity

During Project construction, short-term uses of soil resources could result from soil loss due to construction-related erosion. Reclamation of any temporarily disturbed areas would restore long-term productivity, whereas unreclaimed areas could be eliminated from long-term productivity.

4.6.8 Irreversible and Irretrievable Commitments of Resources

There would be an irreversible commitment of soil resources because of soil losses due to increased erosion or where soil productivity is reduced because of the presence of permanent aboveground facilities.

4.7 Vegetation

4.7.1 Alternative 1: No Action Alternative

Impacts to vegetation resources would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD would construct and operate the Project as described under the Preferred Alternative.

4.7.2 Alternative 2: Preferred Alternative

Potential impacts to vegetation are primarily associated with clearing of vegetation during construction and the loss of vegetation in areas upon which facilities would be constructed. Impacts would also include temporary loss of wildlife forage and cover, and increased potential for noxious weed invasion, though all areas would be restored and revegetated following construction. Long-term impacts include a decrease in

available nesting areas and forage for those species that have the potential to use the areas upon which facilities would be constructed (see Section 3.6).

Approximately 0.1 acre of emergent marsh and 0.4 acre of playa vegetation would be temporarily impacted by construction of treated water pipelines (Table 4.3). Approximately 12.1 acres of agricultural lands would be temporarily impacted by construction of the proposed pipelines. There would be no permanent loss of native vegetation communities that would result from the placement of facilities or aboveground structures. Removal of 3.52 to 3.59 acres of developed and agricultural land use areas would occur due to permanent surface disturbance for the RO Treatment Plant and by-product pipelines.

All eight of the proposed deep aquifer well locations and the collector pipelines would be located in urban/suburban areas where construction would affect primarily non-native, landscaped vegetation.

The Preferred Alternative is unlikely to impact any threatened or endangered plant species because suitable habitat for the two species identified in Section 3.6 does not occur in the Project Area.

Table 4.3. Temporary Disturbance (acres) to Vegetation Community Types in the Project Area

Vegetation Community/Cover Type	Collection Pipelines	Treated Water Pipelines	By-product Pipelines	Total Temporary Disturbance
Developed, Medium - High Intensity	12.9	18.5	7.7	39.1
Developed, Open Space - Low Intensity	3.9	21.8	2.3	28.1
Agriculture	3.8	4.7	3.6	12.1
Intermountain Basins Playa	0.0	0.4	0.0	0.4
North American Arid West Emergent Marsh	0.0	0.1	0.0	0.1
Open Water	0.0	0.2	0.0	0.2
Total Acres	**20.7**	**45.7**	**13.7**	**80.0**

4.7.3 Alternative 3: Minimum Integrated Design Alternative

Impacts to vegetation resources would be the same under the Minimum Integrated Design Alternative as under the No Action and Preferred alternatives.

4.7.4 Cumulative Impacts

Vegetation communities in most of the Jordan Valley have been and are currently being modified as a result of development, weed invasion, and direct human manipulation. Habitat changes include loss of native sagebrush, riparian and wetland habitats, exotic species invasions, and an overall loss of habitat due to agricultural, urban, and industrial development. Compaction of soils and direct disturbance to vegetation from the Project would increase the susceptibility of vegetation communities to weed infestations. All alternatives would contribute to adverse cumulative impacts to vegetation due to short-term disturbance. Implementation and enforcement of BMPs and mitigation measures would greatly reduce the spread of weeds and help facilitate recovery in reseeded areas.

4.7.5 Additional Mitigation Measures

In addition to standard BMPs and other resource protection measures identified in Section 4.2, the following mitigation measures would reduce the potential for impacts to vegetation resources:

- Stockpile top soil for use in reclamation and re-vegetation activities
- Begin reclamation and re-vegetation immediately following completion of pipeline segments using desirable native and non-native plant species
- Monitor reclamation sites to detect the invasion of non-native plants until successful re-establishment of vegetative cover has been achieved
- Remove undesirable plants using appropriate methods (mechanical, biological, or chemical)

4.7.6 Unavoidable Adverse Impacts

Construction activities under any of the alternatives would result in unavoidable temporary or permanent vegetation loss. Vegetation loss is expected to be temporary on the pipeline corridors and permanent loss minimal under all of the alternatives. The magnitude, extent, and permanence of any vegetation loss would depend on the location and extent of development in different portions of the Project Area.

4.7.7 Short-term Use versus Long-term Productivity

Impacts to short-term use of vegetation resources would occur from vegetation clearing and disturbance in the Project Area. Loss of vegetation resources in the short-term is not expected to affect long-term productivity where appropriate BMPs, weed control measures, and reclamation actions are implemented.

4.7.8 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible commitments of vegetation resources except where permanent facilities are developed, which would occur on agricultural and developed land cover types only. Impacts to vegetation would be temporary during construction and reclamation and are expected to be negligible.

4.8 Wildlife

Wildlife resources could be impacted due to the construction and operation of the RO Treatment Plant, eight deep wells, five shallow wells, and pipelines (collection, discharge, and by-product). In the short-term, direct impacts would be largely temporary and associated with vegetation clearing and habitat loss during construction of the by-product pipeline. Because the wells and pipelines would be located primarily within road corridors and other previously disturbed sites, areas containing native vegetation would be reclaimed and revegetated after construction, and impacts to wildlife associated with these components of the Project are expected to be minor, indirect, and short-term, and to result from increased levels of noise, vibration, and human activity in the construction zone. Wildlife adjacent to these areas would likely be displaced to surrounding habitats during construction but should repopulate the Project Area following construction. Wildlife impacts associated with the use of the by-product pipeline would be more substantial and long-term, owing to the effects of selenium toxicity on the Great Salt Lake ecosystem.

The construction of all components of the Project would not be expected to adversely impact threatened, endangered and sensitive species, raptors, or migratory birds. The construction of the remaining proposed facilities would occur between winter 2009 and winter 2011. Where construction would impact wildlife habitat, vegetation would be cleared between September 1 and April 1 to avoid impacts on nesting migratory birds.

The single special status species potentially occurring in the Project Area and carried forth for analysis is the bald eagle (*Haliaeetus leucocephalus*). The habitat of the bald eagle occurs in riparian areas and the eagles may winter along the south shore of the Great Salt Lake. However, there are no records of bald

eagle nests in the Project Area. Additionally, the Project would not damage any roosting sites. Therefore the Project would have no impact on this species. All alternatives would have the same impacts on the bald eagle.

4.8.1 Alternative 1: No Action Alternative

Impacts to wildlife resources would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD would construct and operate the Project as described under the Preferred Alternative.

4.8.2 Alternative 2: Preferred Alternative

Short-term, adverse impacts would occur in proximity to all construction areas due to noise and traffic. These impacts would be minor and would not affect the long-term viability of any raptor or migratory bird species. No threatened, endangered, candidate or sensitive species have been documented in the Project Area; therefore, no adverse impacts are expected.

The RO Treatment Plant site would be located adjacent to the Jordan River, where habitats provide some value to wildlife that uses the river corridor. The river itself is deeply incised along this stretch (10+ feet, vertical banks), so it is unlikely that wildlife other than birds are able to travel easily between the river and the proposed treatment plant site. The site does provide some habitat structure in that it contains a variety of native and non-native trees. However, much of the site consists of irrigated pasture and does not, therefore, provide the same quality of habitat as an undisturbed, native riparian area. Thus, it is likely that the proposed treatment plant would have minimal impact on wildlife. A total of 24 acres would be impacted during construction, with short-term, adverse impacts on 4 acres lasting for approximately 18 months. Long-term, adverse impacts to this marginal wildlife habitat would total approximately 20 acres at the treatment plant site. The 4 acres used during construction would be restored to pre-construction conditions.

As described above, the majority of the pipelines would be located in existing roadways and ROWs, and therefore would not impact wildlife habitat. Native habitats disturbed during construction would be reclaimed and revegetated following pipeline installation. Short-term construction impacts to migrating bird species would be avoided by constructing during the primary non-breeding months. If no raptors are present, construction could occur from September to April. If there are nesting raptors in or adjacent to the Project Area, vegetation clearing or construction could be limited, depending on the species present, to the period between October and January. There could be short-term displacement of general wildlife that uses the area during construction of the pipelines, but the noise and disturbance of construction would be a relatively minor concern in an urban environment. No long-term impacts to wildlife are expected and no net loss of native habitat is anticipated. Vegetation restoration and reclamation and habitat improvement activities would have neutral or beneficial impacts on most wildlife species and their habitats in the Jordan Valley area.

Increases in the amount of selenium entering Great Salt Lake would be expected to increase selenium concentrations in open water and sediments and, ultimately, in aquatic organisms and wildlife. Selenium is of concern because of the potential for bioaccumulation[4] through the food chain (e.g., algae, brine shrimp) which, when combined with biomagnification[5], can result in consumers (e.g., fish, birds,

[4] Bioaccumulation is where a living organism like algae or brine shrimp accumulates a contaminant so that concentrations within the organism are higher than the concentrations that are present in water and food sources.

[5] Biomagnification is the increase in concentration within the food chain from one species consuming another; for example, fish eating zooplankton and aquatic insects, then waterfowl eating the fish.

mammals) accumulating toxic levels of selenium through their diets even though the observed water column concentrations are very low (Lemly 2002). Brine fly larvae were found to be the most likely food chain link for selenium in Great Salt Lake (Johnson et al. 2008). Elevated selenium levels could indirectly negatively impact the brine shrimp industry as well as birds and other consumers through bioaccumulation and biomagnification. Negative direct impacts to the brine shrimp industry, birds and associated food chains, and other Great Salt Lake wildlife could also occur from selenium uptake from open water and sediments.

Increases in the amount of mercury entering Great Salt Lake would be expected to increase mercury concentrations in open water and sediments by 1% at the most. However, mercury is a pollutant of concern due to its ability to bioaccumulate in aquatic organisms and wildlife. Naftz et al. (2005) note the following:

> Seasonal changes in Hg concentrations in eared grebe livers indicate bioaccumulation during the fall molting period when the grebes feed exclusively on brine shrimp. Brine shrimp samples collected during the summer and fall have a higher Hg concentration (median concentration = 0.34 ppm), with 51 out of 52 samples exceeding the average Hg concentration in shrimp of 0.16 ppm (U.S. Environmental Protection Agency 1997). Total Hg and CH_3Hg levels in Great Salt Lake water and biota appear elevated when compared to standards intended to protect aquatic life.

4.8.3 Alternative 3: Minimum Integrated Design Alternative

Impacts to wildlife resources would be the same under the Minimum Integrated Design Alternative as under the No Action and Preferred alternatives, except with respect to selenium toxicity effects on the Great Salt Lake ecosystem. Under this alternative, there would be 110 fewer (11% less) AFY of by-product water discharged to the Great Salt Lake than would occur under the No Action and Preferred alternatives.

4.8.4 Cumulative Impacts

Wildlife habitats in most of the Jordan Valley have been and are currently being modified as a result of development, weed invasion, and direct human manipulation. Habitat changes include loss of native sagebrush, riparian and wetland habitats, exotic species invasions, and an overall loss of habitat and increased human presence due to agricultural, urban, and industrial development. As a result of habitat changes, some wildlife species have been and are being forced out of the area or into successively smaller areas of suitable habitat. Because of the extent of development and existing land uses in the Jordan Valley Basin, cumulative impacts to wildlife as a result of this Project would be negligible because of the existing degree and extent of habitat modification and small amount of native habitats within the Project Area.

Flow reductions from Project groundwater withdrawals have the potential to affect wildlife through negative water quality impacts resulting from the concentration of pollutants and increased temperatures in Great Salt Lake. In addition, selenium and mercury concentrated in by-product water, in combination with known and unknown cumulative selenium and mercury inputs to Great Salt Lake from elsewhere, could cause wildlife impairments through bioaccumulation and biomagnification. Detrimental impacts to Great Salt Lake water quality, and thus wildlife, could be compounded by the combined effects of reduced flows in combination with increased selenium and mercury inputs in addition to other types of water pollutant inputs from the basin. However, the total effluent loads of selenium and mercury would contribute approximately 2.5%–6.2% (approximately 75–185 kg annually) and 1% (approximately 0.38 kg annually), respectively, to the total estimated annual loads of 2,980 kg selenium and 38 kg mercury.

4.8.5 Additional Mitigation Measures

No mitigation measures beyond the construction techniques, BMPs, and other resource protection measures discussed in Section 4.2 have been identified.

4.8.6 Unavoidable Adverse Impacts

Habitat fragmentation and loss, and/or removal of nesting and roosting sites as a result of all alternatives, would result in moderate to minimal unavoidable adverse impacts. There are no mitigation measures that would mitigate the temporary disturbance to wildlife in and near the Project Area. Disturbance to small areas of habitat and the noise and presence of people and construction equipment will likely temporarily displace wildlife to other habitats. Upon completion of the Project and reclamation of vegetation communities in the Project Area, wildlife would be expected to re-occupy these habitats.

4.8.7 Short-term Use versus Long-term Productivity

Temporary disturbance and loss of habitat used by wildlife would constitute a loss of short-term use. The short-term use of the Project Area is not expected to affect, either positively or negatively, the long-term productivity of the lands in the Project Area.

4.8.8 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible commitment of wildlife resources, except through incidental mortality. There would be temporary impacts from vegetation removal, soil disturbance, and wildlife displacement, but these effects would be temporary during construction and reclamation. However, there could be an irretrievable commitment of wildlife habitats due to fragmentation and loss caused by access roads and the construction of permanent aboveground facilities. These effects are not expected to be significant with the implementation of BMPs and reclamation activities.

4.9 Air Quality

4.9.1 Alternative 1: No Action Alternative

Impacts to air quality would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD would construct and operate the Project as described under the Preferred Alternative.

4.9.2 Alternative 2: Preferred Alternative

The potential exists for direct, short-term generation of fugitive dust in the vicinity of proposed construction. Construction-produced fugitive dust (PM10 and PM2.5) could have short-term, adverse impacts on air quality. A New Source Approval Order issued by the UDAQ may be required for construction activities, and contractors may be required to submit a dust control plan for construction activities to the local planning commission when obtaining construction permits. A dust control plan or fugitive dust mitigation would reduce impacts on air quality to a minor level.

Mitigation of fugitive dust would consist of a dust control program or plan, which could include: 1) periodic water spraying of unpaved roadways, staging areas, and construction sites; 2) application of a chemical stabilizer or dust suppressant; 3) prompt removal of dust-forming debris and soil from

roadways; and 4) frequent compaction of road surfaces to reduce the potential, short-term, adverse impacts from construction activities on air quality.

There would be no adverse impacts to air quality from the long-term operation of wells or the RO Treatment Plant. The RO Treatment Plant would discharge a small amount of CO2.

4.9.3 Alternative 3: Minimum Integrated Design Alternative

Impacts to air quality would be the same under the Minimum Integrated Design Alternative as under the No Action and Preferred alternatives.

4.9.4 Cumulative Impacts

Cumulative air quality impacts would result from an increasing human population in and around Salt Lake County, with attendant increases in pollutants from vehicle emissions and home energy use. Implementation of a fugitive dust control plan and other appropriate mitigation measures would limit impacts to air quality during Project construction to negligible levels.

4.9.5 Additional Mitigation Measures

In addition to standard construction BMPs and the measures identified in Section 4.2, implementation of a fugitive dust control plan and other BMPs to reduce dust and other emissions during construction would reduce the potential for impacts to air quality.

4.9.6 Unavoidable Adverse Impacts

Unavoidable construction-related air emissions would occur as a result of any of the alternatives though they would be minimal given BMPs to reduce emissions and the temporary nature of construction.

4.9.7 Short-term Use versus Long-term Productivity

The short-term use of the Project Area would not affect, either positively or negatively, the long-term productivity of air resources in the Jordan Valley.

4.9.8 Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitments of air resources would occur as a result of the proposed actions or alternatives to those actions.

4.10 Cultural Resources

Cultural resource inventories completed for the APE resulted in the update of 16 previously recorded linear historic sites. Seven of these sites are still present in the APE, eight have been destroyed where they would have crossed the APE, and one had no visible remaining segments in the APE (Spurling 2009). Two new historic sites were also identified in the APE. In addition, two isolated occurrences and five isolated features were identified in the Project Area. Of these cultural resource sites, seven have been considered for analyzing the effects of this Project on cultural resources. These seven cultural resource sites consist of four sites that have been determined eligible for the National Register of Historic Places (NRHP) with State Historic Preservation Office (SHPO) concurrence, two sites that are recommended eligible for the NRHP, and one site that has not been previously evaluated (see Table 3.3; Appendix E). Not included in this analysis are three sites that are recommended ineligible for the NRHP. All of the

eligible cultural resources currently identified in the Project Area are linear resources such as railroads, roads, canals, and a transmission line.

4.10.1 Alternative 1: No Action Alternative

Impacts to cultural resources would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD would construct and operate the Project as described under the Preferred Alternative.

4.10.2 Alternative 2: Preferred Alternative

The NRHP-eligible canals, ditches, railroads, roads, and single power line identified in the Project Area would be directly affected by the implementation of any of the alternatives. The six sites eligible for the NRHP are crossed by the pipeline corridor and would be directly affected by temporary and long-term disturbance during construction and maintenance of the pipeline. The primary factor determining impacts on cultural resources is the type of construction method employed. Avoidance of adverse impacts to the types of cultural resources identified in the Project Area is typically accomplished by one of three methods: 1) boring under the resource and thus avoiding the resource completely; 2) attaching pipe to the underside of a bridge or viaduct that spans the cultural resource, thus avoiding the resource completely; or 2) trenching through the resource, installing the pipeline, and then recontouring the resource to its original condition.

4.10.3 Alternative 3: Minimum Integrated Design Alternative

Impacts to cultural resources would be the same under the Minimum Integrated Design Alternative as under the No Action and Preferred alternatives.

4.10.4 Cumulative Impacts

Because of the extent of modern development in the area, impacts associated with the Project would have minimal cumulative effects relative to the effects from past, present, and reasonably foreseeable future activities.

4.10.5 Additional Mitigation Measures

If cultural materials are discovered during construction, work should be halted immediately and the appropriate agency (UDOT or SHPO) notified. The unanticipated discovery of archaeological deposits procedures should also be implemented, according to UDOT Metric Standard Specification Section 01355, Part 1.13, Discovery of Historical, Archaeological, or Paleontological Objects.

4.10.6 Unavoidable Adverse Impacts

All earth disturbing activities both in and outside of known cultural resource locations have the potential for damaging previously unrecorded subsurface cultural resources normally classified with the NRHP. These actions can result in damaging, destroying, dispersing, or altering the contextual integrity of these resources. The implementation of appropriate BMPs and mitigation measures would minimize the potential for adverse impacts to cultural resources in the Project Area.

4.10.7 Short-term Use versus Long-term Productivity

The short-term use of the area during Project activities has the potential to adversely impact the long-term recovery or availability of cultural resources located in the Project Area. These impacts would be minimized through data recovery or other appropriate mitigation or treatment measures. The potential for inadvertent damage or destruction of cultural sites during construction, operation, maintenance, or associated activities, could result in the loss of significant information. Further, information and data retrieved through mitigation measures (i.e., data recovery) would represent short-term use of cultural resources at the expense of future research opportunities. Therefore, long-term productivity would be lost.

4.10.8 Irreversible and Irretrievable Commitments of Resources

Cultural resources would be irreversibly committed if sites are inadvertently discovered and disturbed or destroyed during Project construction, or if increased human activity in the Project Area results in the removal or destruction of cultural resources.

4.11 Paleontological Resources

Based on the results of a file search by Ms. Martha Hayden of the UGS, no fossil localities are known to be present in the Project Area (personal communication, Martha Hayden 2005). However, the proposed pipeline would be constructed at altitudes that cross the approximate elevation of the prehistoric Gilbert lakeshore level of Lake Bonneville, which may have acted to expose fossil beds in the area. Thus, the proposed pipeline may uncover previously unidentified Lake Bonneville constructional lakeshore deposits in the Project Area. If any paleontological deposits are encountered, construction should cease and the UGS office should be notified immediately.

4.11.1 Alternative 1: No Action Alternative

Impacts to paleontological resources would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD would construct and operate the Project as described under the Preferred Alternative.

4.11.2 Alternative 2: Preferred Alternative

Construction activities under this alternative consist of a by-product pipeline that would extend to the Great Salt Lake and could uncover Lake Bonneville constructional deposits. This risk is greatest in the northern part of the Project Area where the pipeline would enter the Great Salt Lake, because this is at the Gilbert level elevation of the Great Salt Lake. Unless paleontological resources are discovered as a result of construction activities, the Project should have no impact on paleontological resources (personal communication, Martha Hayden 2005).

4.11.3 Alternative 3: Minimum Integrated Design Alternative

Impacts to paleontological resources would be the same under the Minimum Integrated Design Alternative as under the No Action and Preferred alternatives.

4.11.4 Cumulative Impacts

The incremental loss of paleontological resources over a period of time as a result of ground disturbance has the potential to result in significant cumulative effects, because it could result in the destruction of

non-renewable paleontological resources and irretrievable loss of scientific information. However, when paleontological monitoring and mitigation are implemented prior to and during Project construction, fossils are protected and information is gained. Cumulative effects on paleontological resources under any of the alternatives in conjunction with past, present, and reasonably foreseeable activities would be negligible. Further, any scientifically significant fossils discovered prior to or during ground disturbances would benefit the scientific community through an increase in knowledge associated with the fossils.

4.11.5 Additional Mitigation Measures

If paleontological materials are discovered during construction, work should be halted immediately and the appropriate agency (UDOT or SHPO) would be notified. The unanticipated discovery of paleontological deposits procedures should also be implemented, according to UDTO Metric Standard Specification Section 01355, Part 1.13, Discovery of Historical, Archaeological, or Paleontological Objects.

4.11.6 Unavoidable Adverse Impacts

Construction work under any of the alternatives, even after proposed mitigation measures, has the potential for unavoidable adverse impacts to paleontological resources, if present. Because of the low potential for significant fossil localities in the Project Area, Project operations are not likely to present unavoidable adverse impacts to paleontological resources.

4.11.7 Short-term Use versus Long-term Productivity

During the short-term construction period, paleontological resources could be inadvertently damaged or destroyed and could result in the loss of significant information. These impacts would be mitigated to the extent possible through data recovery or other appropriate treatment. Information and data retrieved through mitigation measures (i.e., data recovery) would represent short-term use of paleontological resources at the expense of future research opportunities. Therefore, long-term productivity would be lost.

4.11.8 Irreversible and Irretrievable Commitments of Resources

Paleontological resources would be irreversibly committed if removed or destroyed during Project construction.

4.12 Noise

4.12.1 Alternative 1: No Action Alternative

Impacts with respect to noise would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD would construct and operate the Project as described under the Preferred Alternative.

4.12.2 Alternative 2: Preferred Alternative

For the Project, potential noise sources would include well operation, treatment plant operation, pump station operation, and construction associated with installation and construction of the proposed facilities. Construction noise (i.e., well drilling, excavation, construction) would exceed background levels. Following construction, Project noise levels would be at or below background levels.

Under the Preferred Alternative, the water treatment facility would be completely enclosed in concrete or masonry walls, and all mechanical equipment would be contained in the facility. There would be direct, short-term noise impacts from well drilling and facility construction-related activities. These short-term impacts would have minor adverse impacts on residents dwelling adjacent to the proposed construction areas, and have potential direct adverse impacts on wildlife that nest, roost, or browse in the noise-affected area.

There would be long-term noise produced by vehicles temporarily accessing well heads and water treatment facilities for periodic maintenance. Although well heads would be visited daily and the treatment plant would be staffed on five out of every seven days, long-term traffic noise impacts would be minor, because the number of vehicles required for daily well head visits or required to staff the treatment plant are very few, and facility maintenance would be infrequent.

4.12.3 Alternative 3: Minimum Integrated Design Alternative

Impacts with respect to noise would be the same under the Minimum Integrated Design Alternative as under the No Action and Preferred alternatives.

4.12.4 Cumulative Impacts

Increased noise levels may impact area residents during Project construction and maintenance. Cumulative effects of noise from Project implementation in conjunction with past, present, and reasonably foreseeable activities is expected to have overall neutral impacts on area residents; there would not be a perceptible increase in the noise level on a sustained basis.

4.12.5 Additional Mitigation Measures

In addition to the standard BMPs and other resource protection measures discussed in Section 4.2, construction equipment should possess properly working mufflers, should be properly maintained, and should use other noise-abatement methods as needed to reduce noise.

4.12.6 Unavoidable Adverse Impacts

Even with standard BMPs and other mitigation measures, there is potential for a temporary increase in noise levels from vehicle traffic and construction. Although the degree of noise impacts cannot be determined, mitigation and containment measures will ensure that noise impacts are localized and short-term.

4.12.7 Short-term Use versus Long-term Productivity

The short-term increase in noise levels is not expected to affect the long-term productivity of lands in the Project Area or surrounding communities.

4.12.8 Irreversible and Irretrievable Commitments of Resources

There are no irreversible or irretrievable impacts that would occur as a result of the Project. There will be a temporary increase in noise associated with Project activities in and near the Project Area. However, these impacts will be temporary, lasting during the construction process only.

4.13 Public Health

4.13.1 Alternative 1: No Action Alternative

Impacts to public health would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD would construct and operate the Project as described under the Preferred Alternative.

4.13.2 Alternative 2: Preferred Alternative

The Preferred Alternative would have direct and indirect long-term beneficial impacts on public health. Under this alternative, sulfate-contaminated groundwater would be extracted by deep and shallow wells, and pumped to and treated at a water treatment facility. Treated water would be delivered to the municipal water supply. This would have direct long-term beneficial effects on public health by lowering the concentrations of sulfate-contaminated groundwater in Zone B. Indirect long-term beneficial impacts on public health would result from the restoration of Zone B groundwater to a condition that would meet EPA groundwater quality standards, and would reduce the level of sulfate contaminant seepage of Zone B groundwater into the Jordan River.

Under this alternative, the potential exists for short-term, adverse impacts to public safety caused by an increase in construction-related traffic during treatment facility, pipeline, well, and pumping facility construction. The Project Area lies in a densely populated, predominantly urban area capable of handling the increase in traffic. The potentially adverse impacts from increased traffic caused by construction would be minor to negligible.

Other potential, short-term impacts to public health include reduced air quality from vehicle emissions and fugitive dust, odors associated with equipment use, and noise.

4.13.3 Alternative 3: Minimum Integrated Design Alternative

The impacts to public health under the Minimum Integrated Design Alternative would be the same as those described for the No Action and Preferred alternatives.

4.13.4 Cumulative Impacts

Construction activities may inconvenience area residents during Project completion and maintenance. Over the long-term, public health will be positively affected from reduced concentrations of sulfate-contaminated groundwater.

4.13.5 Additional Mitigation Measures

In addition to the BMPs and other resource protection measures listed in Section 4.2, mitigation measures for noise and a Fugitive Dust Control Plan would minimize impacts to public health from Project construction and maintenance activities.

4.13.6 Unavoidable Adverse Impacts

Even with standard BMPs and other mitigation measures, there is potential for temporary impacts to public health from increased traffic and construction activities and associated reductions in air quality and increased noise levels. Although the degree of such impacts cannot be determined, they are expected to be negligible.

4.13.7 Short-term Use versus Long-term Productivity

The short-term use of the pipeline corridors and staging areas is not expected to affect the long-term productivity of the lands in the Project Area. The Project ensures the continued use of these lands and the surrounding communities by removing contaminated groundwater and improving municipal water supplies.

4.13.8 Irreversible and Irretrievable Commitments of Resources

There are no irreversible or irretrievable impacts that would occur as a result of the Project. There are multiple potential impacts to public health, including dust and emissions impacts to air quality, and increased noise levels in and near the Project Area. However, these impacts will be temporary, lasting during the construction and reclamation process that follows (up to five years).

4.14 Socioeconomic Resources

The Project would be completed using funds provided by the State of Utah and KUCC from the consent decree trust (approximately $38,000,000), bonds issued by JVWCD (approximately $20,000,000), and, depending on the alternative selected, special appropriations grants from EPA (totaling approximately $1,029,000). As a result of this EA, the EPA will decide whether or not to release the grant funds to JVWCD for the purpose of Project completion. Under all alternatives, the total Project cost is estimated to be $59, 029,000.

4.14.1 Alternative 1: No Action Alternative

The No Action Alternative would not change the current land uses, socioeconomic conditions, or activities. There would be no impacts to existing land uses, current population changes, or economic growth in the Project Area under this alternative. However, under the No Action Alternative, over $1 million dollars for project implementation would need to be obtained from revenue or bonds. As a result there may be a negligible increase in wholesale water rates (currently ranging from $118.41 to $467.33 per acre-foot) to fund the Project. This cost increase would likely not be noticeable to customer municipalities. Impacts to socioeconomic conditions related to construction and operation of the plant would be the same under the No Action Alternative as under the Preferred and Minimum Integrated Design alternatives. As stated in Chapter 2, selection of the No Action Alternative on the part of EPA would not mean the Project would not be constructed and operated. JVWCD would construct and operate the Project as described under the Preferred Alternative.

4.14.2 Alternative 2: Preferred Alternative

Under the Preferred Alternative, construction and operation of a water treatment facility and pipelines would have minor to negligible, short-term and long-term, direct and indirect impacts on land use, economic growth, and population growth. Overall, the Project would have net beneficial impacts on socioeconomic resources due to increased employment opportunities and associated income and tax revenues. Sulfate-contaminated groundwater remediation would provide a new, long-term potable water source and an additional municipal water supply for the affected suburban cities of west Salt Lake Valley. However, as the treated water would enter JVWCD's water distribution system and be dispersed throughout the Jordan Valley Water District, there would not be any local beneficial socioeconomic impacts from additional water in the Project Area.

The proposed water treatment facility would have negligible impacts on current or future land uses in the Project Area, because access to existing facilities would not impede vehicle traffic in the vicinity of the facility and long-term vehicle traffic associated with maintenance and waste disposal would be minimal.

There would be an irretrievable loss of 3.5 acres of JVWCD-owned land where the treatment facility would be constructed, and where wells would be drilled and maintained, for the lifetime of the Project. However, this irretrievable loss of land would have a negligible impact on population and economic growth or on land use because of the small amount of area removed from potential use for other purposes. Construction of pipelines would not result in an irretrievable loss of land, as most of the pipelines would be constructed within existing road ROWs. Those pipelines not constructed in existing road ROWs would be buried and the disturbed land would be reclaimed and available for future use.

Construction of pipelines would result in minor short-term impacts to traffic caused by trenching and laying pipelines primarily within existing road ROWs. It is likely that traffic would be re-directed around construction zones during construction. This could increase travel time, in the short-term, for commuters in the Project Area.

4.14.3 Alternative 3: Minimum Integrated Design Alternative

Impacts to socioeconomic resources would be the same under the Minimum Integrated Design Alternative as under the Preferred Alternative.

4.14.4 Cumulative Impacts

The cumulative effects area for socioeconomics, unlike that for the other subject areas, includes the entire county. This difference is primarily because taxation, government agencies, law enforcement, and other services are generally administered by county unit, and socioeconomic statistics are reported by county or municipality. Cumulative effects of Project implementation in conjunction with past, present, and reasonably foreseeable activities would have overall beneficial impacts to Salt Lake County and its residents.

4.14.5 Additional Mitigation Measures

In addition to the standard BMPs and other resource protection measures identified in Section 4.2, to reduce economic impacts to local land owners, fence lines in the Project Area and proposed pipeline corridors would be avoided. Where fences cannot be avoided, measures to mitigate damage to fences would be implemented.

4.14.6 Unavoidable Adverse Impacts

Adverse effects from construction on land use and local traffic would present negligible to minor unavoidable adverse impacts.

4.14.7 Short-term Use versus Long-term Productivity

The short-term uses of workforce and resources (during construction and operations) would enhance the long-term economic and social stability of the area.

4.14.8 Irreversible and Irretrievable Commitments of Resources

Land conversion, an increased tax base from expanded employment opportunities, and any changes in municipal water costs would constitute irreversible commitments of area socioeconomic resources. In addition, the Project will require substantial expenditure of funds, which are expected to come from bonds issued by JVWCD, the State of Utah, KUCC consent decree, special appropriations grants. These expenditures would represent a loss of non-renewable, irretrievable economic resources, which would not be available for other local, state or federal development purposes. Long-term social and economic benefits of the Project are expected to outweigh these financial commitments.

5 CONSULTATION AND COORDINATION

5.1 Preparers of the Environmental Assessment

Table 5.1. List of Preparers

Name	Position	Affiliation
Benjamin Gaddis, M.E.M.	Project Manager	SWCA Environmental Consultants
J. Hope Hornbeck, M.S.	Environmental Specialist	SWCA Environmental Consultants
Gretchen Semerad, M.S.	Environmental Specialist	SWCA Environmental Consultants
Amy Spurling	Cultural Resource Specialist	SWCA Environmental Consultants
Linda Burfitt	Technical Editing	SWCA Environmental Consultants
Rachel Johnson	GIS	SWCA Environmental Consultants
Allen Stutz	GIS	SWCA Environmental Consultants
Mark Atencio	Project Manager	Jordan Valley Water Conservation District
Todd Marti	Project Manager	Jordan Valley Water Conservation District

5.2 Public Participation

The State of Utah NRD Trustee published a notification of a public comment period from September 2, 2003 through October 1, 2003 for comments on the proposed groundwater treatment project in the Southwest Jordan Valley. The announcement contained information on the History, Consent Decree, Proposed Project, Use of the Trust Fund, and other information resources relevant to the Project. A 30-day scoping period was held from September 2, 2003 through October 1, 2003, during which the public and other stakeholders could provide comments to the Utah NRD Trustee about the proposed Project.

The Utah NRD Trustee also announced the public comment period and two public hearings held on Wednesday, September 10, 2003 from 6:30 to 9:30 pm at West Jordan City Hall, West Jordan, Utah; and Thursday, September 25, 2003 from 3:30 to 6:30 pm at the UDEQ in Salt Lake City, Utah. These meetings were held to allow interested persons an opportunity to learn about the Southwest Jordan Valley Groundwater Cleanup Project, discuss concerns with resource specialists, and most importantly, to submit their comments.

The issues of concern raised during scoping, including the potential impacts resulting from the Project, are summarized in Section 4.1, and discussed in detail in Chapter 4 of this EA.

The draft EA was made available for public comment in 2011. The EPA received two letters during the public comment period. In preparing the final EA, comments from the letters were considered and text was modified or added for further explanation.

5.3 Agency Coordination and Consultation

The Summary of Issues (Section 4.1) identifies the environmental issues analyzed in detail in Chapter 4. The following lists contain the organizations and agencies that were contacted or consulted during the scoping process and preparation of the draft EA.

5.3.1 Federal Offices

U.S. Army Corps of Engineers

EPA, Region 8

USFWS

5.3.2 State Offices

UDEQ

UDWQ

Utah Department of Transportation

Utah State Historic Preservation Office

5.3.3 Special Interest

FRIENDS of Great Salt Lake

5.3.4 Industry

KUCC

JVWCD

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Appendix A

Figures

Figure A1. Project location.

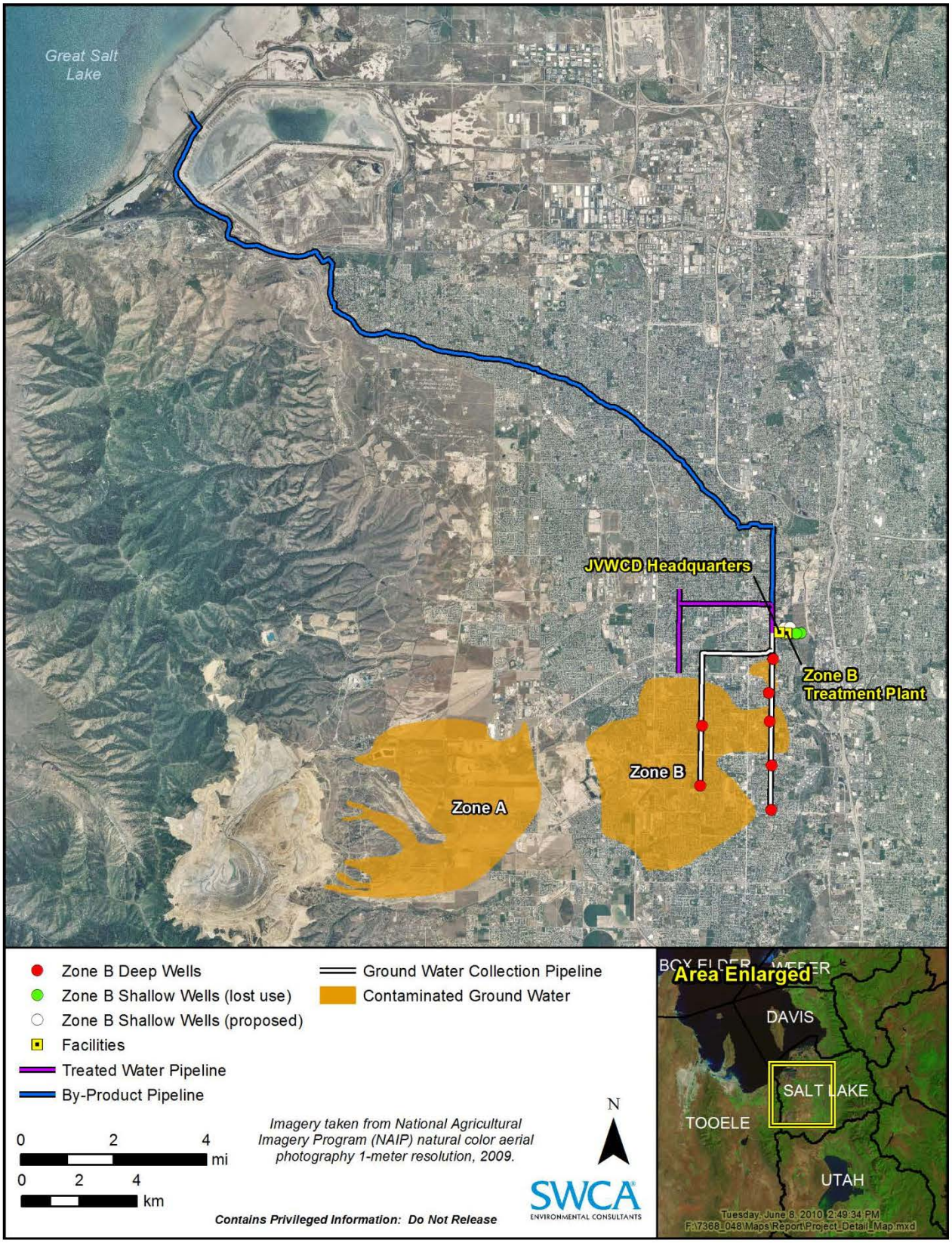
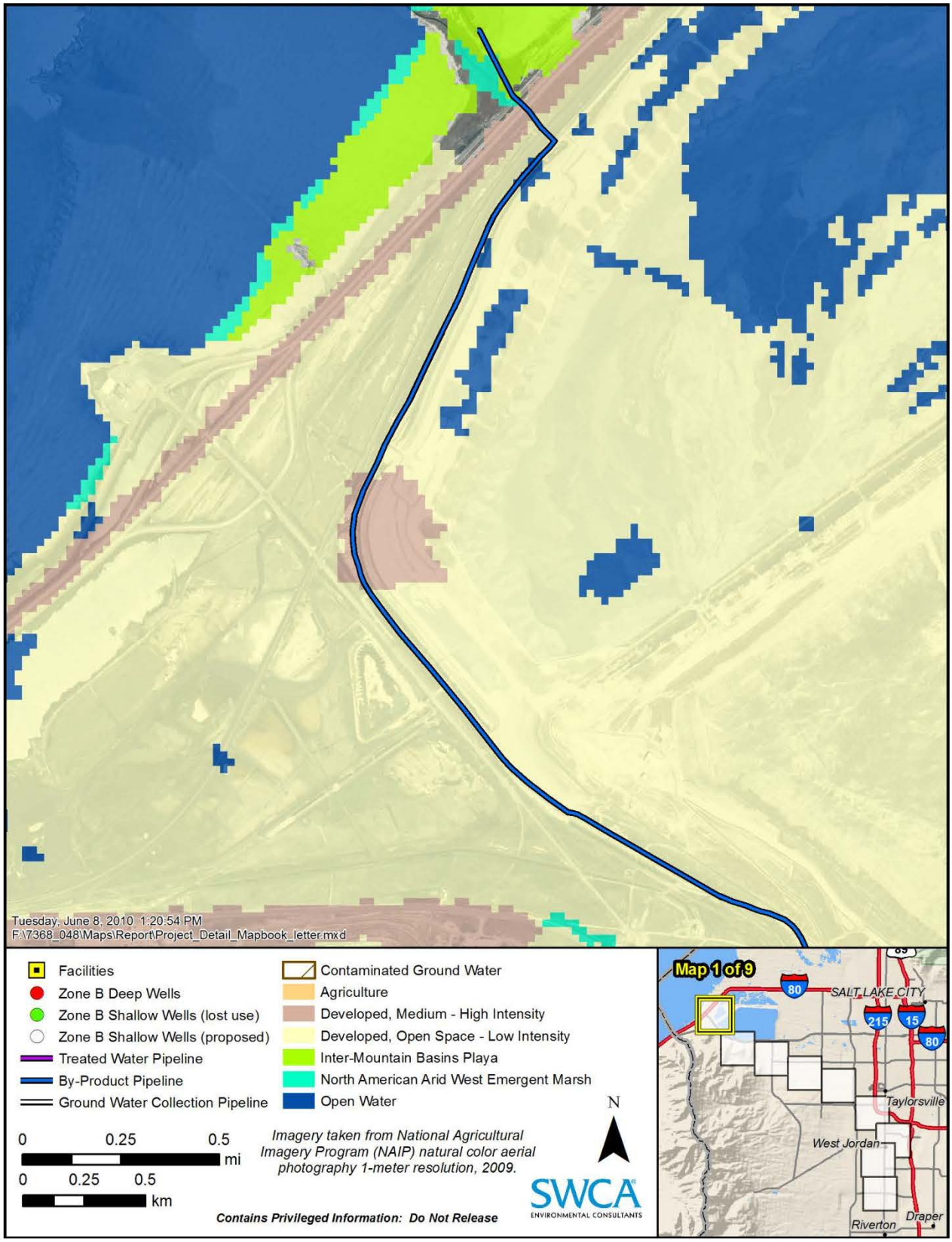
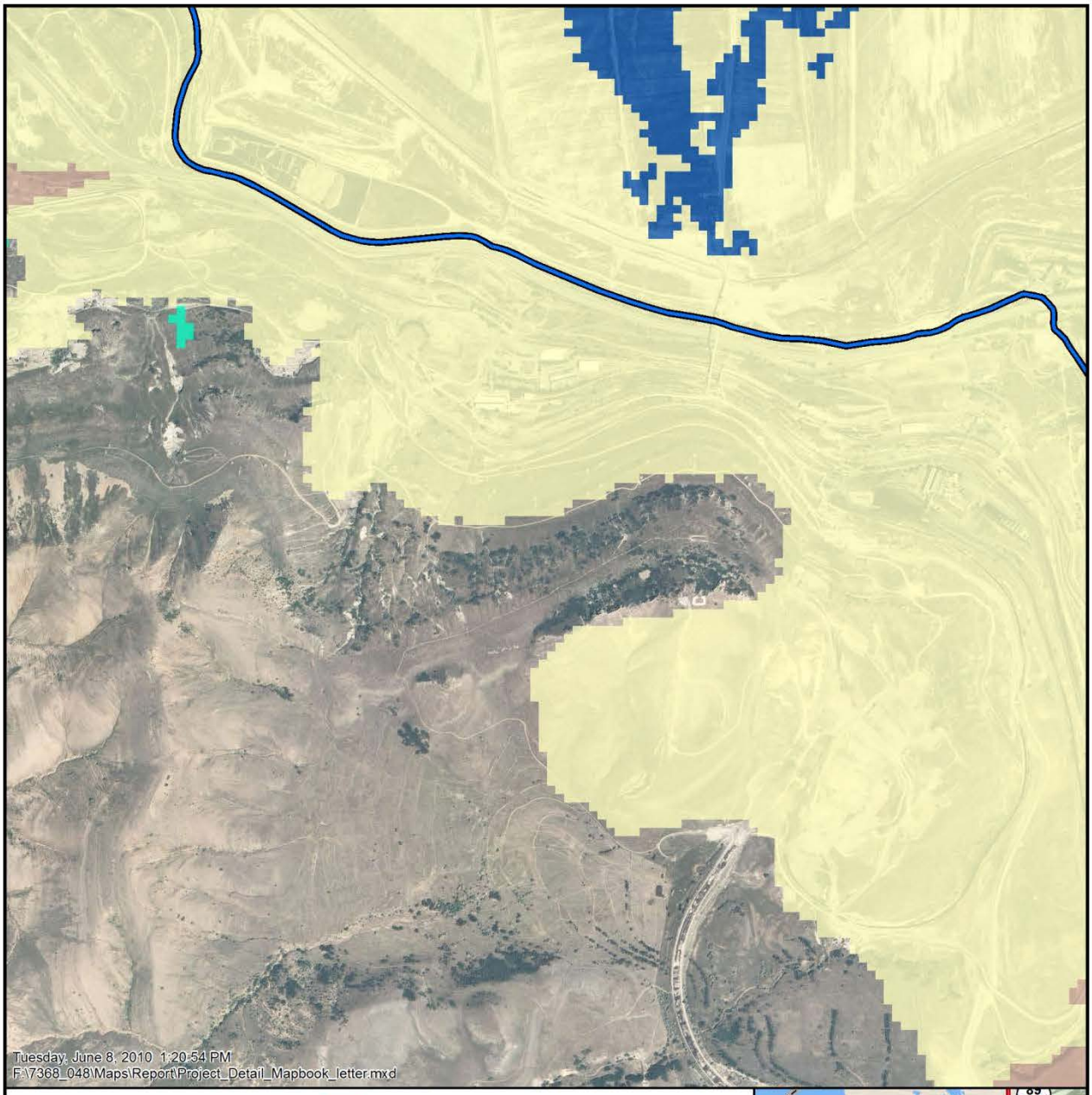


Figure A2. Project pipeline alignments (maps 1–9)





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- By-Product Pipeline
- Ground Water Collection Pipeline
- Contaminated Ground Water
- Agriculture
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- Developed, Open Space - Low Intensity
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- North American Arid West Emergent Marsh
- Open Water

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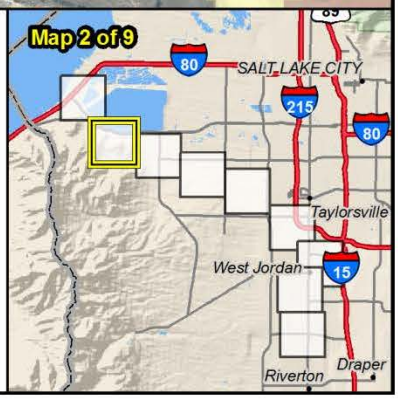

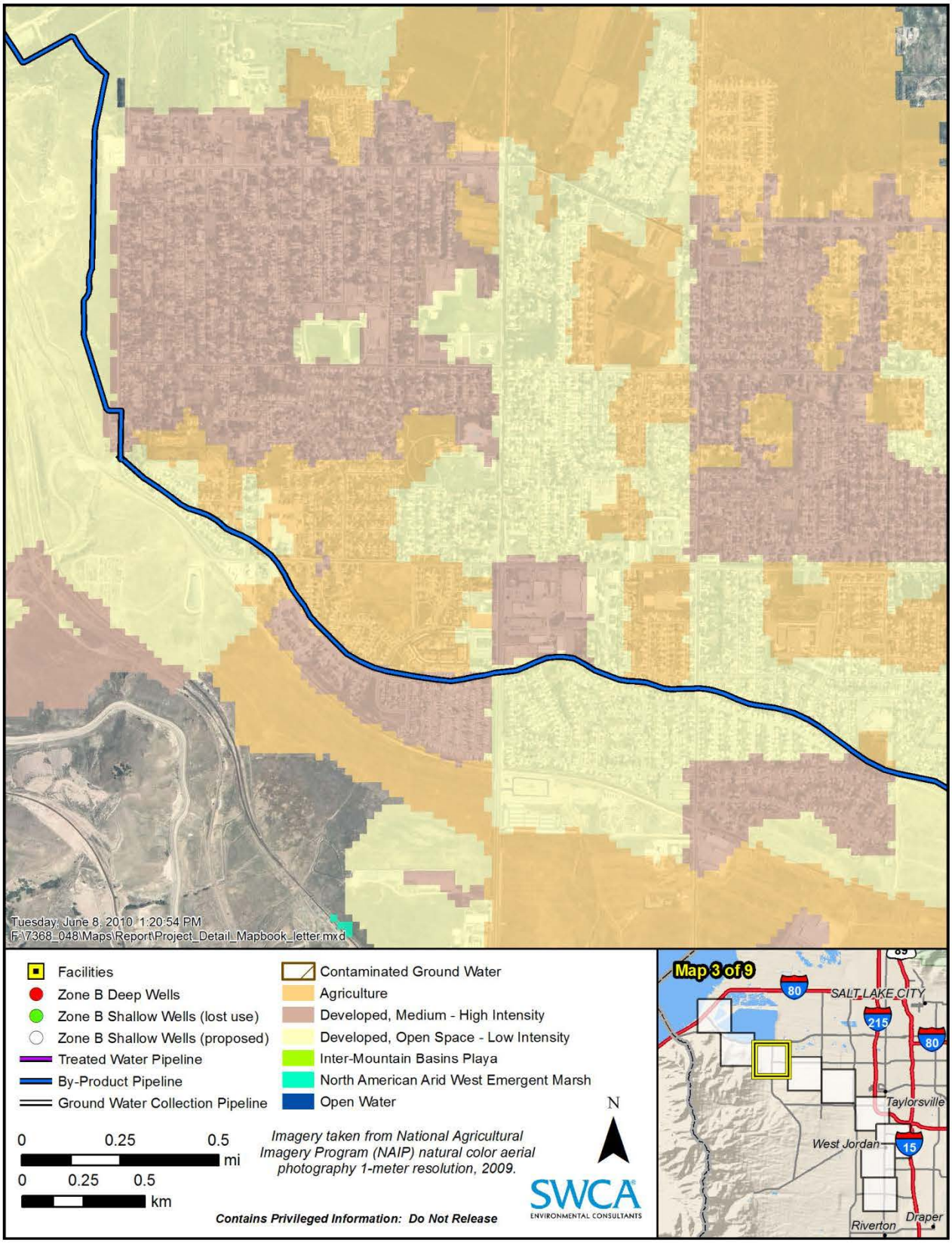
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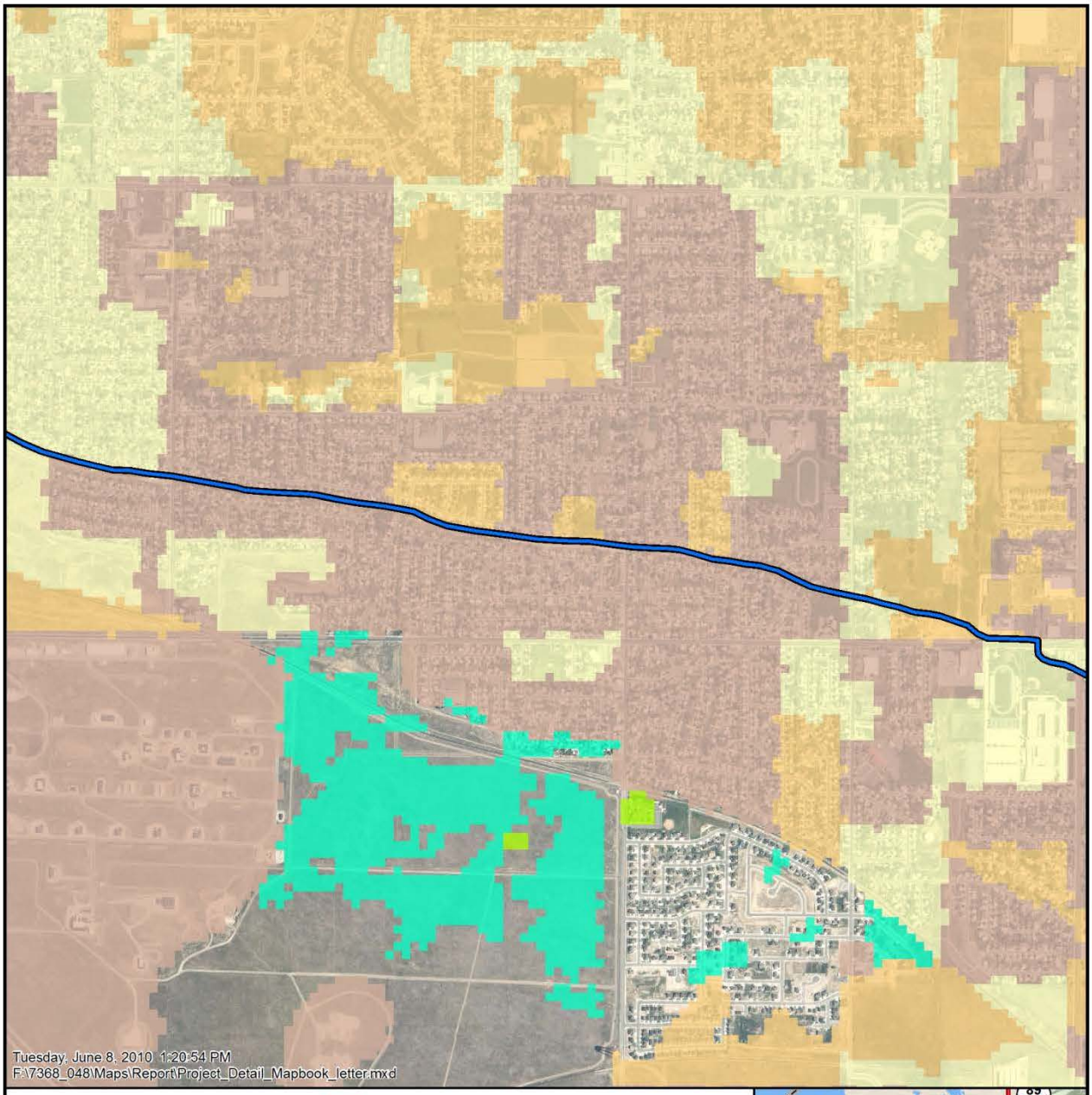

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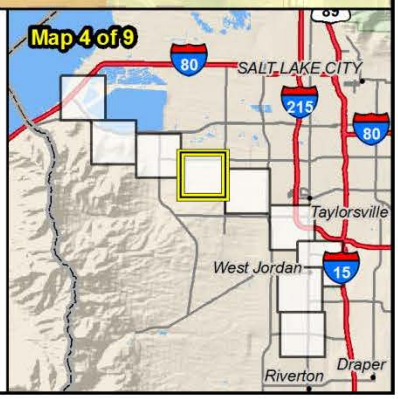

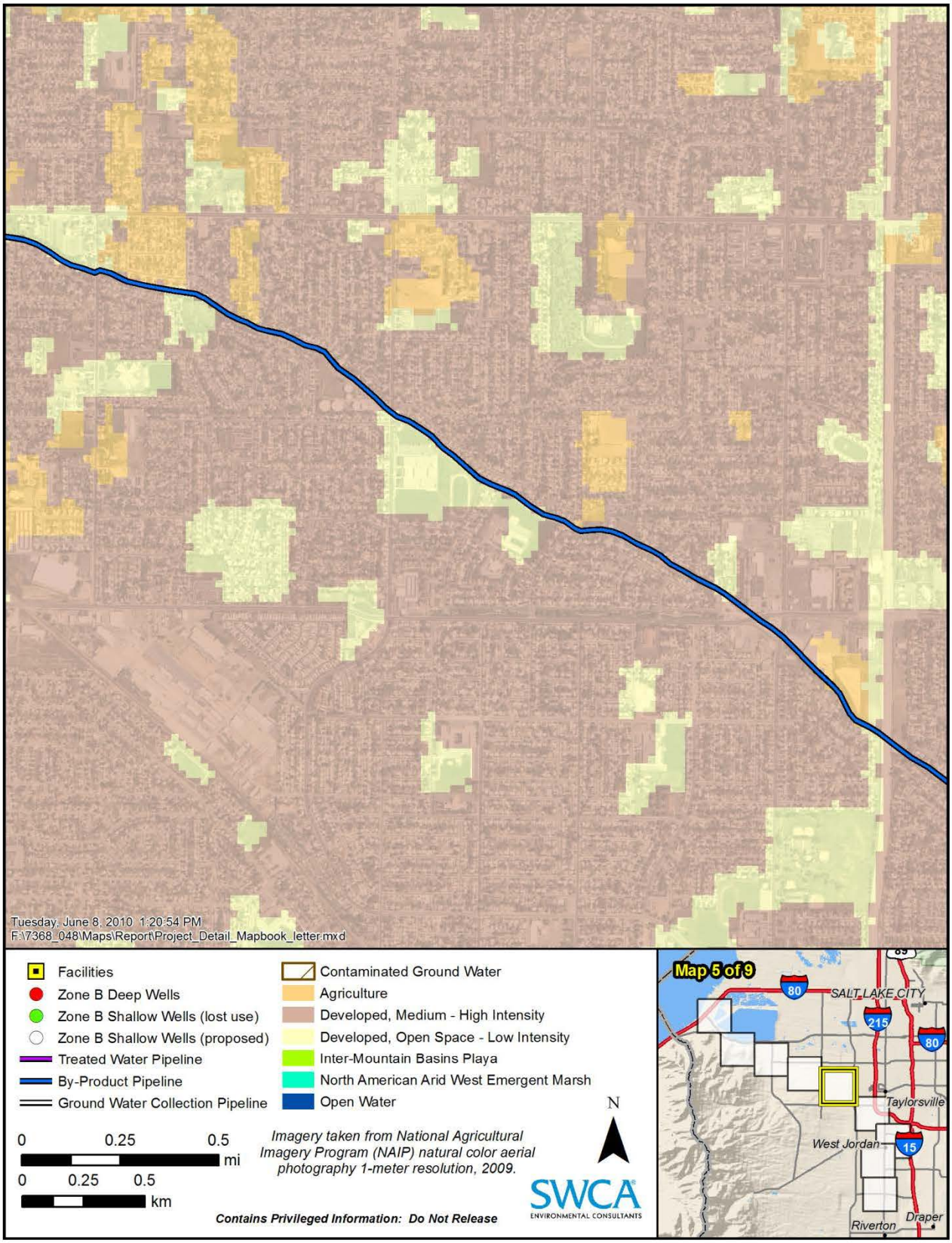
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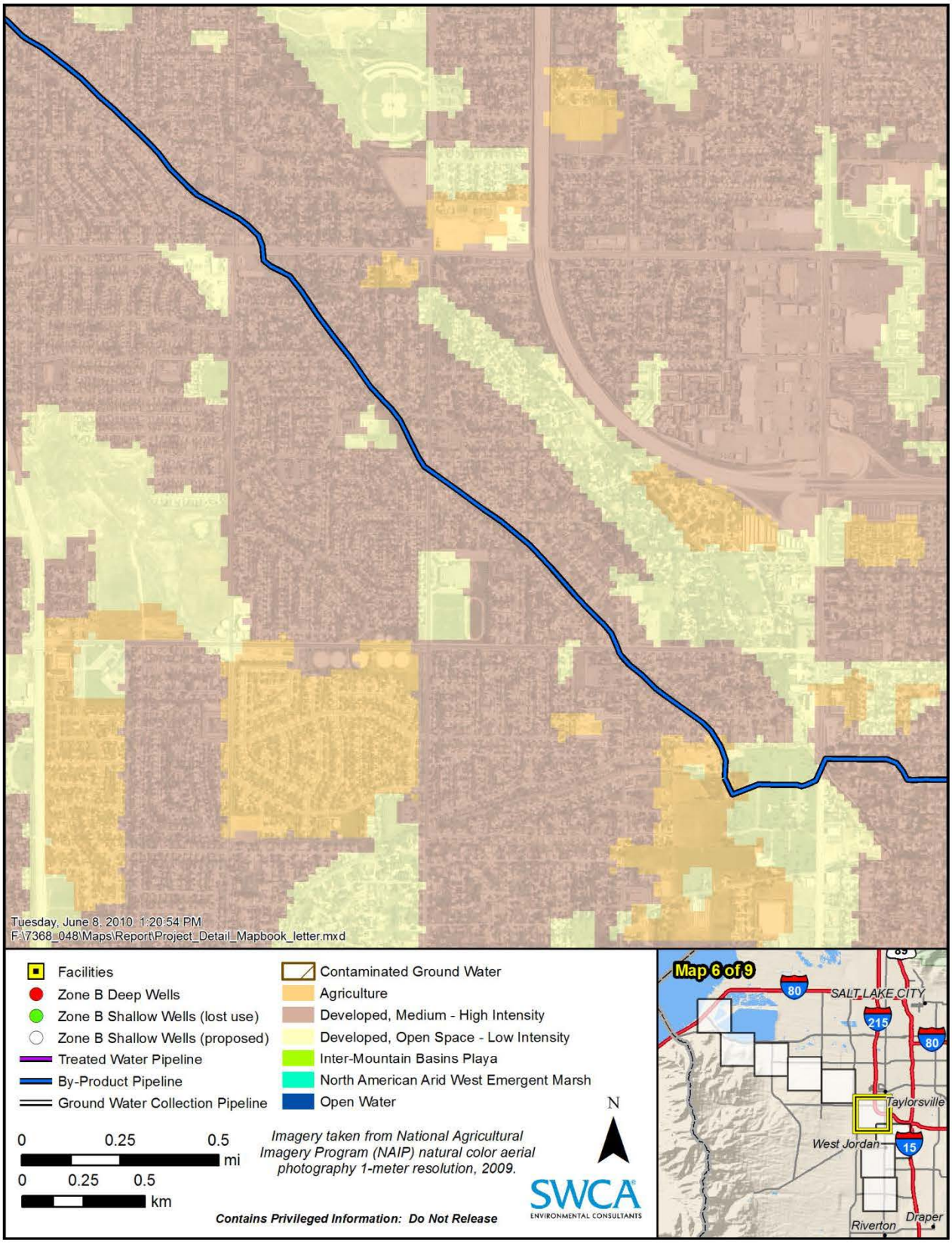
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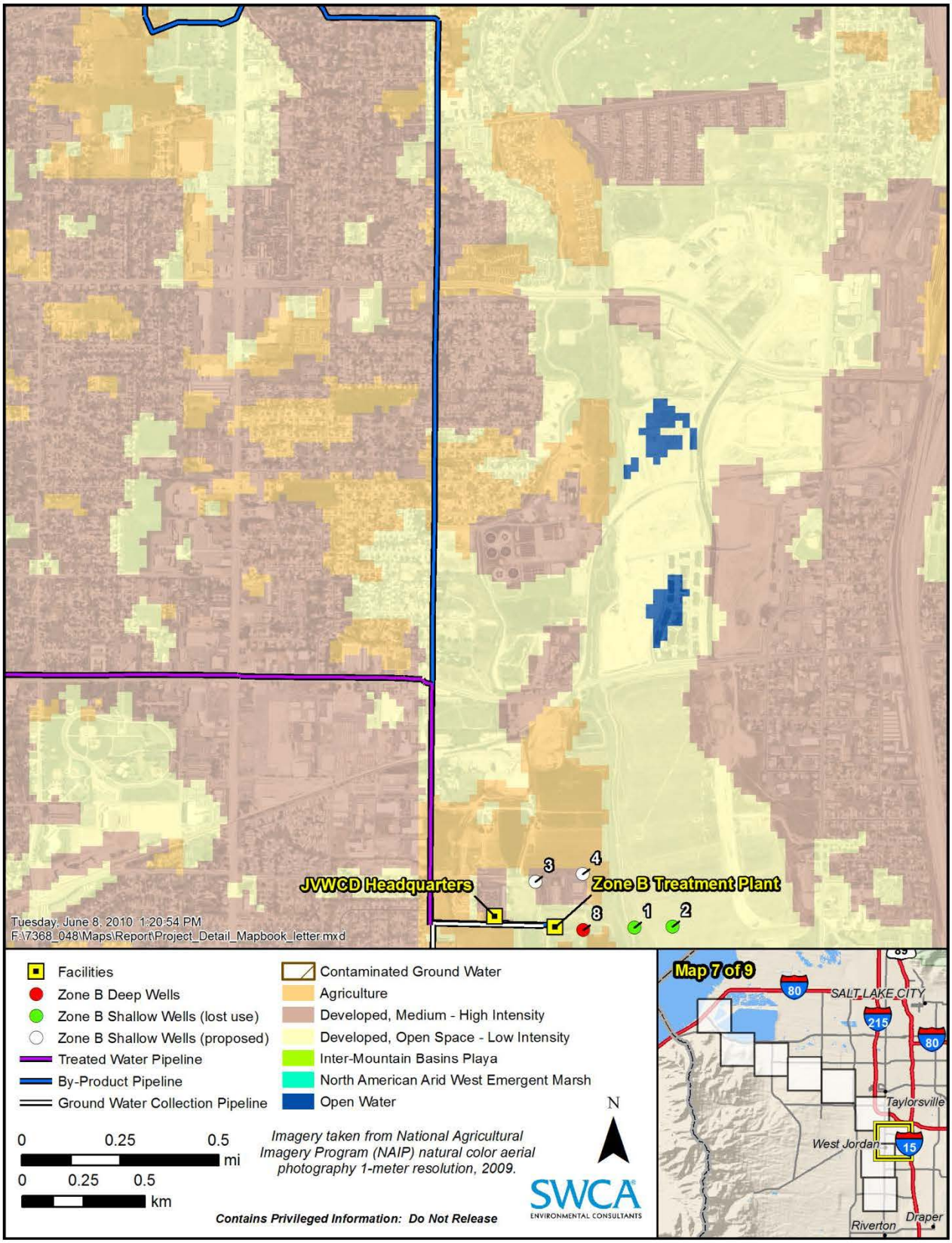
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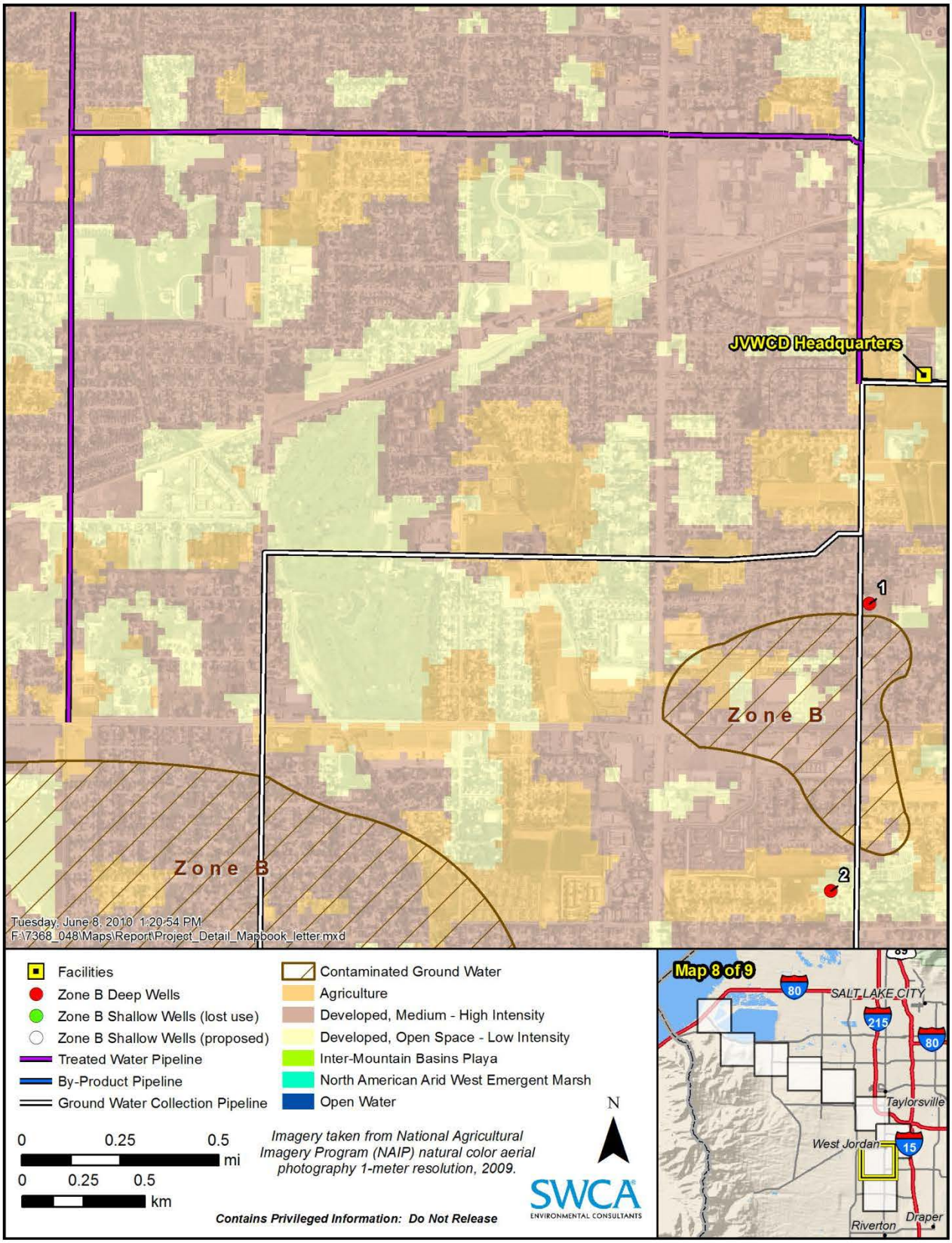
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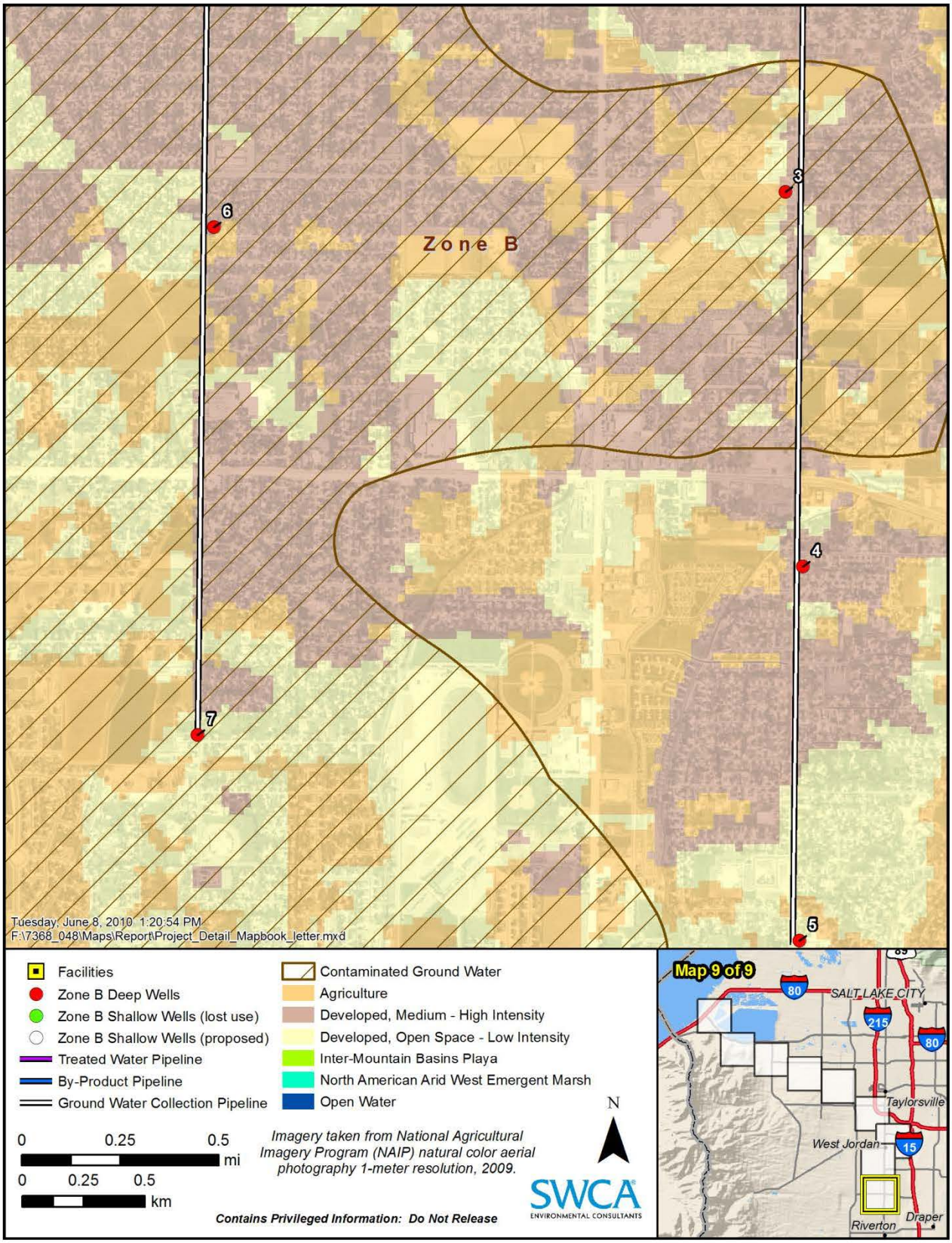
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Figure A3. Separate design by-product treatment process

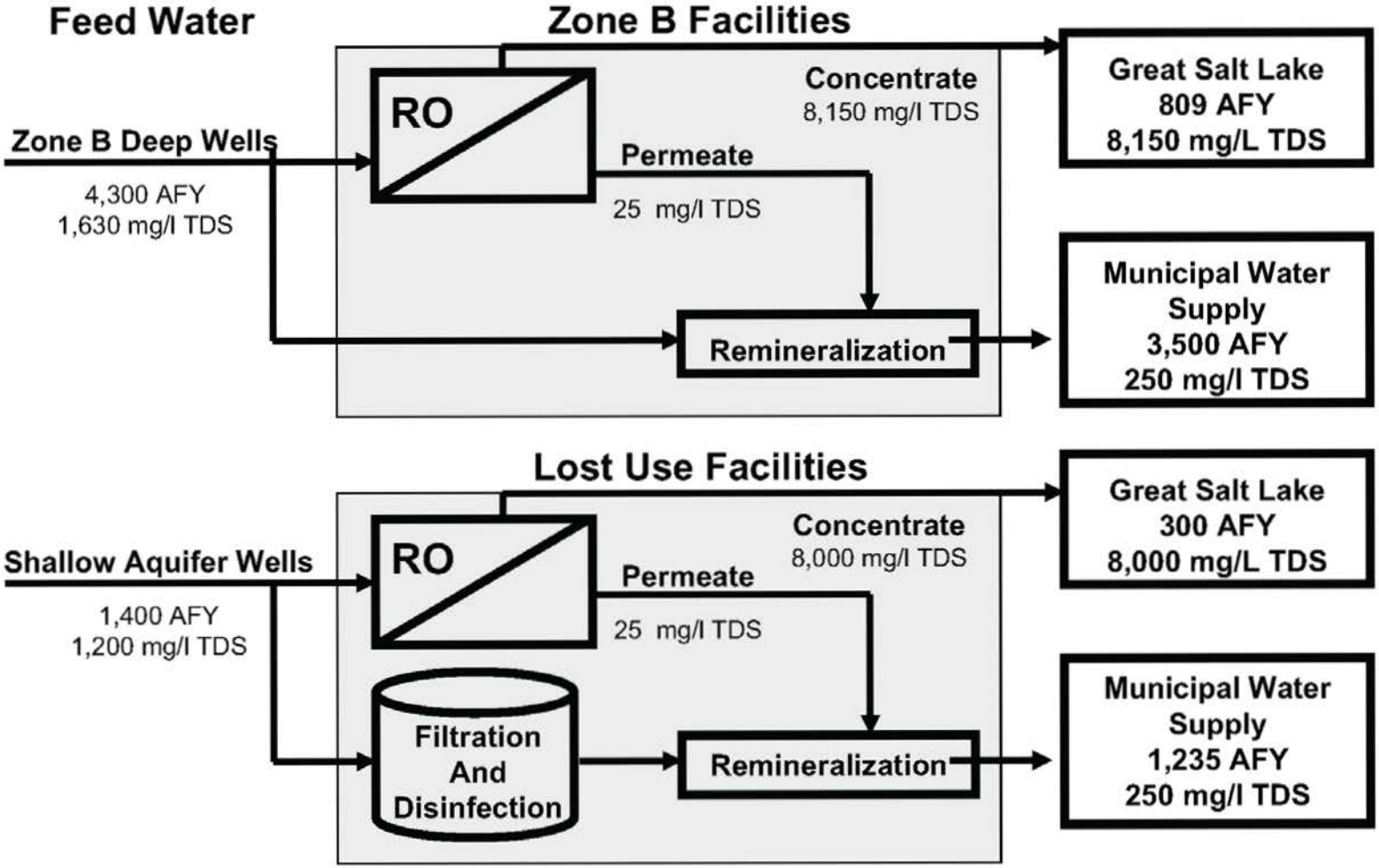
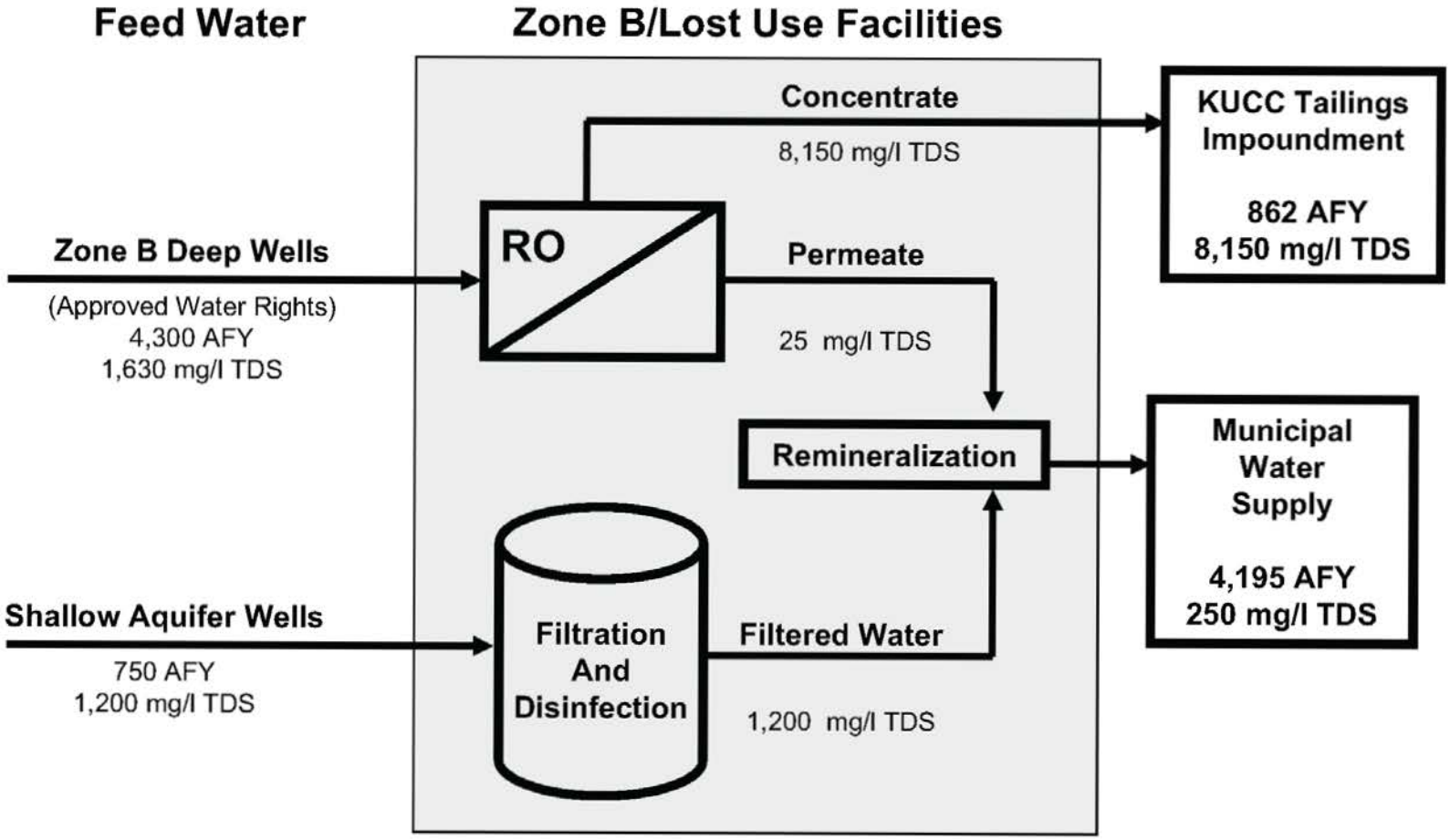


Figure A4. Minimum integrated design by-product treatment process.



Appendix B

UPDES Permit UT0025836 and Supporting Documents

Permit No. UT0025836
Major Industrial

STATE OF UTAH
DIVISION OF WATER QUALITY
DEPARTMENT OF ENVIRONMENTAL QUALITY
SALT LAKE CITY, UTAH

AUTHORIZATION TO DISCHARGE UNDER THE

UTAH POLLUTANT DISCHARGE ELIMINATION SYSTEM
(UPDES)

In compliance with provisions of the Utah *Water Quality Act, Title 19, Chapter 5, Utah Code Annotated ("UCA") 1953, as amended* (the *"Act"*),

JORDAN VALLEY WATER CONSERVANCY DISTRICT

is hereby authorized to discharge from its facility located in West Jordan in Salt Lake County, Utah, with the outfalls located at the following:

Outfall	Latitude	Longitude	To receiving waters named
001	40°45'37.59"N	112°10'13.32"W	Transitional Waters and Gilbert Bay of Great Salt Lake
002	40°36'5.58"N	111°55'13.37"W	Jordan River

in accordance with discharge points, effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on April 1, 2014

This permit expires at midnight, March 31, 2019

Signed the 7th day of March, 2014

John J. Whitehead
Acting Director

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I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Definitions.

1. The "30-day and monthly average" is the arithmetic average of all samples collected during a consecutive 30-day period or calendar month whichever is applicable. The calendar month shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms.

2. "Daily Maximum" ("Daily Max.") is the maximum value allowable in any single sample or instantaneous measurement.

3. A "grab" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.

4. An "instantaneous" measurement, for monitoring requirements, is defined as a single reading, observation, or measurement.

5. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

6. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

7. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

8. "Director" means Director of the Utah Division of Water Quality.

9. "EPA" means the United States Environmental Protection Agency.

10. "Act" means the "*Utah Water Quality Act*".

11. "Best Management Practices" ("*BMP's*") means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. *BMP's* also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

12. "*CWA*" means *The Federal Water Pollution Control Act*, as amended, by *The Clean Water Act of 1987*.

13. "Point Source" means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharges. This term does not include return flows from irrigated agriculture or agriculture storm water runoff.

14. "Significant spills" includes, but is not limited to: releases of oil or hazardous substances in excess of reportable quantities under *Section 311* of the *Clean Water Act* (see *40 CFR 110.10* and *40 CFR 117.21*) or *Section 102* of *CERCLA* (see *40 CFR 302.4*).

15. "Acute toxicity" occurs when 50 percent or more mortality is observed for either test species at any effluent concentration (lethal concentration or "LC_{50}").

16. "Chronic toxicity" occurs when the survival, growth, or reproduction for either test species exposed to a specific percent effluent dilution is significantly less (at the 95 percent confidence level) than the survival, growth, or reproduction of the control specimens.

17. "IC25" is the concentration of toxicant (given in % effluent) that would cause a 25% reduction in mean young per female, or a 25% reduction in overall growth for the test population.

18. "Composite Samples" shall be flow proportioned. The composite sample shall, as a minimum, contain at least four (4) samples collected over the compositing period. Unless otherwise specified, the time between the collection of the first sample and the last sample shall not be less than six (6) hours nor more than 24 hours. Acceptable methods for preparation of composite samples are as follows:

    (a) Constant time interval between samples, sample volume proportional to flow rate at time of sampling;

    (b) Constant time interval between samples, sample volume proportional to total flow (volume) since last sample. For the first sample, the flow rate at the time the sample was collected may be used;

    (c) Constant sample volume, time interval between samples proportional to flow (i.e., sample taken every "X" gallons of flow); and,

    (d) Continuous sample volume, with sample collection rate proportional to flow rate.

B. Description of Discharge Point.

The authorization to discharge provided under this permit is limited to those outfalls specifically designated below as discharge locations. Discharges at any location not authorized under a UPDES permit are in violation of the *Act* and may be subject to penalties under the *Act*. Knowingly discharging from an unauthorized location or failing to report an unauthorized discharge may be subject to criminal penalties as provided under the *Act*.

Outfall Number	Location of Discharge Point(s)
001	Located at latitude 40°45'37.59"N and longitude 112°10'13.32"W. This outfall will convey byproduct and excess untreated groundwater from the deep aquifer. The discharge is through a 16-inch diameter pipe directly to the Transitional Waters and Gilbert Bay of the Great Salt Lake. The compliance monitoring point is at the Southwest Groundwater Treatment Plant prior to effluent entering the 21 mile byproduct pipeline. (Except for end of pipe monitoring as required in *Part I.D. Self Monitoring and Reporting Requirements, Footnotes b/ and e/* of the UPDES permit.)
002	Located at latitude 40°36'5.58"N and longitude 111°55'13.37"W. The discharge will consist only of untreated shallow aquifer groundwater that has not been impacted by mining activities through a 30-inch diameter pipe from the river discharge vault at the Southwest Groundwater Treatment Plant to the Jordan River.

C. Narrative Standard.

It shall be unlawful, and a violation of this permit, for the permittee to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum, or other nuisances such as color, odor or taste, or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures.

D. Specific Limitations and Self-monitoring Requirements.

1. Effective immediately and lasting the duration of this permit, there shall be no toxics in toxic amounts from Outfalls 001 and 002 as determined by test procedures described in *Part I.D.* of this permit.

2. Effective immediately and lasting the duration of this permit, the permittee is authorized to discharge from Outfalls 001 and 002. Such discharges shall be limited and monitored by the permittee as specified below:

Parameter	Effluent Limitations Outfall 001 a/b/c/d/e/				
	Max Monthly Average	Max Weekly Average	Daily Min	Daily Max	Annual Max
Total Flow, MGD f/g/	3.0				
Selenium, total, mg/L				0.054	
Selenium, kg/year					224
Selenium h/					
TSS, mg/L	25	35		70	
Mercury, kg/yr i/j/					0.38
Oil & Grease, mg/L				10	
pH, Standard Units			6.5	9.0	
WET, Chronic Biomonitoring, Both Species				Pass IC_{25} (EOP)	

a/ See definitions Part I.A. for definition of terms.

b/ All parameters in this table will be reported monthly in the monthly Discharge Monitoring Report.

c/ Metals samples should be analyzed using a method that meets MDL requirements. If a test method is not available the permittee must submit documentation to the Director regarding the method that will be used. The sample type (composite or grab) should be performed according to the methods requirements.

d/ There shall be no visible sheen or floating solids or visible foam in other than trace amounts.

e/ There shall be no discharge of sanitary wastes.

f/ Flow measurements of effluent volume shall be made in such a manner that the permittee can affirmatively demonstrate that representative values are being obtained.

g/ The flow rates and durations of all discharges shall be reported in the Annual Project Operating Report.

h/ Implementation of the selenium water quality standard of 12.5 mg/kg for Gilbert Bay of the GSL is outlined in Part I.D.8 of this UPDES Permit.

i/ Mercury samples must be analyzed using Method 1631 or other sufficiently sensitive method. The sample type (composite or grab) should be performed according to the method's requirements.

j/ This load constitutes 1% of the annual mercury load entering the GSL from all sources for this parameter and may change once the aquifer is fully characterized or other information on the effluent or receiving water becomes available.

Parameter	Effluent Limitations Outfall 002 a/b/c/d/e/				
	Max Monthly Average	Max Weekly Average	Daily Min	Daily Max	Annual Max
TDS, mg/L				1,200	
Selenium, total, kg/yr					26.4
Selenium, mg/L				0.027	
TSS, mg/L	25	35		70	
Oil & Grease, mg/L				10	
pH, Standard Units			6.5	9.0	
WET, Acute Biomonitoring, both species				Pass LC_{50} (EOP)	

a/ See definitions Part I.A. for definition of terms.

b/ All of the parameters in the above table, shall be reported monthly in the Discharge Monitoring Report.

c/ Metals samples should be analyzed using a method that meets MDL requirements. If a test method is not available the permittee must submit documentation to the Director regarding the method that will be used. The sample type (composite or grab) should be performed according to the methods requirements.

d/ There shall be no visible sheet or floating solids or visible foam in other than trace amounts.

e/ There shall be no discharge of sanitary wastes.

Self-Monitoring and Reporting Requirements, Outfall 001 a/b/c/			
Parameter	Frequency	Sample Type	Units
Total Flow	Daily or Continuous	Measured	MGD
Total Mercury	Monthly	Composite or Grab	ng/L
Total Mercury d/	Monthly	Calculated	kg/yr
Total Selenium	2 x Weekly	Composite or Grab	mg/L
Total Selenium d/	Monthly	Calculated	kg/yr
TSS e/	2 x Weekly	Composite or Grab	mg/L
Selenium	Annually	Bird Eggs	mg/kg
Oil & Grease	Monthly if sheen is observed	Grab	mg/L
pH	Monthly	Grab	SU
WET, Chronic Biomonitoring	Quarterly, alternating species	Composite	Pass/fail

a/ See definitions Part I.A. for definition of terms.

b/ Jordan Valley shall also monitor all parameters and BOD_5, quarterly at the end of pipe for the first year of operation and then bi-annually thereafter. If lake levels rise where monitoring at end of pipe is not feasible, then Jordan Valley may petition the Director to establish an alternate sampling point.

c/ Mercury samples must be analyzed using Method 1631 or other sufficiently sensitive method. The sample type (composite or grab) should be performed according to the methods requirements

d/ Cumulative totals for these parameters shall be reported on the monthly Discharge Monitoring Reports.

e/ Monitoring of this parameter is required at end of pipe during pipeline cleaning operations. Monitoring results must be included with the DMR for that monitoring period. If lake levels rise where monitoring at end of pipe is not feasible, then Jordan Valley may petition the Director to establish an alternate sampling point.

Self-Monitoring and Reporting Requirements, Outfall 002 a/b/c/			
Parameter	Frequency	Sample Type	Units
Total Flow	Daily or Continuous	Measured	MGD
TDS	2 x Weekly	Composite or Grab	mg/L
Total Selenium	2 x Weekly	Composite or Grab	mg/L
Total Selenium d/	Annually	Calculated	kg/yr
TSS	2 x Weekly	Composite or Grab	mg/L
Mercury	Monthly	Composite or Grab	ng/L
Oil & Grease	2 x Weekly, if sheen is observed	Grab	mg/L
pH	2 x Weekly	Grab	SU
WET, Acute Biomonitoring	Quarterly, both species	Composite	Pass/Fail

a/ See definitions Part I.A. for definition of terms.

b/ Mercury samples must be analyzed using Method 1631 or other sufficiently sensitive method. The sample type (composite or grab) should be performed according to the methods requirements.

c/ Flow measurements of effluent volume shall be made in such a manner that the permittee can affirmatively demonstrate that representative values are being obtained.

d/ Cumulative totals for this parameter shall be reported on the monthly Discharge Monitoring Reports.

3. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following locations: 001 shall be monitored at the Southwest Groundwater Treatment Plant prior to the effluent entering the byproduct pipeline and 002 shall be monitored prior to mixing with any receiving water.

4. ***Annual Project Operating Report for Pump to Waste, Upset Discharges and Cleaning and Maintenance Conditions for the Shallow Wells***: On an annual basis, Jordan Valley will summarize the duration and frequency of all pump to waste discharges, discharges associated with cleaning and maintenance of the RO unit and any discharges resulting from facility upset conditions that occurred during that calendar year. This summary will be submitted to the DWQ by February 1st of the following year.

5. ***Deep Aquifer Compliance Schedule:*** The permittee shall submit to the DWQ a sampling and analysis plan for characterization of the mercury concentration in the deep aquifer for approval within three months of the effective date of this permit. The characterization and a summary of the findings and all supporting water quality data shall be submitted to the DWQ within one year of the Southwest Groundwater Treatment Plant becoming operational.

6. ***Joint Discharge Area Transitional Waters Monitoring Program:*** Jordan Valley is required to annually sample eight (8) bird eggs, if available, but not to exceed 20% of available eggs, during the nesting season, April 15 through June 30, for the current permit cycle. The eggs will be collected from bird nests in the joint Jordan Valley Outfall 001 and Kennecott Outfall 012 affected outfall area. These samples will be subject to the tissue based selenium water quality standard of 12.5 mg/kg dry weight for Gilbert Bay of Great Salt Lake to demonstrate compliance with the Narrative Standard. Jordan Valley must notify the Director within 7 business days of becoming aware of any egg concentrations that exceed 9.8 mg/kg. In addition, total mercury concentrations in the egg tissue samples must also be evaluated and reported by Jordan Valley.

   Jordan Valley will conduct annual bird surveys approximately every two weeks between April 15 and June 30 (four times per season) to document bird abundance, diversity, and use of the Outfall 001 mud flat habitat, particularly for evidence of feeding and nesting using methodology approved by the Director. This data will be submitted in the Annual Project Operating Report.

   Jordan Valley is required to annually collect co-located macroinvertebrate, water and sediment samples once between April 15 and June 30 and as close in time as practical to the bird egg collection. These samples will be analyzed for selenium, biota and sediment will also be analyzed for total mercury, water samples will be analyzed for methyl and total mercury. The co-located macroinvertebrates, sediment and water samples will be collected at up to six (6) evenly spaced locations along the discharge watercourse from the discharge point to the waters edge from where Outfall 001 enters the standing waters of Great Salt Lake.

   Jordan Valley is required to biannually collect co-located brine shrimp and water samples twice per year from the open waters of Gilbert Bay in the vicinity of the outfall. Jordan Valley is required to submit an addendum to the Sampling Plan for approval by the Director within 90 days of issuance of this permit that includes the sampling methods and geographic coordinates to define the sampling area. Sample collection is constrained by brine shrimp dynamics in the sampling area as brine shrimp may not always be present when sampling is attempted. The Sampling Plan addendum will also include the minimum number of days that sampling will be attempted. The intent is to collect brine shrimp samples as close as available to where the effluent waters enter Gilbert Bay between April 15 and June 30 and in October. The water sample will be analyzed for total and methyl mercury and selenium. The brine shrimp sample will be analyzed for total mercury and selenium.

DWQ strongly recommends that Jordan Valley coordinate with other facilities that discharge in the same delta to avoid needless duplication and further impact to avian wildlife in the delta area. Other monitoring requirements may be shared if appropriate. The Director shall be notified as soon as possible, but no later than April 1, if the efforts to coordinate monitoring with other dischargers to the delta area are unsuccessful. The detailed field and laboratory data, analysis and a summary of the results from the bird surveys, egg samples and co-located water, sediment and macroinvertibrates' monitoring must be submitted to the DWQ by February 1, or another agreed upon date, following the end of the calendar year for which the results were obtained as a part of the Annual Project Operating Report.

7. ***Mercury Monitoring of Byproduct Pipeline:*** Upon the commencement of operations at the Southwest Groundwater Treatment Plant, Jordan Valley shall monitor the methyl mercury and total mercury concentrations of the byproduct in April and June of each year at the following monitoring locations: prior to entering the byproduct pipeline and at the end of pipeline (Outfall 001) prior to mixing with the receiving water. The analysis must be submitted with the DMR following the monitoring period.

8. ***Implementation of the 12.5 mg/kg Se Tissue Based Standard:*** Jordan Valley is subject to the following actions when the annual geometric mean dry weight concentrations outlined below exist in bird eggs collected as part of the approved *Joint Discharge Area Transitional Waters Monitoring Program*:

   9.8 to 12.4 mg/kg Se and above: Jordan Valley will prepare and implement a plan to decrease bird exposures to Se from the effluent unless Jordan Valley can demonstrate to the Director's satisfaction that the discharge is not the cause of the increasing Se concentrations in eggs. The plan, including an implementation schedule, must be approved by the Director within 180 days of notice that this condition exists.

   12.5 mg/kg Se and above: The reopener provision for this permit will be exercised and Jordan Valley will be subject to additional Se reductions unless Jordan Valley can demonstrate to the Director's satisfaction that the discharge is not the cause of the Se exceedances in eggs. If these waters are determined to be impaired, Jordan Valley may be subject to additional Se reductions under the TMDL process.

11. <u>Whole Effluent Toxicity (WET) Testing</u>.

    a. *Whole Effluent Testing – Acute Toxicity*. Beginning with the start-up of the treatment plant, the permittee shall conduct quarterly acute static replacement toxicity tests on a composite sample from the end of pipe (EOP) of the final effluent. The sample shall be collected at Outfall 002.

       The monitoring frequency for acute tests shall be quarterly unless a sample is found to be acutely toxic during a routine test. If that occurs, the monitoring frequency shall become weekly (See *Part I.8.b, Accelerated Testing*). Samples shall be collected on a two day progression; i.e., if the first sample is on a

Monday, during the next sampling period, the sampling shall begin on a Wednesday, etc.

The replacement static acute toxicity tests shall be conducted in accordance with the procedures set out in the latest revision of *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 5th Edition, (EPA 821/R/02/012), October 2002,* as per *40 CFR 136.3(a) TABLE 1A-LIST OF APPROVED BIOLOGICAL METHODS.* The permittee shall conduct the 48-hour static replacement toxicity test using Ceriodaphnia dubia and the acute 96-hour static replacement toxicity test using Pimephales promelas (fathead minnow).

Acute toxicity occurs when 50 percent or more mortality is observed for either species at any effluent concentration (LC_{50}). Mortality in the control must simultaneously be 10 percent or less for the results to be considered valid. If more than 10 percent control mortality occurs, the test shall be repeated until satisfactory control mortality is achieved. A variance to this requirement may be granted by the Director if a mortality of less than 10 percent was observed in higher effluent dilutions.

Quarterly test results shall be reported along with the Discharge Monitoring Report (DMR) submitted for the end of the reporting calendar quarter e.g., biomonitoring results for the calendar quarter ending March 31 shall be reported with the DMR due April 28, with the remaining biomonitoring reports submitted with DMRs due each July 28, October 28, and January 28). All test results shall be reported along with the DMR submitted for that reporting period. The format for the report shall be consistent with the latest revision of the *Region VIII Guidance for Acute Whole Effluent Reporting (August, 1997)* and shall include all chemical and physical data as specified.

If the results for a minimum of ten consecutive tests for each test species indicate no acute toxicity, the permittee may request a reduction in testing frequency and/or reduction of test species. The Director may approve, partially approve, or deny the request based on results and other available information. If approval is given, the modification will take place without a public notice.

b. *Whole Effluent* Testing – *Chronic Toxicity*. Beginning with the start-up of the treatment plant, the permittee shall quarterly conduct short-term toxicity tests on a composite sample of the final effluent. The sample shall be collected at Outfall 001.

The monitoring frequency for Chronic WET testing shall be quarterly. Samples shall be collected on a two-day progression; i.e., if the first sample is on a Monday, during the next sampling period, sampling shall be on a Wednesday. If chronic toxicity is detected, the test shall be repeated in less than four weeks from the date the initial sample was taken. The need for any additional

samples, and/or a Toxicity Reduction Evaluation (TRE), see Part I.C.11.f, shall be determined by the Director. If the second test shows no chronic toxicity, routine monitoring shall be resumed.

The chronic toxicity tests shall be conducted in general accordance with the procedures set out in the latest revision of *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms. Third Edition. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 821–R–02–014, and the Region VIII EPA NPDES Chronic Test Conditions - Static Renewal Whole Effluent Toxicity Test (August, 1997).* Test species shall consist of *Americamysis bahia* (mysid shrimp) and *Cyprinodon variegatus* (sheepshead minnow). A CO2 atmosphere may be used (in conjunction with an unmodified test) in order to account for artificial pH drift, as previously demonstrated to and authorized by the Director.

Chronic toxicity occurs when the survival, growth, or reproduction for either test species, when exposed to a concentration of 100 percent effluent, is significantly less (at 95% confidence level) than that of the control specimens. Concentrations of 100 percent effluent only will be required, plus the control. If any of the acceptable control performance criteria are not met, the test shall be considered invalid. IC25 is the inhibition concentration of toxicant (given in % effluent) that would cause a 25% reduction in mean young per female, or a 25% reduction in overall growth for the test population.

Quarterly test results shall be reported along with the Discharge Monitoring Report (DMR) submitted for the end of the reporting calendar quarter (e.g., biomonitoring results for the calendar quarter ending March 31 shall be reported with the DMR due April 28, with the remaining biomonitoring reports submitted with DMRs due each July 28, October 28, and January 28). All test results shall be reported along with the DMR submitted for that reporting period. The format for the report shall be consistent with the latest revision of the Region VIII Guidance for Chronic Whole Effluent Reporting (August, 1997) and shall include all the physical testing as specified.

If the results for a minimum of ten consecutive tests indicate no chronic toxicity, the permittee may request a reduction in testing frequency and/or reduction to one species. The Director may approve, partially approve, or deny the request based on results and other available information. If approval is given, the modification will take place without a public notice.

The current Utah whole effluent toxicity (WET) policy is in the process of being updated and revised to assure its consistency with the Environmental Protection Agency's national and regional WET policy. When said revised WET policy has been finalized and officially adopted, this permit will be reopened and modified to incorporate satisfactory follow-up chronic toxicity

language (chronic pattern of toxicity, PTI and/or TIE/TRE, etc.) without a public notice, as warranted and appropriate.

c. *Accelerated* Testing. When acute toxicity is indicated during routine biomonitoring as specified in this permit, the permittee shall notify the Director in writing within five (5) days after becoming aware of the test result. The permittee shall perform an accelerated schedule of biomonitoring to establish whether a pattern of toxicity exists. Accelerated testing will begin within seven (7) days after the permittee becomes aware of the test result. Accelerated testing shall be conducted as specified under *Part I.C.3.c., Pattern of Toxicity*. If the accelerated testing demonstrates no pattern of toxicity, routine monitoring shall be resumed.

d. *Pattern of Toxicity*. A pattern of toxicity is defined by the results of a series of up to five (5) biomonitoring tests pursuant to the accelerated testing requirements using 100 percent effluent on the single species found to be more sensitive, once every week for up to five (5) consecutive weeks.

If two (2) consecutive tests (not including the scheduled quarterly or monthly test which triggered the search for a pattern of toxicity) do not result in acute toxicity, no further accelerated testing will be required and no pattern of toxicity will be found to exist. The permittee will provide written verification to the Director within five (5) days, and resume routine monitoring.

A pattern of toxicity is established if one of the following occurs:

(1) If two (2) consecutive test results (not including the scheduled quarterly or monthly test, which triggered the search for a pattern of toxicity) indicate acute toxicity, this constitutes an established pattern of toxicity.

(2) If consecutive tests continue to yield differing results each time, the permittee will be required to conduct up to a maximum of five (5) acute tests (not including the scheduled quarterly or monthly test which triggered the search for a pattern of toxicity). If three out of five test results indicate acute toxicity, this will constitute an established pattern of toxicity.

e. *Preliminary* Toxicity *Investigation.*

(1) When a pattern of toxicity is detected the permittee will notify the Director in writing within five (5) days and begin an evaluation of the possible causes of the toxicity. The permittee will have fifteen (15) working days from demonstration of the pattern to complete a Preliminary Toxicity Investigation (PTI) and submit a written report of the results to the Director. The PTI may include, but is not limited to, additional chemical and biological monitoring, examination of

pretreatment program records, examination of discharge monitoring reports, a thorough review of the testing protocol, evaluation of treatment processes and chemical use, inspection of material storage and transfer areas to determine if a spill may have occurred, and similar procedures.

(2) If the PTI identifies a probable toxicant and/or a probable source of toxicity the permittee shall submit, as part of its final results written notification of that effect to the Director. Within thirty (30) days of completing the PTI the permittee shall submit for approval a control program to control effluent toxicity and shall proceed to implement such a plan within seven (7) days following approval. The control program, as submitted to or revised by the Director, may be incorporated into the permit.

(3) If no probable explanation for toxicity is identified in the PTI, the permittee shall notify the Director as part of its final report, along with a schedule for conducting a Phase I Toxicity Reduction Evaluation (TRE) (See *Part I.C.3.e., Toxicity Reduction Evaluation*).

If toxicity spontaneously disappears during the PTI, the permittee shall submit written notification to that effect to the Director as part of the reporting requirements of paragraph a. of this section.

f. *Toxicity Reduction Evaluation (TRE)*. If toxicity is detected during the life of this permit and it is determined by the Director that a TRE is necessary, the permittee shall be so notified and shall initiate a TRE immediately thereafter. The purpose of the TRE will be to establish the cause of toxicity, locate the source(s) of the toxicity, and control or provide treatment for the toxicity.

A TRE may include but is not limited to one, all, or a combination of the following:

(1) Phase I – Toxicity Characterization
(2) Phase II – Toxicity Identification Procedures
(3) Phase III – Toxicity Control Procedures
(4) Any other appropriate procedures for toxicity source elimination and control.

If the TRE establishes that the toxicity cannot be immediately eliminated, the permittee shall submit a proposed compliance plan to the Director. The plan shall include the proposed approach to control toxicity and a proposed compliance schedule for achieving control. If the approach and schedule are acceptable to the Director, this permit may be reopened and modified.

If the TRE shows that the toxicity is caused by a toxicant(s) that may be controlled with specific numerical limitations, the permittee may:

(1) Submit an alternative control program for compliance with the numerical requirements.
(2) If necessary, provide a modified biomonitoring protocol, which compensates for the pollutant(s) being controlled numerically.

If acceptable to the Director, this permit may be reopened and modified to incorporate any additional numerical limitations, a modified compliance schedule if judged necessary by the Director, and/or a modified biomonitoring protocol.

Failure to conduct an adequate TRE, or failure to submit a plan or program as described above, or the submittal of a plan or program judged inadequate by the Director, shall be considered a violation of this permit.

D. Reporting of Discharge Monitoring Results. Monitoring results obtained during the previous month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), post-marked no later than the 28th day of the month following the completed reporting period. The first report is due on May 28, 2014. If no discharge occurs during the reporting period, "no discharge" shall be reported. Legible copies of these, and all other reports including whole effluent toxicity (WET) test reports and the annual Project Operating Report required herein, shall be signed and certified in accordance with the requirements of *Signatory Requirements (see Part VII.G)*, and submitted to the Division of Water Quality at the following address:

Department of Environmental Quality
Division of Water Quality
195 North 1950 West
PO Box 144870
Salt Lake City, Utah 84114-4870

II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. Representative Sampling. Samples taken in compliance with the monitoring requirements established under *Part I* shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge.

B. Monitoring Procedures. Monitoring must be conducted according to test procedures approved under *Utah Administrative Code ("UAC") R317-2-10*, unless other test procedures have been specified in this permit.

C. Penalties for Tampering. The *Act* provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

D. Reporting of Monitoring Results. Monitoring results obtained during the previous month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), post-marked no later than the 28th day of the month following the completed reporting period. The first report is due on May 28, 2014. If no discharge occurs during the reporting period, "no discharge" shall be reported. Legible copies of these, and all other reports required herein, shall be signed and certified in accordance with the requirements of *Signatory Requirements (see Part V.G)*, and submitted to the Director, Division of Water Quality and to EPA at the following addresses:

Original to: Department of Environmental Quality
Division of Water Quality
195 North 1950 West
PO Box 144870
Salt Lake City, Utah 84114-4870

E. Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. Additional Monitoring by the Permittee. If the permittee monitors any parameter more frequently than required by this permit, using test procedures approved under *UAC R317-2-10* or as otherwise specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated. Only those parameters required by the permit need to be reported.

G. Records Contents. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements:
2. The individual(s) who performed the sampling or measurements;
3. The date(s) and time(s) analyses were performed;

4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and,
6. The results of such analyses.

H. Retention of Records. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time. A copy of this UPDES permit must be maintained on site during the duration of activity at the permitted location.

I. Twenty-four Hour Notice of Noncompliance Reporting.

1. The permittee shall (orally) report any noncompliance which may seriously endanger health or environment as soon as possible, but no later than twenty-four (24) hours from the time the permittee first became aware of circumstances. The report shall be made to the Division of Water Quality, (801) 536-4300, or 24 hour answering service (801) 536-4123.

2. The following occurrences of noncompliance shall be reported by telephone (801) 536-4123 as soon as possible but no later than 24 hours from the time the permittee becomes aware of the circumstances:

   a. Any noncompliance which may endanger health or the environment;

   b. Any unanticipated bypass which exceeds any effluent limitation in the permit (See *Part IV.G, Bypass of Treatment Facilities.)*;

   c. Any upset which exceeds any effluent limitation in the permit (See *Part IV.H, Upset Conditions.*); or,

   d. Violation of a maximum daily discharge limitation for any of the pollutants listed in the permit.

3. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

   a. A description of the noncompliance and its cause;

   b. The period of noncompliance, including exact dates and times;

   c. The estimated time noncompliance is expected to continue if it has not been corrected;

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance;

e. Steps taken, if any, to mitigate the adverse impacts on the environment and human health during the noncompliance period.

4. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Division of Water Quality, (801) 536-4300.

5. Reports shall be submitted to the addresses in *Part III.D, Reporting of Monitoring Results*.

J. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for *Part III.D* are submitted. The reports shall contain the information listed in *Part III.I.3*.

K. Inspection and Entry. The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and,

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the *Act*, any substances or parameters at any location.

III. COMPLIANCE RESPONSIBILITIES

A. Duty to Comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. Penalties for Violations of Permit Conditions. The *Act* provides that any person who violates a permit condition implementing provisions of the *Act* is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions of the Act is subject to a fine not exceeding $25,000 per day of violation; Any person convicted under *UCA 19-5-115(2)* a second time shall be punished by a fine not exceeding $50,000 per day. Except as provided at *Part IV.G, Bypass of Treatment Facilities* and *Part IV.H, Upset Conditions*, nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

F. Removed Substances. Collected screening, grit, solids, sludges, or other pollutants removed in the course of treatment shall be buried or disposed of in such a manner so as to prevent any pollutant from entering any waters of the state or creating a health hazard. Sludge/digester supernatant and filter backwash shall not directly enter either the final effluent or waters of the state by any other direct route.

G. Bypass of Treatment Facilities.

1. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to 2. and 3. of this section.

2. Prohibition of Bypass.

   a. Bypass is prohibited, and the Director may take enforcement action against a permittee for bypass, unless:

      (1) Bypass was unavoidable to prevent loss of human life, personal injury, or severe property damage;

      (2) There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance, and

      (3) The permittee submitted notices as required under section G.3.

   b. The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed in sections G.2a. (1), (2) and (3).

3. Notice.

   a. Anticipated bypass. Except as provided above in section G.2. and below in section G. 3.b, if the permittee knows in advance of the need for a bypass, it shall submit prior notice, at least ninety days before the date of bypass. The prior notice shall include the following unless otherwise waived by the Director:

      (1) Evaluation of alternative to bypass, including cost-benefit analysis containing an assessment of anticipated resource damages:

      (2) A specific bypass plan describing the work to be performed including scheduled dates and times. The permittee must notify the Director in advance of any changes to the bypass schedule;

      (3) Description of specific measures to be taken to minimize environmental and public health impacts;

      (4) A notification plan sufficient to alert all downstream users, the public and others reasonably expected to be impacted by the bypass;

(5) A water quality assessment plan to include sufficient monitoring of the receiving water before, during and following the bypass to enable evaluation of public health risks and environmental impacts; and

(6) Any additional information requested by the Director.

b. Emergency Bypass. Where ninety days advance notice is not possible, the permittee must notify the Director, and the Director of the Department of Natural Resources, as soon as it becomes aware of the need to bypass and provide to the Director the information in section G.3.a.(1) through (6) to the extent practicable.

c. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass to the Director as required under Part III.I., Twenty Four Hour Reporting. The permittee shall also immediately notify the Director of the Department of Natural Resources, the public and downstream users and shall implement measures to minimize impacts to public health and environment to the extent practicable.

H. Upset Conditions.

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of paragraph 2. of this section are met. Director's administrative determination regarding a claim of upset cannot be judiciously challenged by the permittee until such time as an action is initiated for noncompliance.

2. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

a. An upset occurred and that the permittee can identify the cause(s) of the upset;

b. The permitted facility was at the time being properly operated;

c. The permittee submitted notice of the upset as required under Part III.I, Twenty-four Hour Notice of Noncompliance Reporting; and,

d. The permittee complied with any remedial measures required under Part IV.D, Duty to Mitigate.

3. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

I. Toxic Pollutants. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of *The Water Quality Act of 1987* for toxic pollutants within

the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

J. Changes in Discharge of Toxic Substances. Notification shall be provided to the Director as soon as the permittee knows of, or has reason to believe:

1. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

   a. One hundred micrograms per liter (100 ug/L);

   b. Two hundred micrograms per liter (200 ug/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/L) for 2, 4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;

   c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with *UAC R317-8-3.5(7)* or (10); or,

   d. The level established by the Director in accordance with *UAC R317-8-4.2(6)*.

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

   a. Five hundred micrograms per liter (500 ug/L);

   b. One milligram per liter (1 mg/L) for antimony:

   c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with *UAC R317-8-3.5(9)*; or,

   d. The level established by the Director in accordance with *UAC R317-8-4.2(6)*.

K. Industrial Pretreatment. Any wastewaters discharged to the sanitary sewer, either as a direct discharge or as a hauled waste, are subject to Federal, State and local pretreatment regulations. Pursuant to Section 307 of *The Water Quality Act of 1987*, the permittee shall comply with all applicable federal General Pretreatment Regulations promulgated at *40 CFR 403*, the State Pretreatment Requirements at *UAC R317-8-8*, and any specific local discharge limitations developed by the Publicly Owned Treatment Works (POTW) accepting the wastewaters.

In addition, in accordance with *40 CFR 403.12(p)(1)*, the permittee must notify the POTW, the EPA Regional Waste Management Director, and the State hazardous waste authorities, in writing, if they discharge any substance into a POTW which if otherwise disposed of would be considered a hazardous waste under *40 CFR 261*. This notification must include the name

of the hazardous waste, the EPA hazardous waste number, and the type of discharge (continuous or batch).

IV. GENERAL REQUIREMENTS

A. Planned Changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when the alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are not subject to effluent limitations in the permit. In addition, if there are any planned substantial changes to the permittee's existing sludge facilities or their manner of operation or to current sludge management practices of storage and disposal, the permittee shall give notice to the Director of any planned changes at least 30 days prior to their implementation.

B. Anticipated Noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

C. Permit Actions. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

D. Duty to Reapply. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee shall apply for and obtain a new permit. The application shall be submitted at least 180 days before the expiration date of this permit.

E. Duty to Provide Information. The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

F. Other Information. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.

G. Signatory Requirements. All applications, reports or information submitted to the Director shall be signed and certified.

1. All permit applications shall be signed by either a principal executive officer or ranking elected official

2. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the Director, and,

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to authorization. If an authorization under paragraph V.G.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph V.G.2 must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. Penalties for Falsification of Reports. The *Act* provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than $10,000.00 per violation, or by imprisonment for not more than six months per violation, or by both.

I. Availability of Reports. Except for data determined to be confidential under *UAC R317-8-3.2*, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of Director. As required by the *Act*, permit applications, permits and effluent data shall not be considered confidential

J. Oil and Hazardous Substance Liability. Nothing in this permit shall be construed to preclude the permittee of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under the *Act*.

K. Property Rights. The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

L. Severability. The provisions of this permit are severable, and if any provisions of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

M. Transfers. This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 20 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

N. State Laws. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by *UCA 19-5-117*.

O. Water Quality-Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include the appropriate effluent limitations and compliance schedule, if necessary, if one or more of the following events occurs:

1. Water Quality Standards for the receiving water(s) to which the permittee discharges are modified in such a manner as to require different effluent limits than contained in this permit.

2. A final wasteload allocation is developed and approved by the State and/or EPA for incorporation in this permit.

3. A revision to the current Water Quality Management Plan is approved and adopted which calls for different effluent limitations than contained in this permit.

P. Toxicity Limitation-Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include whole effluent toxicity (WET) testing, a WET limitation, a compliance schedule, a compliance date, additional or modified numerical limitations, or any other conditions related to the control of toxicants if toxicity is detected during the life of this permit.

Q. Storm Water-Reopener Provision. At any time during the duration (life) of this permit, this permit may be reopened and modified (following proper administrative procedures) as per *UAC R317.8*, to include, any applicable storm water provisions and requirements, a storm water pollution prevention plan, a compliance schedule, a compliance date, monitoring and/or reporting requirements, or any other conditions related to the control of storm water discharges to "waters-of-the-State".

FACT SHEET / STATEMENT OF BASIS
JORDAN VALLEY WATER CONSERVANCY DISTRICT
SOUTHWEST GROUNDWATER TREATMENT PLANT
NEW PERMIT: DISCHARGE
UPDES PERMIT NUMBER: UT0025836
MAJOR INDUSTRIAL

1.0 FACILITY CONTACTS

Person Name:	Richard Bay	Person Name:	Shazelle Terry
Position:	General Manager	Position:	Manager, Treatment Department

Facility Name:	Southwest Groundwater Treatment Plant
Address:	8215 South 1300 West West Jordan, Utah 84088
Telephone:	801-565-4300

2.0 SUMMARY

The Jordan Valley Southwest Groundwater Treatment Plant is being constructed to provide drinking quality water to several communities in the Southwestern part of the Salt Lake Valley by treating a combination of deep groundwater impacted by historic mining activities and shallow groundwater unaffected by mining impacts.

This project is part of a larger Natural Resource Damage Claim (NRDC) filed in1986 by the State of Utah under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act of 1980) against Kennecott Utah Copper for damages to the deep ground water in the Southwest Salt Lake Valley due to historic mining practices. The impacted deep aquifer is referred to as Zone B in NRDC settlement discussions.

The treatment process utilized at the Southwest Groundwater Treatment Plant is reverse osmosis. Reverse osmosis is a process in which total dissolved solids (salts) are removed from a solution (such as water). This is accomplished by pushing water through a semi-permeable membrane. The membrane allows only the water to pass through with a small percentage of the dissolved salts and other contaminates. The majority of the dissolved salts and other contaminates will be removed by the membrane and collected in the byproduct waste stream. During normal operations, treatment will result in three streams from the Southwest Groundwater Treatment Plant: drinking quality water that will be distributed through Jordan Valley's existing system, excess untreated shallow groundwater that will be discharged to the Jordan River via Outfall 002 and a byproduct stream containing concentrated dissolved salts and trace metals that are proposed to be discharged from Outfall 001 to Gilbert Bay of Great Salt Lake via a 21 mile byproduct pipeline.

The draft permit contains effluent limitations for discharges to the Jordan River and Great Salt Lake from the Southwest Groundwater Treatment Plant. The effluent limitations for Outfall 002 to the Jordan River are based upon existing water quality standards. Because there are no numeric water quality based standards for Great Salt Lake or its Transitional Waters, the Division of Water Quality has adopted the use of a weight-of-evidence approach to ensure that the Narrative Standard, as specified in *UAC R317-2-7.2,* and the associated beneficial uses of Gilbert Bay and the Transitional Waters will be protected with the addition of this discharge from

Outfall 001. A weight-of-evidence approach utilizes multiple lines of reasoning and analysis in order to determine the best and most supportable result or conclusion.

The Antidegradation Level II Review, completed in 2010 for Outfall 001 to Great Salt Lake, identified selenium as a parameter of concern because byproduct concentrations will be greater than ambient in the receiving waters. The antidegradation review also identified mercury as a parameter of concern because of its biomagnification potential. Biomagnification is the process whereby the tissue concentrations of a contaminant increase as it passes up the food chain through two or more organisms. The Division of Water Quality established effluent limits for these parameters with extensive monitoring requirements at Outfall 001 based upon a modification of the USEPA (2010) Methylmercury Implementation Guidance.

3.0 DESCRIPTION OF FACILITY

The Southwest Groundwater Treatment Plant is owned and operated by the Jordan Valley Water Conservancy District (Jordan Valley). The plant is located near Jordan Valley's headquarters, adjacent to the Jordan River, at 8215 South 1300 West.

The Southwest Groundwater Project will remediate deep groundwater contaminated from historic mining activities in southwest Salt Lake County. This project will improve groundwater quality and prevent further contaminant migration in the Salt Lake Valley. The project will extract mining-impacted groundwater with elevated total dissolved solids (salts) via a series of deep aquifer wells and purify the extracted water utilizing a reverse osmosis treatment process at the Southwest Groundwater Treatment Plant. The project will also extract shallow groundwater with elevated total dissolved solids. This shallow groundwater has not been impacted by mining activities. The hydrologic system in the Salt Lake Valley results in groundwater being discharged naturally to the Jordan River. Accordingly, the water quality of the Jordan River reflects the quality of the groundwater commingled with base flow from Utah Lake.

The drinking quality water generated will be distributed by Jordan Valley to its member agencies for supply to their drinking water systems. Reverse osmosis byproduct water (i.e. concentrate), containing the extracted salts from the treated water, will be routed via a 21 mile pipeline to Outfall 001, which flows through the Transitional Waters of Great Salt Lake's Gilbert Bay and ultimately into Gilbert Bay. Initially, the Southwest Groundwater Treatment Plant will have a capacity of producing seven million gallons per day of treated drinking quality water and will discharge a maximum of 1.5 million gallons per day of byproduct. At ultimate build out, the treatment plant capacity will increase to 14 million gallons per day of drinking water with 3 million gallons per day of byproduct to be discharged.

Normal discharges under this permit will be of reverse osmosis byproduct via Outfall 001 to the Transitional Waters and Gilbert Bay and excess feed water to the Jordan River via Outfall 002. Limited intermittent start-up flows from deep and shallow wells will be discharged through municipal storm drain systems at various times to the Jordan River and the Utah and Salt Lake Canal. Discharges of water from the shallow aquifer eventually reach the Jordan River, due to the fact that the natural flow pattern of the shallow aquifer is to the Jordan River. Discharges of mining contaminated groundwater from the deep aquifer wells to municipal storm drains will not be allowed, except intermittently upon start-up as described in section 4.2.

4.0 OPERATING CONDITIONS

The following is a description of the various operating and discharge conditions that will occur at the facility.

4.1 Normal Operations

The Southwest Groundwater Treatment Plant will operate three rows of membranes, two for treating water from deep aquifer wells, and one for treating water from shallow aquifer wells. Each of these three sets of membranes is called a "treatment train." Under normal operating conditions, the Southwest Groundwater Treatment Plant will operate all treatment trains, the byproduct water will be discharged to Gilbert Bay and drinking quality water will be delivered to Jordan Valley's member agencies.

On a near continuous basis, the Southwest Groundwater Treatment Plant will need to discharge excess feed water from pressure relief valves of the shallow aquifer treatment train to the Jordan River, in order to supply feed water to the plant at a constant pressure and flow. The shallow aquifer has not been impacted by historic mining practices. It is expected that the flow will average 1 million gallons per day most days of the year. The excess flows from the pressure relief valves for the deep aquifer (groundwater impacted by historical mining practices) treatment trains will be discharged to the Transitional Waters and Gilbert Bay via the by-product pipeline.

4.2 Pump to Waste Start-Up Condition

The Southwest Groundwater Project includes shallow and deep aquifer wells. When these wells are initially started up, the water may contain a small amount of sediment also known as suspended solids. A process called "pump to waste" is used to discharge this water so that the sediment doesn't make it to the Southwest Groundwater Treatment Plant where it would likely damage the membranes used in the reverse osmosis process. These wells will pump to waste intermittently at start-up of the well pump, to purge the well casings of suspended solids after shut down and before pumping the water to the Southwest Groundwater Treatment Plant. It is intended that the wells will pump and supply feed water to the project on a near continuous basis. The start-up conditions are expected to be limited, only occurring each time a well is started up. The wells will pump to waste at their individual locations to the respective municipal storm drain system(s) which flow to either the Utah and Salt Lake Canal or the Jordan River.

Based on wasteload analysis completed for each well location, it is expected that these discharges will not cause or contribute to a violation of water quality standards and therefore will not have effluent limits associated with the discharges. Reporting of duration and frequency of each discharge will be required. The reporting of these discharges will be provided to the Division of Water Quality (DWQ) in an annual project operating report.

4.3 Cleaning and Maintenance Conditions for the Shallow Aquifer Wells

The Southwest Groundwater Treatment Plant requires routine cleaning and maintenance. Under this maintenance condition, which will occur no more than 90 days each year, the feed water from the shallow wells will be diverted to the Jordan River and will not enter the Southwest Groundwater Treatment Plant. Under these maintenance conditions, the feed water from the deep aquifer wells will be discharged to the Transitional Waters and Gilbert Bay via the byproduct pipeline.

The total flow to the Jordan River of the combined discharges from cleaning, maintenance and pressure relief conditions will not exceed a maximum of 4.6 million gallons per day. A wasteload calculated for the shallow well discharges to the Jordan River under these conditions show that the effluent will not cause or contribute to a violation of water quality standards.

4.4 Upset Conditions

In the event of a power outage at the Southwest Groundwater Treatment Plant, the portion of the deep well water that exceeds a concentration of 1,200 mg/L TDS will be directed to Outfall 001 and discharged to the Transitional Waters and Gilbert Bay. Shallow groundwater will be discharged to the Jordan River via Outfall 002. Deep wells which have been identified to contain TDS concentrations less than 1,200 mg/L will be discharged at the well sites to the respective municipal storm drain(s).

4.5 Discharges to the Jordan River

Discharges of shallow groundwater to the Jordan River will occur under well start-up, maintenance, upset and normal operating conditions. Since the Jordan River is currently impaired for TDS, it is required by *UAC R317-8-2.2* that the discharge will not cause or contribute to a violation of water quality standards. Based on wasteload analysis conducted for each well, these discharges will not cause or contribute to a violation of Utah's water quality standards.

5.0 DISCHARGE

5.1 Description of Discharge

Outfall	Description of Discharge Point
001	Located at latitude 40°45'37.59"N and longitude 112°10'13.32"W. This outfall will convey byproduct and excess untreated groundwater from the deep aquifer. The discharge is through a 16-inch diameter pipe directly to the Transitional Waters and Gilbert Bay of the Great Salt Lake. The compliance monitoring point is at the Southwest Groundwater Treatment Plant prior to effluent entering the 21 mile byproduct pipeline. (Except for end of pipe monitoring as required in *Part I.D. Self Monitoring and Reporting Requirements, Footnotes b/ and e/* of the UPDES permit.)
002	Located at latitude 40°36'5.58"N and longitude 111°55'13.37"W. The discharge will consist only of untreated shallow aquifer groundwater that has not been impacted by

historic mining activities. The discharge is through a 30-inch diameter pipe from the river discharge vault at the Southwest Groundwater Treatment Plant to the Jordan River.

5.2 Receiving Waters and Stream Classification

The final discharge is of reverse osmosis byproduct and excess deep aquifer feed water to the Transitional Waters and Gilbert Bay via Outfall 001. Discharges of untreated shallow groundwater will occur to the Jordan River via Outfall 002 based upon plant operations.

Gilbert Bay of Great Salt Lake, the ultimate receiving water for Outfall 001, is classified as Class 5A. The Transitional Waters along the Shoreline of Great Salt Lake are classified as 5E. The Jordan River, the receiving water for Outfall 002, is classified as Class 2B, 3A and 4.

Class 2B	-Protected for secondary contact recreation such as boating, wading, or similar uses.
Class 3A	-Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.
Class 4	-Protected for agricultural uses including irrigation of crops and stock watering.
Class 5A	-Gilbert Bay of GSL. Protected for frequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.
Class 5E	-Transitional Waters along the Shoreline of GSL geographical boundary. Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.

5.3 Effluent Limitations and Basis for Effluent Limitations

Effluent limits for the Southwest Groundwater Treatment Plant are based on Utah Secondary Treatment Standards, Utah Water Quality Standards, and best professional judgment (BPJ) (see explanation of BPJ in section 5.3.1).

The DWQ's review of the proposed discharge to the Transitional Waters and Gilbert Bay has identified selenium and mercury as the only two constituents of concern. As discussed in the Level II Antidegradation Review for Outfall 001, the only pollutants of concern that could degrade water quality are mercury and selenium. Degradation occurs when effluent concentrations are higher than the receiving water. DWQ concluded that the requirements of the Narrative Standard are met for all pollutants in the effluent present at concentrations less than ambient. No evidence exists that the existing concentrations of these pollutants are impairing the uses of Gilbert Bay or the adjacent Transitional Waters. The Whole Effluent Toxicity (WET) testing requirements of this permit provide additional assurance that the Narrative Standard will be met.

The evaluation summarized in the following paragraphs, are based on the rationale presented in appendix one, *Jordan Valley Water Conservancy District Southwest Groundwater Treatment Plant Outfall 001 FSSOB Supporting Information for Selenium and Mercury*. Both selenium and mercury have the potential to adversely affect aquatic and aquatic-dependent wildlife in both Gilbert Bay and the Transitional Waters (mudflat wetlands). In addition to Narrative Standards, a tissue based selenium water quality standard exists for Gilbert Bay. No numeric mercury water quality standard

exists for Gilbert Bay, only Narrative Standards. In addition, no numeric water quality standards exist for the Transitional Waters, only Narrative Standards.

5.3.1 Outfall 001, RO Byproduct and Excess Deep Aquifer Feed Water

The Southwest Groundwater Treatment Plant concentrates the pollutants found in the intake (or feed) water by a factor of five. The byproduct flows through a 21 mile pipeline and is ultimately discharged to the Transitional Waters and Gilbert Bay. Limitations on total suspended solids (TSS) and pH are based on current Utah Secondary Treatment Standards, *UAC R317-1-3.2*. The Oil and Grease limitation is based on Best Professional Judgment (BPJ). BPJ is used on a case-by-case basis in the absence of effluent guidelines or water quality standards. In this case Oil and Grease is not anticipated to be present in the effluent due to the nature of the process, however it is precautionary to include an Oil and Grease limit in case there is an operational malfunction. The daily maximum concentration limit and annual load limit for selenium are based on BPJ to prevent egg concentrations in affected birds from exceeding 12.5 mg/kg because there are no water column standards for selenium for Gilbert Bay or the Transitional Waters. The 12.5 mg/kg selenium tissue-based standard for Gilbert Bay is based upon *R317-2-14* and is also being applied to the Transitional Waters to demonstrate compliance with the Narrative Standards.

The annual maximum load for mercury is 0.38 kg/yr and is 1% of the total mercury load for GSL from all sources of 38 kg/yr (Mercury Inputs to Great Salt Lake, Utah: Reconnaissance-Phase Results, *D. Naftz et al, 2009*). The technical rationale to support these limits is presented in the attached *Jordan Valley Water Conservancy District Southwest Groundwater Treatment Plant Outfall 001 FSSOB Supporting Information for Selenium and Mercury*.

The draft permit effluent limitations are:

Parameter	Effluent Limitations Outfall 001 a/b/c/d/e/				
	Max Monthly Average	Max Weekly Average	Daily Min	Daily Max	Annual Max
Total Flow, MGD f/g/	3.0				
Selenium, total, mg/L				0.054	
Selenium, kg/year					224
Selenium h/					
TSS, mg/L	25	35		70	
Mercury, kg/yr i/j/					0.38
Oil & Grease, mg/L				10	
pH, Standard Units			6.5	9.0	
WET, Chronic Biomonitoring, Both Species				Pass IC25 (EOP)	

a/ See definitions Part I.A. for definition of terms.

b/ All parameters in this table will be reported monthly in the monthly Discharge Monitoring Report.

c/ Metals samples should be analyzed using a method that meets MDL requirements. If a test method is not available the permittee must submit documentation to the Director regarding the method that will be used. The sample type (composite or grab) should be performed according to the methods requirements.

d/ There shall be no visible sheen or floating solids or visible foam in other than trace amounts.

e/ There shall be no discharge of sanitary wastes.

f/ Flow measurements of effluent volume shall be made in such a manner that the permittee can affirmatively demonstrate that representative values are being obtained.

g/ The flow rates and durations of all discharges shall be reported in the Annual Project Operating Report.

h/ Implementation of the selenium water quality standard of 12.5 mg/kg for Gilbert Bay of the GSL is outlined in Part I.D.8 of the UPDES Permit.

i/ Mercury samples must be analyzed using Method 1631 or other sufficiently sensitive method. The sample type (composite or grab) should be performed according to the method's requirements.

j/ This load constitutes 1% of the annual mercury load entering the GSL from all sources for this parameter and may change once the aquifer is fully characterized or other information on the effluent or receiving water becomes available.

5.3.2 Outfall 002, Shallow Aquifer Discharges to the Jordan River

During times of plant maintenance and to dispose of excess groundwater, the facility will need to discharge shallow well feed water (untreated groundwater) to the Jordan River. The limitations on TSS and pH are based on current Utah Secondary Treatment Standards, *UAC R317-1-3.2*. The Oil and Grease limitation is based upon BPJ (see 5.3.1 for explanation of BPJ). Due to uncertainties in plant operations, the DWQ will include a load limit for selenium based upon a continuous pressure relief bleed flow of 1.0 million gallons per day 270 days a year and a flow of 4.6 million gallons per day for 95 days a year. The flow of 4.6 million gallons per day is a combination of pressure relief bleed flow and feed water discharged as a result of maintenance activities. The selenium concentration used to calculate the load is based upon the anticipated effluent concentration of 0.0079 mg/L plus a 30% safety factor. The resulting concentration is 0.0103 mg/L. A wasteload calculated based upon an Acute Effluent Flow of 4.6 million gallons per day and a Chronic Effluent Flow of 1.0 million gallons per day resulted in allowable selenium concentrations of 0.089 mg/L and 0.027 mg/L respectively. Based on this, the use of 0.0103 mg/L in the load calculation is sufficiently protective. The selenium concentration effluent limit is based upon the most restrictive wasteload analysis. The limitation on TDS is based on Utah Water Quality Standards. The permit limitations are:

Parameter	Effluent Limitations Outfall 002 a/b/c/d/e/				
	Max Monthly Average	Max Weekly Average	Daily Min	Daily Max	Annual Max
TDS, mg/L				1,200	
Selenium, total, kg/yr					26.4
Selenium, mg/L				0.027	
TSS, mg/L	25	35		70	
Oil & Grease, mg/L				10	
pH, Standard Units			6.5	9.0	
WET, Acute Biomonitoring, both species				Pass LC_{50} (EOP)	

a/ See definitions Part I.A. for definition of terms.

b/ All of the parameters in the above table shall be reported monthly in the Discharge Monitoring Report.

c/ Metals samples should be analyzed using a method that meets MDL requirements. If a test method is not available the permittee must submit documentation to the Director regarding the method that will be used. The sample type (composite or grab) should be performed according to the methods requirements.

d/ There shall be no visible sheet or floating solids or visible foam in other than trace amounts.

e/ There shall be no discharge of sanitary wastes.

6.0 DEEP AQUIFER CHARACTERIZATION COMPLIANCE SCHEDULE

Further characterization of the deep aquifer is necessary for constituents that can't be adequately characterized until the plant is operational. Specifically, Jordan Valley needs to further characterize the low-level mercury concentrations in the deep aquifer. Preliminary samples, obtained before the wells were equipped with permanent pumps and the plant operational, were not analyzed using a low-level detection method. Further, obtaining the best representative sample of the deep aquifer is not entirely feasible until deep wells are in full production, thus giving a representative picture of the deep aquifer. A subsequent round of monitoring was conducted and analyzed using a low-level detection method for mercury but, due to a laboratory QA/QC error, the reported concentrations did not meet the data quality objectives. Additional sampling and analysis was done in first quarter of 2012. These results suggest that mercury concentrations will be up to 0.000015mg/L (15ng/L) in the effluent with an annual loading of 0.06 kg/yr. However, additional testing is needed to confirm the annual mercury loading results with a fuller representation of the aquifer. A compliance schedule will be included in the permit to allow the facility one year from the Southwest Groundwater Treatment Plant becoming

operational to further characterize the aquifer. In the interim, DWQ believes the 0.38 kg/yr mercury load limit from this discharge is insignificant relative to other mercury sources to the GSL and should be protective.

7.0 MONITORING AND REPORTING REQUIREMENTS

7.1 Self-monitoring and Reporting Requirements

The following self-monitoring requirements are based on the Utah Division of Water Quality's *Monitoring, Recording and Reporting Guidelines*. The permit will require reports to be submitted monthly and quarterly, as applicable, on Discharge Monitoring Report (DMR) forms due 28 days after the end of the monitoring period. Lab sheets for biomonitoring must be attached to the biomonitoring DMR.

Self-Monitoring and Reporting Requirements, Outfall 001 a/b/c/			
Parameter	Frequency	Sample Type	Units
Total Flow	Daily or Continuous	Measured	MGD
Total Mercury	Monthly	Composite or Grab	ng/L
Total Mercury d/	Monthly	Calculated	kg/yr
Total Selenium	2 x Weekly	Composite or Grab	mg/L
Total Selenium d/	Monthly	Calculated	kg/yr
TSS e/	2 x Weekly	Composite or Grab	mg/L
Selenium	Annually	Bird Eggs	mg/kg
Oil & Grease	Monthly if sheen is observed	Grab	mg/L
pH	Monthly	Grab	SU
WET, Chronic Biomonitoring	Quarterly, alternating species	Composite	Pass/fail

a/ See definitions Part I.A. for definition of terms.

b/ Jordan Valley shall also monitor all parameters and BOD_5, quarterly at the end of pipe for the first year of operation and then bi-annually thereafter. If lake levels rise where monitoring at end of pipe is not feasible, then Jordan Valley may petition the Director to establish an alternate sampling point.

c/ Mercury samples must be analyzed using Method 1631 or other sufficiently sensitive method. The sample type (composite or grab) should be performed according to the methods requirements.

d/ Cumulative totals for this parameter shall be reported on the monthly Discharge Monitoring Reports.

e/ Monitoring of this parameter is required at end of pipe during pipeline cleaning operations. Monitoring results must be included with the DMR for that monitoring period. If lake levels rise where monitoring at end of pipe is not feasible, then Jordan Valley may petition the Director to establish an alternate sampling point.

Self-Monitoring and Reporting Requirements, Outfall 002 a/b/c/			
Parameter	Frequency	Sample Type	Units
Total Flow	Daily or Continuous	Measured	MGD
TDS	2 x Weekly	Composite or Grab	mg/L
Total Selenium	2 x Weekly	Composite or Grab	mg/L
Total Selenium d/	Annually	Calculated	kg/yr
TSS	2 x Weekly	Composite or Grab	mg/L
Mercury	Monthly	Composite or Grab	ng/L
Oil & Grease	2 x Weekly, if sheen is observed	Grab	mg/L
pH	2 x Weekly	Grab	SU
WET, Acute Biomonitoring	Quarterly, both species	Composite	Pass/Fail

a/ See definitions Part I.A. of the draft permit for definition of terms.
b/ Mercury samples must be analyzed using Method 1631 or other sufficiently sensitive method. The sample type (composite or grab) should be performed according to the methods requirements.
c/ Flow measurements of effluent volume shall be made in such a manner that the permittee can affirmatively demonstrate that representative values are being obtained.
d/ Cumulative totals for this parameter shall be reported on the monthly Discharge Monitoring Reports.

7.2 Joint Discharge Area Transitional Waters Monitoring Program

One of the outcomes of the analyses presented in the *Jordan Valley Water Conservancy District Southwest Groundwater Treatment Plant Outfall 001 FSSOB Supporting Information for Selenium and Mercury* was the recommendation to implement a monitoring program to decrease uncertainty. A comprehensive sampling and analysis plan for egg, water, sediment and macroinvertibrates including field and laboratory standard operating procedures and methods was developed in 2011 and approved by the Director. This plan was made available for public review and comment as part of the Director's review process in March 2011. If lake levels rise significantly during this permit cycle, an alternate sampling plan, including methods and locations, must be submitted to the Director for approval prior to February 1 of that year.

Jordan Valley is required to annually sample eight (8) bird eggs, if available, but not to exceed 20% of available eggs, during the nesting season, April15 through June 30, for the current permit cycle. The eggs will be collected from bird nests in the joint Jordan Valley outfall 001 and Kennecott 012 affected outfall area. These samples will be subject to the tissue based selenium water quality standard of 12.5 mg/kg dry weight for Gilbert Bay of Great Salt Lake to demonstrate compliance with the Narrative Standard. Jordan Valley must notify the Director within 7 business days of becoming aware of any egg concentrations that exceed 9.8 mg/kg. In addition, total mercury concentrations in the egg tissue samples must also be evaluated and reported by Jordan Valley.

Jordan Valley is required to annually collect co-located macroinvertebrate, water, and sediment samples once between April 15 and June 30 and as close in time as practical to the bird egg collection. All samples will be analyzed for selenium. Biota and sediment will also be analyzed for total mercury. Water samples will be analyzed for methyl and total mercury. The co-located macroinvertebrates, sediment and water samples will be collected at up to six (6) evenly spaced locations along the discharge watercourse from the discharge point to the water's edge from where Outfall 001 enters standing waters of the Great Salt Lake.

Jordan Valley is required to biannually collect co-located brine shrimp and water samples twice per year from the open waters of Gilbert Bay in the vicinity of the outfall. Jordan Valley is required to submit an addendum to the Sampling Plan for approval by the Director within 90 days of issuance of this permit that includes the sampling methods and geographic coordinates to define the sampling area. Sample collection is constrained by brine shrimp dynamics in the sampling area as brine shrimp may not always be present when sampling is attempted. The Sampling Plan addendum will also include the minimum number of days that sampling will be attempted. The intent is to collect brine shrimp samples as close as available to where the effluent waters enter Gilbert Bay between April 15 and June 30 and in October. The water sample will be analyzed for total and methyl mercury and selenium. The brine shrimp sample will be analyzed for total mercury and selenium.

Jordan Valley will conduct annual bird surveys approximately every two weeks between April 15 and June 30 (four times per season) to document bird abundance, diversity, and use of the Outfall 001 mud flat habitat, particularly for evidence of feeding and nesting using methodology approved by the Director. This data will be submitted in the Annual Project Operating Report.

DWQ strongly recommends that Jordan Valley coordinate with other facilities that discharge in the same delta to avoid needless duplication and further impact to avian wildlife in the delta area. Other monitoring requirements may be shared if appropriate. The Director shall be notified as soon as possible, but no later than April 1, if the efforts to coordinate monitoring with other dischargers to the delta area are unsuccessful. The detailed field and laboratory data, analysis and a summary of the results from the bird surveys, egg samples and co-located water, sediment and macroinvertibrates' monitoring must be submitted to the DWQ by February 1, or another agreed upon date, following the end of the calendar year for which the results were obtained as a part of the Annual Project Operating Report.

8.0 STORM WATER

The Southwest Groundwater Treatment Plant has a Standard Industrial Classification (SIC) of 4941, Water Supply. Facilities under this classification are not required to obtain coverage under the UPDES Multi-Sector General Permit for Storm Water Discharges from Industrial Activity, Permit Number UTR000000. The permit contains a storm water re-opener provision if requirements are needed in the future.

9.0 PRETREATMENT REQUIREMENTS

Any process wastewater that the facility may discharge to the sanitary sewer, either as direct discharge or as a hauled waste, is subject to federal, state and local pretreatment regulations.

Pursuant to section 307 of the Clean Water Act, the permittee shall comply with all applicable Federal General Pretreatment Regulations promulgated, found in 40 CFR section 403, the State Pretreatment Requirements found in *UAC R317-8-8*, and any specific local discharge limitations developed by the Publicly Owned Treatment Works (POTW) accepting the waste. As this project will not discharge into a POTW there will be no Pretreatment requirements.

10.0 WHOLE EFFLUENT TOXICITY (BIOMONITORING) REQUIREMENTS

A nationwide effort to control toxic discharges where effluent toxicity is an existing or potential concern is regulated in accordance with the *State of Utah Permitting and Enforcement Guidance Document for Whole Effluent Toxicity Control (biomonitoring)*. Authority to require effluent biomonitoring is provided in *Permit Conditions, UAC R317-8-4.2, Permit Provisions, UAC R317-8-5.3* and *Water Quality Standards, UAC R317-2-5* and *R317 -2-7.2.*

Since the permittee will be a new major industrial discharging facility, with no previous discharge to evaluate, the permit will require acute whole effluent toxicity (WET) biomonitoring testing at the end of pipe (EOP) from Outfall 002, which will discharge to the Jordan River. Based upon these facts and being programmatically consistent utilizing the above referenced biomonitoring guidance document, the permittee will be required to quarterly conduct and pass the acute LC_{50} WET testing for both test species consisting of *ceriodaphnia dubia(water flea)* and *pimephales promales(fathead minnow)* as appropriate. Acute toxicity occurs when 50 percent or more mortality is observed for either species at any effluent concentration during the WET testing. Therefore, the permittee is required to "Pass" the Lethal Concentration criteria (LC_{50}) for each WET monitoring period, as detailed in the permit. Chronic WET toxicity tests have not been included in this permit for this outfall because the estimated low flow receiving stream conditions, with discharges from Outfall 002, are projected to be generally greater than a 20:1 dilution ratio. This rationale is consistent with similar permits and with the WET Guidance Document referenced above.

Jordan Valley will also be required to conduct and pass quarterly chronic IC_{25} WET testing from Outfall 001, which will discharge to the Transitional Waters and Gilbert Bay. Jordan Valley will utilize and alternate between two approved test species, *Americamysis bahia* (mysid shrimp) and *Cyprinodon variegatus* (sheepshead minnow). Chronic toxicity occurs when the survival, growth, or reproduction for either test species exposed to a specific percent effluent dilution is significantly less (at the 95 percent confidence level) than the survival, growth, or reproduction of the control specimens. IC_{25} is defined as the concentration of a toxicant (given in percent effluent) that would cause a 25% reduction in mean young per female, or a 25% reduction in overall growth for the test population.

The permit also contains standard requirements for accelerated testing upon failure of a WET test, and a Preliminary Toxicity Investigation (PTI) and Toxicity Reduction Evaluation (TRE) as necessary. The permit will also contain the Toxicity Limitation Re-opener provision that allows for modification of the permit at any time to include additional WET testing requirements and/or test methods should additional information indicate the presence of toxicity in future discharges.

11.0 ANTIDEGRADATION LEVEL II REVIEW

Antidegradation Reviews are intended to ensure that waters that have better quality than required

by the standards are not degraded unless the degradation is necessary for important social or economic reasons.

Jordan Valley has completed Antidegradation Level II Reviews for the discharge of the byproduct water to the Transitional Waters and Gilbert Bay of Great Salt Lake and for the feed water from the shallow wells to the Jordan River. These documents are part of the UPDES Permit Application and are available for review.

The Level II Review for the byproduct discharge noted that discharge of the byproduct water to GSL is not the least degrading alternative nor is it the lowest cost alternative. However, given the net environmental and social benefits, it was determined that this alternative was the best option.

The DWQ concurs with the findings of the Level I (compliance with water quality standards) and Level II Reviews.

12.0 PERMIT DURATION

It is recommended that this permit be effective for a duration of five (5) years.

Drafted by
Kim Shelley, Discharge
Mike George, Storm Water
Jeff Studenka and Mike Herkimer, Whole Effluent Toxicity
Chris Bittner, ADR and Outfall 001 FSSOB Supporting Information for Selenium and Mercury
Utah Division of Water Quality

13.0 PUBLIC NOTICE

Began: May 13, 2013
Ended: June 28, 2013
Public Noticed in the Salt Lake Tribune and Desert News.

Comments were received during the public comment period. A comment response summary was sent to all commenters on March 4, 2014. The final permit is not the same as the public noticed draft. It has been modified as per the comment response document.

Initial Public Notice Period
Began: December 1, 2010
Ended: February 1, 2011
Public Noticed in the Salt Lake Tribune and Desert News.

Comments were received during the public comment period. A comment response summary was sent to all commenters on May 18, 2012.

APPENDIX 1

Jordan Valley Water Conservancy District Southwest Groundwater Treatment Plant Outfall 001 FSSOB Supporting Information for Selenium and Mercury

1.0 Introduction Selenium and mercury are different than other pollutants in the Jordan Valley Southwest Groundwater Treatment Plant byproduct (effluent) because aquatic-dependent birds, as opposed to aquatic organisms, are the most sensitive receptors of the uses defined in R317-2-6 (Division of Water Quality(DWQ), 2008; Schwarzbach and Adelsbach, 2003; NJ, 2002; USEPA, 1995, 1997). Selenium has a numeric tissue-based water quality criterion of 12.5 mg/kg in bird eggs (R317-2-14, Table 2.14.2) for Gilbert Bay but no numeric criterion is available for the Transitional Waters. No numeric standards for mercury apply to Gilbert Bay or Transitional Waters. DWQ used a weight-of-evidence approach to determine that the under the conditions of the permit, the selenium and mercury in the byproduct will comply with the Narrative Standard and the uses will be protected. Although WET testing is a requirement of this permit, WET testing may not effectively evaluate pollutants that are a greater potential threat to the upper trophic level (aquatic dependent birds) because of biomagnification (mercury) or when the upper trophic levels are toxicologically more sensitive (selenium).

The Antidegradation Review, completed in 2010, identified selenium as a parameter of concern because byproduct concentrations will be greater than ambient in the receiving waters. The antidegradation review also identified mercury as a parameter of concern because of its biomagnification potential and incomplete information regarding mercury concentrations in the byproduct. Subsequent sampling and analyses by Jordan Valley are summarized in Table 1 and provide more refined estimates of potential mercury concentrations in the byproduct than were available for the previous permit draft.

In the previous draft of the permit public noticed from December 2010-January 2011, selenium effluent limits were based on a mixing model and mercury effluent limits were based on non-detect values[1]. The estimated mercury loads from the Southwest Groundwater Treatment Plant's byproduct were compared to existing loads of mercury to Gilbert Bay. DWQ reevaluated the available data, applicable rules, and permitting guidance and concludes that the approach recommended in USEPA (2010) *Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion* (*Methylmercury Guidance*) is more appropriate for evaluating the discharges of selenium and mercury than the previous approach. The *Methylmercury Guidance* states "EPA believes, depending on the particular facts, that a permit writer may reasonably conclude that limits on point sources consistent with this guidance are likely to be as stringent as necessary to achieve water quality standards."

1 Mercury concentrations were too low to be measured using the analytical method commonly used. Jordan Valley collected additional water samples for mercury analysis using more rigorous methods.

Table 1. Mercury Concentrations in Southwest Groundwater Treatment Plant Feed Water and Byproduct and Flow Rates

Well	Feedwater Flow Rate (gpm)	Byproduct Flow Rate (gpm)	Groundwater Mercury Concentration (ng/l)	Projected Mercury Concentration (ng/l)
DW1	675	135	1.61	8.1
DW2	210	42	11.37	56.8
DW3	175	35	4.07	20.4
DW4	ND	ND	4.20	21.0
DW5	ND	ND	3.62	18.1
DW6	777	155	2.99	15.0
DW7	1500	300	1.97	9.8
DW8	ND	ND	1.48	7.4
Shallow	6792	1358	3.17	15.8

gpm = gallons per minute
ng/l = nanograms per liter
ND = no data

The *Methylmercury Guidance* was developed to assist USEPA and States in implementing the methylmercury criterion because the standard[2] is based on mercury concentrations in fish tissue. This was the first tissue-based numeric standard ever promulgated by USEPA. USEPA anticipated challenges in implementing a tissue-based numeric standard and committed to developing implementation guidance when the standard was adopted in 2001. USEPA took 9 years from adoption of the tissue-based standard to develop and finalize the *Methylmercury Guidance*. Utah's tissue-based numeric selenium standard for Gilbert Bay was promulgated in 2008 and approved by USEPA in 2011.

DWQ reviewed the *Methylmercury Guidance* and determined that the approach could be adapted to the selenium standard. DWQ has also adapted the approach in the *Methylmercury Guidance* to selenium in the Transitional Waters (R317-2-6.5.E.) and mercury in Gilbert Bay and in the Transitional Waters. The major differences from the approach in the previous draft permit are that the *Methylmercury Guidance* approach does not rely on mixing zone analyses and provides specific recommendations to address existing data gaps that may be encountered when implementing a tissue-based standard.

Figure 1 shows the process adapted for selenium from the *Methylmercury Guidance*. Selenium was substituted for mercury and egg tissue is substituted for fish tissue when compared to Figure 5 in the *Methylmercury Guidance*. To apply the process to mercury, mercury is substituted for selenium in Figure 1.

Mercury impacts have been studied by scientists in a wider range of environments than selenium. Like selenium, the chemical form of mercury affects its toxicity with elemental generally being the least toxic and organic forms such as methyl mercury being the most toxic. It is anticipated that Jordan Valley will not discharge methylmercury but rather an inorganic salt. The water in Gilbert Bay has methyl mercury in addition to other forms of mercury. A portion of the mercury discharged into Gilbert Bay is expected to be converted to the more toxic methylmercury by bacteria in the lake. While the focus of the analyses of

2 Antidegradation, Uses, Numeric Criteria, and Narrative Criteria comprise Standards of Quality for Waters of the State (R317-2). However, numeric criteria are commonly referred to as standards and this common usage is adopted here.

mercury will be on methylmercury, the reader should remember that Jordan Valley's discharge is not expected to contain methylmercury. This assumption will be verified by the monitoring required by this permit.

The available studies on mercury demonstrate the complexity and site-specificity of mercury dynamics. USEPA's *Mercury Study to Congress* (1997), the USEPA Great Lakes Initiative, and USEPA *Methylmercury Guidance* represent extensive efforts by USEPA to understand and effectively regulate mercury. USEPA is aware that for many water bodies, including Great Salt Lake, air deposition is the major source of mercury and further regulation of point source discharges would have no apparent effect in improving water quality (FR March 23, 1995 p. 15365). The remainder of this analysis follows the process in Figure 1 and is organized by pollutant and receiving water:

1. Selenium discharge to Gilbert Bay
2. Selenium discharge to the Transitional Waters
3. Mercury discharge to Gilbert Bay
4. Mercury discharge to the Transitional Waters

2.0 Selenium .

2.1 Selenium discharge to Gilbert Bay

2.1.1 Selenium water translator for Gilbert Bay.

Following the process in Figure 1, the standard (see footnote 1 regarding criterion and standard) for selenium is expressed in terms of a tissue concentration. Gilbert Bay has a tissue-based standard of 12.5 mg/kg[3] selenium in bird eggs. The next question asks if a water column translator for selenium is available. A water translator would provide the selenium water concentration that would result in 12.5 mg/kg selenium in aquatic dependent bird eggs. A water column translator is a mathematical formula that relates selenium concentrations in the water to selenium concentrations in bird egg tissue. If the water column translator is available, water quality based effluent limits can be calculated (if necessary) using the established methods for UDPES permits, *i.e.*, a waste load analysis. Site-specific translators typically determined using empirical data are the most reliable (USEPA, 2010; Adams et al., 1998). The implicit assumption of using a translator is that changes in water column concentrations of selenium will predictably result in changes in egg tissue concentrations (Section 6, DWQ, 2008). Based on the following analyses, DWQ concluded that a translator is not available.

Water translators are simplified models of complex processes. A conceptual site model for the cycling of selenium was created for Great Salt Lake that identifies the key abiotic and biotic compartments for the transfer of selenium through the food web (Sections 6 & 7, DWQ 2008). Samples of co-located water, food, and egg data were analyzed to characterize the selenium relationship between each compartment with the ultimate goal of identifying a single translator. A single translator would integrate the transfer of selenium through several already simplified compartments from water to eggs, e.g., water → algae → brine shrimp/brine flies → birds → eggs. If the overall translator performs poorly, i.e., the translator doesn't accurately or reliably predict egg concentrations from water concentrations, examining translators between each compartment may identify the food web link with the highest variability and focus research efforts.

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3 All concentrations in solid media (for instance, brine shrimp, sediment, and eggs) are reported as dry weight unless otherwise noted.

Initial efforts to determine a water translator for selenium in Gilbert Bay are documented in Brix et al. (2004). This study was the basis of the existing water-quality-based effluent limit for Kennecott Utah Copper's (Kennecott) UDPES permit. Selenium, primarily as selenate, displayed a curvilinear relationship between water and brine shrimp exposed in a laboratory or field setting. Assuming a linear relationship and that a maximum allowable concentration of 5 mg/kg selenium in brine shrimp would protect birds feeding on the shrimp, an acceptable water concentration of 27 µg/l was determined. Kennecott's existing maximum daily effluent selenium concentration of 54 µg/l was based on a twofold dilution in the mixing zone of the 27 µg/l.

A key limitation of Brix et al. (2004) is that the only transfer of selenium from water to brine shrimp was measured in the laboratory. Uptake rates measured this way may underestimate uptake for Gilbert Bay if the inorganic selenium in Kennecott's discharge is converted to organic forms of selenium in for instance, algae in Gilbert Bay. The selenium translator assumed by Brix et al. (2004) for brine shrimp to birds was estimated from laboratory and field studies for other aquatic systems that are quite different from Great Salt Lake. As discussed later in this section, more recent studies of selenium at Gilbert Bay support a higher acceptable concentration of selenium in brine shrimp than the 5 mg/kg assumed by Brix et al. (2004).

Brine shrimp uptake of selenium under laboratory conditions was studied as part of *Development of a Selenium Standard for the Open Waters of Great Salt Lake* (DWQ, 2008). Figure 2 shows brine shrimp uptake at concentrations in water up to about 80 µg/l. However, the marked decrease in brine shrimp tissue concentrations observed at the higher concentrations is difficult to explain. These brine shrimp were only exposed for 24 hours, the uptake was from water only (no dietary exposure), and the results are inconsistent with similar studies, so this data is considered unreliable for determining a translator.

Byron et al. (2011) compiled data from three different saline environments including Gilbert Bay to derive a selenium translator from water to brine shrimp. Figure 3 from Byron et al. (2011) shows that Gilbert Bay selenium concentrations were generally less than 1 µg/l[4] and concentrations in corresponding brine shrimp don't respond predictably. Byron et al. (2011) concludes that selenium concentrations must be higher before concentrations in brine shrimp respond predictably. Using the translator proposed by Byron et al. (2011) and assuming 27 µg/l selenium in water results in a predicted brine shrimp concentration of 11 mg/kg whereas Brix et al. (2004) predicts 5 mg/kg.

As shown on Figure 4, Gilbert Bay selenium concentrations in water and brine shrimp do not appear highly correlated. Geometric mean selenium concentrations in Gilbert Bay waters from the different sampling events ranged from 0.26 to 1. The lack of correlation to brine shrimp selenium concentration could be simply due to lack of large fluctuations in selenium concentrations in the water. Ultimately, the importance of determining which brine shrimp translator is most appropriate is diminished because of the uncertainties regarding an acceptable selenium concentration in bird diet (brine shrimp). Selenium dynamics in Gilbert Bay were studied for approximately 18 months as part of the DWQ Selenium Study. The primary limitation of this effort in deriving a water translator for selenium is that egg concentrations in Gilbert Bay were (and remain) less than 12.5 mg/kg. The highest geometric mean for eggs from Gilbert Bay shorebirds was less than 6 mg/kg which limits the ability to model higher concentrations such as 12.5 mg/kg (Figure 5). Extrapolating <u>beyond the models predictive interval</u> to 12.5 mg/kg selenium in eggs predicts a concentration in bird diet of 6 mg/kg. Additional work on the

model since the DWQ Selenium Study suggests that the current best estimate is 7.8 mg/kg selenium in bird diet if extrapolated beyond the prediction interval to 12.5 mg/kg in eggs. Extrapolating the relationship between diet and eggs from lower concentrations to higher concentrations is undesirable because egg concentrations of selenium may be overestimated (Brix et al., 2004; DeForest *et al.*, 2007; Grosell 2008 in DWQ, 2008).

Translators for bird diet to bird egg from the literature were considered but data from Gilbert Bay suggest that selenium transfer from food to eggs is lower than in these systems. Cavitt and Stone, (2007) collected 4 female shorebirds and their eggs from Gilbert Bay. The blood, livers, and eggs were analyzed for selenium. The ratio of selenium between Great Salt Lake bird blood to eggs and bird liver to eggs was compared to laboratory studies of Santolo et al. (1999) and Heinz et al. (1989). Santolo et al. (1999) fed kestrels organic selenium and measured the transfer to blood and eggs. Santolo's translator applied to Cavitt's Gilbert Bay bird blood predicts much higher selenium concentrations in eggs than observed (Table 2). Similarly, Heinz et al. (1989) fed organic selenium to mallards and measured the selenium concentration in the liver and eggs. Heinz's translator applied to Cavitt's Gilbert Bay liver predicts much higher selenium concentrations in eggs than was observed (Table 2). Cavitt's eggs data suggests that the selenium translator between birds and eggs is lower in Gilbert Bay than observed in studies of other systems.

DWQ continues to actively investigate and monitor selenium in Gilbert Bay. As shown on Figure 6, Cavitt and Wilson (2012) collected additional samples of eggs, invertebrates, water, and sediment in 2011 but the egg concentrations were less than 2 mg/kg. Samples collected from Antelope Island (Gilbert Bay) and Farmington Bay (Class 5D) in 2011 measured selenium in dietary items (insects) at higher concentrations than in eggs, which is opposite of the relationship observed in other samples shown on Figure 5 and in studies of other aquatic systems (Presser et al. 2010) . These 2011 results should be interpreted cautiously pending confirmation with the results of future sampling.

Table 2 Selenium Concentrations in Gilbert Bay Bird Blood, Liver, and Eggs Compared to Egg Concentrations Predicted from Blood and Liver

Bird Blood (mg/kg dw)	Predicted Egg Concentration (mg/kg dw)	Bird Liver (mg/kg dw)	Predicted Egg Concentration (mg/kg dw)	Clutch Average Egg (mg/kg dw)
23	52.4	14	15.5	2.6
12	27.4	11	12.0	1.8
13	29.7	11	12.0	2.1
21	47.8	17	19.1	2.3

Concentrations in blood, liver, and eggs from Cavitt and Stone (2007). Egg concentration predicted from blood concentration using Santolo et al. (1999). Egg concentration predicted from liver concentration using Heinz et al. (1989) and assuming 71% moisture for egg tissue and 68% moisture for liver tissue.

In the context of the process in Figure 1, DWQ concludes that reliable selenium translators from water to bird eggs, water to diet (brine shrimp or brine flies), and diet to eggs are unavailable for the Gilbert Bay.

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4 Byron et al. 2011 identifies Gilbert Bay samples as being greater than 100 µg/l but these are not Gilbert Bay samples. These are samples collected by Brix et al. (2004) from the West C7 Ditch which historically had higher concentrations of selenium not representative of current conditions.

2.1.2 Selenium Reasonable Potential for Gilbert Bay Following the process described in Figure 1, the next question is if the byproduct has quantifiable selenium which is yes. The following question is if the bird eggs from Gilbert Bay exceed the criterion or are there other factors that would lead DWQ to find reasonable potential.

For the discharge to Gilbert Bay, the available data supports that selenium from the Southwest Groundwater Treatment Plant discharge will not adversely affect birds in Gilbert Bay based on a comparison to historic loadings from KUC's discharge. Selenium egg concentrations from Gilbert Bay are less than the selenium standard of 12.5 mg/kg, so the standard has not been exceeded since more frequent sampling began in 2006.

All of the available studies support a lack of observed adverse effects to birds at Gilbert Bay from selenium or other pollutants. The strength of the no adverse effects conclusion is limited because these studies were not designed or intended to comprehensively evaluate either the health of Gilbert Bay's birds or the immediate area of Jordan Valley's proposed discharge.

1. Cavitt, J. F. and N. Wilson, 2012. *Concentrations of Selenium and Mercury in American Avocet Eggs at Great Salt Lake, Utah 2011 Report* . Avian Ecology Laboratory, Weber State University

2. Cavitt, J.F., M. Linford, and N. Wilson. *Selenium Concentration in Shorebird Eggs at Great Salt Lake Utah 2010 Report*, Avian Ecology Laboratory, Weber State University

3. DWQ, 2008. *Development of a Selenium Standard for the Open Waters of Great Salt Lake.* Prepared by CH2M Hill. May.

4. U.S. Fish and Wildlife Service (USFWS). 2009. *Assessment of Contaminants in the Wetlands and Open Waters of the Great Salt Lake, Utah 1996-2000*

5. Vest, J.L., M.R. Conover, C. Perschon, J. Luft, and J.O. Hall. 2009. Trace Element Concentrations in Wintering Waterfowl from Great Salt Lake. *Arch. Environ. Contam. Toxicol.* 56:302-316

6. Conover, M.R. and J.L. Vest. 2008. Selenium and Mercury Concentrations in California Gulls Breeding on the Great Salt Lake, Utah, USA. *Environ. Tox. Chem.*

While there's no evidence the selenium standard is exceeded in Gilbert Bay at existing loading, the additional selenium loading from the Southwest Groundwater Treatment Plant's byproduct must also be considered because the Southwest Groundwater Treatment Plant's selenium loading will be in addition to Kennecott's.

Figure 7 shows Kennecott's selenium loading since 2002 and Figure 8 shows Gilbert Bay selenium water concentrations are consistently between 0.3 and 1 µg/l over the same period. Figure 4 shows the geometric mean concentrations of selenium measured in brine shrimp from Gilbert Bay. As previously noted, Byron et al. (2011) concluded that brine shrimp do not respond predictably to changing selenium water concentrations less than 1 µg/l. The lack of measurable response of Gilbert Bay water concentrations to varying loads from Kennecott's discharge demonstrates that despite Gilbert Bay being part of a terminal lake, selenium loading is not conservative and Gilbert Bay has assimilative capacity[5] beyond simple dilution. The absence of a measurable response in water concentrations to varying loads

5 Assimilative capacity is the amount of selenium that can be added and the water still meet the standards.

also suggests that selenium assimilative capacity remains. Selenium is lost from Gilbert Bay by several ways but the predominant mechanism is volatilization (Johnson *et al.*, 2007).

DWQ concludes no reasonable potential at a selenium loading limit of 900 kg/yr based on a documented lack of adverse impacts to birds at these loads previously discharged by Kennecott. USFWS (2009) provides some evidence that historical selenium loads of greater than 900 kg/yr have not adversely affected birds. This permit limits the Southwest Groundwater Treatment Plant's selenium loading to 224 kg/yr and therefore, DWQ concludes that this load, in addition to loading from Kennecott Outfall 012, is a combined annual selenium load greater than 900 kg/yr, and results in an "unknown reasonable potential" in the context of the process in Figure 1.

Consistent with the process in Figure 1, this permit requires Jordan Valley to submit a monitoring plan to the Director for approval to evaluate selenium uptake into lake biota for the Gilbert Bay waters. Data quality objectives include characterizing selenium concentrations in Gilbert Bay co-located brine shrimp and water collected as proximate as practical to where the byproduct enters Gilbert Bay from the Transitional Waters. The permit also requires Jordan Valley to submit these results annually to be approved by DWQ. Jordan Valley is not required to prepare a Selenium Minimization Plan because the source of selenium is the feed water (untreated groundwater). The *Methylmercury Guidance* states that the minimization plans focus on sources and wastes that originate with and are under the reasonable control of a facility, not on pollutants in rainwater or source water.

The primary goal of the additional monitoring in the Gilbert Bay is to monitor for increasing trends in selenium concentrations. The selenium standard is currently met in Gilbert Bay, so monitoring for an increasing trend can provide an early warning prior to concentrations becoming high enough to impair the uses. If concentrations continue to increase, the effluent limits for all permits to Gilbert Bay can be reevaluated. In conjunction with DWQ's monitoring, the monitoring required by this permit will also improve the understanding of spatial and temporal dynamics of selenium concentrations. This data will also be used by DWQ in ongoing efforts to evaluate the feasibility of a selenium water translator. DWQ has initiated a twice per year monitoring program for Gilbert Bay and samples of water and brine shrimp were collected and analyzed for inorganic pollutants including selenium (DWQ, 2012). Selenium concentrations in brine shrimp and water from 1995 through 2011 are summarized on Figure 4.

Monitoring brine shrimp is anticipated to provide more stable estimates of selenium dynamics in Gilbert Bay than water despite the lack of stability documented in Figure 4. The lack of stability in brine shrimp concentrations is likely due to low selenium concentrations in water (< 1 µg/l Byron et al. 2011). Stability is anticipated to improve if concentrations in water increase because concentrations in brine shrimp represent selenium concentrations averaged over a longer time which is expected to show less variation than grab samples of water. In addition, brine shrimp are one food-web step closer to an egg which is also anticipated to decrease the variability. Gilbert Bay is not impaired for selenium and a lack of detectable increase in selenium concentrations provides evidence that the assimilative capacity remains and the uses will remain protected. However, the converse is not necessarily true. Bird eggs are less than 12.5 mg/kg indicating additional assimilative capacity remains. Monitoring brine shrimp concentrations for increasing trends in conjunction with the selenium egg triggers in R317-2 Table 13.4.2 Footnote 14, provide adequate assurance that Gilbert Bay's beneficial uses will continue to be met. The monitoring will also inform whether water or brine shrimp are better predictors of selenium in bird eggs.

Additional studies by DWQ, U.S. Fish and Wildlife Service, Utah Division of Wildlife Resources, U.S. Geological Survey, and others continue to evaluate avian health in Great Salt Lake. DWQ continues to

monitor the outcome of these studies in managing the water quality of Gilbert Bay. Jordan Valley's permit can be modified using the reopener provision as recommended by the process illustrated in Figure 1.

2.2. Selenium discharge to Transitional Waters

2.2.1 Selenium water translator for Transitional Waters. The Transitional Waters do not have a numeric standard for selenium. The channel created by the discharge will be effluent dominated when either Kennecott or the Southwest Groundwater Treatment Plant are discharging[6]. The Southwest Groundwater Treatment Plant is expected to have a continuous discharge, eventually up to 3 million gallons per day. DWQ has determined that shorebirds are the most sensitive receptors for the same reasons that shorebirds are the most sensitive receptors for Gilbert Bay (DWQ, 2008) DWQ determined that the 12.5 mg/kg selenium standard for Gilbert Bay is applicable to confirm that the requirements of the Narrative Standard are met and existing uses are protected in the Transitional Waters.

Like Gilbert Bay, no reliable water translator is available for the Transitional Waters. Applying the relationship observed in Figure 5 to the Transitional Waters at Jordan Valley's discharge may not be appropriate. The sample locations represented in Figure 5 are from primarily shoreline environments where the source of selenium is likely Gilbert Bay as opposed to Southwest Groundwater Treatment Plant byproduct. Uptake of selenium from water to birds is dependent on the chemical form of selenium with organic selenium having the highest uptake rates. Even within organic types of selenium, uptake rates are dependent on the particular organic form of selenium (Heinz et al. 1999). Therefore, no data specific for the Southwest Groundwater Treatment Plant's byproduct are available. Transfer of selenium from the water to biota is anticipated to be lower in the Transitional Waters than for Gilbert Bay waters because of flow and a limited amount of time for conversion to the more bioavailable organic forms of selenium (Presser and Luoma, 2010).

In accordance with the process shown in Figure 1, this permit includes a monitoring requirement for the Transitional Waters located in the effluent channel between the outfall and Gilbert Bay. The Southwest Groundwater Treatment Plant was not discharging, but in spring 2011, Jordan Valley voluntarily conducted this monitoring. A results report, 2011 *Delta Monitoring Report August 2012*, was submitted to DWQ. Selenium was measured in water, sediment, and invertebrates but no eggs were available for collection. Other than the results of the 2011 sampling in the discharge delta (CH2M Hill, 2012) when the Southwest Groundwater Treatment Plant was not discharging, little specific data is available to define the transfer of selenium from the Southwest Groundwater Treatment Plant to the food web. For these reasons, DWQ concludes that a selenium water column translator is unavailable for the Transitional Waters.

2.2.2 Selenium reasonable potential for the Transitional Waters. As previously discussed, the primary source of water in the channel created by the discharge in the 5E waters will be effluent. Assuming little assimilative capacity for the Transitional Waters, concentration, as opposed to loading, is the most applicable parameter for selenium. The Southwest Groundwater Treatment Plant proposed selenium discharge limit of 54 µg/l is the same as Kennecott's UDPES permit. Eggs were collected from the Transitional Waters in the vicinity of Kennecott's effluent channel in 2007 and were all below 12.5 mg/kg selenium (Figure 5). However, the discharge concentrations were below the maximum permitted

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6 A low flow of water can be observed in the discharge channel when Kennecott is not discharging. This water is thought to be daylighting groundwater and presumably would provide some dilution. For the purposes of this analysis, dilution is assumed to be negligible and is not considered.

concentration of 54 µg/l: May 2007 30-day average 23 µg/l; maximum daily maximum 26 µg/l vs. permitted daily maximum 54 µg/l (Figure 9). Permit maximum concentrations consider effluent variation when they are set and it's common for actual concentrations to be lower than permitted.

As part of the 2011 sampling (CH2M Hill, 2012), a brine shrimp sample was collected at the interface of Gilbert Bay and the Transitional Waters. Based on the relatively low salinity of Kennecott's effluent and previous observations of no brine shrimp, the shrimp were likely transients pushed ashore by a wind seiche (CH2M Hill, 2012). The selenium concentration reported for this single brine shrimp sample is higher at 30.8 mg/kg than previous samples collected from Gilbert Bay even though water concentrations were not correspondingly elevated (5.4 µg/l). The second highest selenium concentrations in brine shrimp were measured by Brix et al. (2004). Brix et al. (2004) measured a maximum selenium concentration in brine shrimp of less than 10 mg/kg in two samples collected from the nearby West C7 Ditch where the water concentrations were approximately 120 µg/l.

The single 2011 shrimp sample also had an anomalously high moisture content (98.6%) when compared to previous brine shrimp samples collected from Gilbert Bay. When the selenium concentration for this sample is calculated as wet weight, the concentrations are similar to previous samples suggesting that the dry weight concentration is exaggerated because of an error with the moisture measurements (CH2M Hill, 2012).

DWQ reviewed the *2011 Field and Laboratory Data Great Salt Lake Outfall 001* (CH2M Hill, 2012) results during the preparation of this permit. The data has limited applicability for developing translators because of the lack of co-located eggs.

The 2007 egg sampling (DWQ, 2008) from the Transitional Waters in the area of the Kennecott's outfall 012 provides limited support that a maximum discharge concentration effluent limit of 54 µg/l will protect the use (aquatic dependent birds). However, these results are based on a limited number of samples and their representativeness to the Southwest Groundwater Treatment Plant byproduct is unknown. Therefore, DWQ concludes that the existing data is inconclusive for determining reasonable potential for the Transitional Waters. In accordance with the process described in Figure 1, this permit requires Jordan Valley to monitor water, sediment, invertebrates, and eggs in the Transitional Waters for selenium. This monitoring is summarized in the *Joint Discharge Area Transitional Waters Monitoring Program.*

In addition, the permit contains two triggers based on concentrations of selenium measured in bird eggs. If geometric mean concentrations exceed 12.5 mg/kg dry weight because of the Southwest Groundwater Treatment Plant, reductions of selenium will be required. If geometric mean concentrations of selenium increase from current conditions to 9.8 mkg/kg or or greater because of the Southwest Groundwater Treatment Plant effluent, Jordan Valley must implement a plan to reduce bird exposures to selenium from the effluent. Two triggers in the previous draft of this permit were deleted. The first trigger at 5.0 mg/kg selenium in eggs required a reevaluation of the sufficiency of the monitoring plan. This trigger was unnecessary because the *Joint Discharge Area Transitional Waters Monitoring Program* was developed assuming selenium concentrations in eggs will be at or above 5 mg/kg. The second deleted trigger at 6.4 mg/kg selenium concentrations in eggs required that the antidegradation review be reviewed. This trigger was deleted because a recent Level II antidegradation review of the Southwest Groundwater Treatment Plant was completed as part of this permit application.

As for the open waters, a Selenium Minimization Plan is not required.

2.3 Selenium Summary. In summary, DWQ finds that the data is insufficient to determine reasonable potential for selenium for Gilbert Bay and the Transitional Waters. As a result of these determinations, DWQ has added permit conditions requiring monitoring of Gilbert Bay brine shrimp and co-located water proximate to where the discharge enters from the Transitional Waters. Consistent with the previous draft of the permit, the condition to require monitoring of water, sediment, invertebrates, birds, and bird eggs for selenium in the Transitional Waters remains. The permit also has a reopener clause to reassess reasonable potential (if necessary) based on the results of this monitoring.

3.0 Mercury

3.1 Mercury discharge to Gilbert Bay. Less data is available for mercury than for selenium in Gilbert Bay. The 2008 and 2010 Integrated Reports assessed Gilbert Bay (and the other bays and Transitional Waters at Great Salt Lake) as Category 3C[7]. Category 3C is a unique assessment Category used for Great Salt Lake. Assessment of the Great Salt Lake ecosystem with traditional approaches is complicated by the current lack of numeric standards, with the exception of a selenium standard applicable to bird eggs. Also, the lake is naturally hypersaline, so traditional assessment methods are not appropriate. DWQ is working toward developing both numeric standards and assessment methods for this ecosystem. In the interim, the Integrated Report will include an Appendix that summarizes progress that was made in the most recent 2-year reporting cycle.

3.1.1Mercury water translator for Gilbert Bay. Efforts by DWQ to assess if water quality is supporting Gilbert Bay's s uses with regards to mercury have focused on methylmercury. The 2008 and 2010 Utah Integrated Report documents these efforts. Methylmercury, an organic form of mercury, is present in Gilbert Bay's water and biota[8] at measurable concentrations. As discussed in the Introduction, the Southwest Groundwater Treatment Plant is not expected to discharge methylmercury but a portion of the mercury discharged to the lake is anticipated to be methylated by bacteria. Because of the increased toxicity and biotransfer potential of methylmercury compared to other forms of mercury found in the environment, methylmercury has the greater potential for impairing the uses. No numeric standards are available for methylmercury for Gilbert Bay.

As discussed in the Appendix A of the *2010 Integrated Report*, methylmercury biomagnifies in the food web resulting in increasing exposures at higher trophic levels. Therefore, birds as members of the upper trophic food web are the focus of protecting Gilbert Bay and the Transitional Waters beneficial uses. Based on the review of the literature documented in the 2010 Integrated Report, a tissue-based standard is likely to protect aquatic dependent birds (the most sensitive use) from impairment by methylmercury. Therefore, DWQ is adapting the same tissue-based permitting approach from the *Methylmercury Guidance* used for selenium to mercury (Figure 1).

The data for all pollutants in the Southwest Groundwater Treatment Plant byproduct are estimates because the plant is not yet operating. For instance, several of the Southwest Groundwater Treatment Plant groundwater wells are not yet functioning (see Table 1). The mercury estimates have additional uncertainties because mercury concentrations are low enough to require special sample handling and analysis procedures. For the previous draft of the permit, mercury concentrations were estimated from

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7 Other Integrated Report Categories include for instance, that the water quality is Fully Supporting, Impaired by a Pollutant and a TMDL is required, or Impaired and the TMDL is complete. See Figure 6 in Utah's 2010 Integrated Report Part 1: Methods of Assessing and Reporting the Condition of Lakes and Streams.

8 Measurements of mercury in biota for Great Salt Lake are for total mercury that is assumed to be mainly methylmercury.

non-detect analytical results. This is the same as the approach used for the majority of other Great Salt Lake UPDES permits. For most of these permits, mercury concentrations are not precisely known because the results from the more common analytical method with higher detection limits are non-detects. The previous draft of this permit required Jordan Valley to use a more rigorous analytical method for mercury because of specific concerns identified in the Integrated Report regarding mercury.

Jordan Valley voluntarily conducted additional sampling and analyses that provide more refined estimates of mercury concentrations in the byproduct. Jordan Valley estimates that the byproduct will contain up to 0.000015 mg/l (15 ng/l) of mercury with annual loads of up to 0.06 kg/yr (Table 1). This annual load is less than 0.38 kg/yr estimated for the previous draft of the permit. However, DWQ is not proposing to revise the permit effluent limits from the previous draft at this time because of remaining uncertainties regarding the concentrations of mercury under normal operating conditions. Jordan Valley is required by this permit to complete the characterization of mercury in the byproduct when operations commence and DWQ will evaluate revising the load limits when this data becomes available.

As documented in the 2008 and 2010 Integrated Reports, existing data is insufficient to determine if mercury or methylmercury are impairing the uses of Gilbert Bay or the Transitional Waters. USFWS (2009) did detect (assumed) methylmercury concentrations in some samples of biota above screening levels collected from Gilbert Bay. In deriving a mercury water quality standard for protection of wildlife in the Great Lakes, USEPA estimated water to bird translators (biomagnification and bioaccumulation) exceeding 1 million (the concentration in water needs to be over 1 million times lower than acceptable concentration in bird diet). The data needed to determine translators for Great Salt Lake using a model similar to the one used for the Great Lakes requires data that is currently unavailable for Great Salt Lake.

More recent data still being reviewed by DWQ includes water and brine shrimp collected from the Gilbert Bay by Naftz et al., in 2009 and samples analyzed by DWQ collected in July and October of 2011 (Figure 9). The DWQ results should be treated with caution pending completion of the data validation. For instance, in some samples, the concentration of methylmercury exceeds total mercury which is a physical impossibility. Clean sampling and laboratory techniques are required to avoid quality control problems like methylmercury being higher than total mercury when concentrations are so low.

In addition to the lack of a Gilbert Bay specific maximum acceptable concentration of methylmercury in bird eggs, data representing the actual methylmercury concentrations in bird eggs is also lacking. This general lack of egg data specific to Gilbert Bay is in part because the Gilbert Bay does not support suitable nesting species for monitoring (DWQ, 2008).

In the context of the process in Figure 1, DWQ concludes that the data are inadequate to derive water to food, or food to bird translators for Gilbert Bay.

3.1.2 Mercury reasonable potential for Gilbert Bay. No numeric standards are available for the mercury in Gilbert Bay. The USEPA tissue-based standard for methylmercury is based on the concentration of mercury in fish and the human consumption. This standard should not be applied to Gilbert Bay because of the lack of fish and human consumption. Other standards such as Utah's freshwater mercury standard and USEPA's chronic mercury standard for saltwater were also evaluated for applicability to the Gilbert Bay. Mercury concentrations in the Southwest Groundwater Treatment Plant's byproduct (15 ng/l) are anticipated to be similar to Utah's freshwater chronic mercury standard (12 ng/l) but Utah's freshwater standard is based on accumulation in fish consumed by people like USEPA's tissue-based standard. USEPA's recommended chronic standard for mercury in salt water is 980 ng/l but is based on direct effects to aquatic organisms and does not consider biotransfer through the

food web. For the Great Lakes, USEPA recommends a mercury standard of 1.3 ng/l for the protection of wildlife (includes bird) which is below naturally occurring mercury concentrations in the groundwater that will be treated by Jordan Valley.

USGS analyzed mercury concentrations in brine shrimp collected from Gilbert Bay in each month, June through December 2008. Monthly geometric mean concentrations of mercury were less than 70 µg/kg (unpublished data). DWQ observed similar results when brine shrimp were sampled from Gilbert Bay in 2011 (Figure 10). As discussed in the 2010 Integrated Report, an acceptable concentration for mercury in brine shrimp is uncertain. However, Evers et al. (2004) proposes that mercury concentrations less than 500 µg/kg in fish would be low risk to fish-eating birds. Brine shrimp are less than 500 µg/kg mercury. Although several technical issues have to be addressed before adopting Evers et al. (2004) as reliable for Great Salt Lake, the Evers values are judged more likely to overestimate mercury toxicity in Gilbert Bay than underestimate. This preliminary conclusion is based on the prevalence of known mercury antagonists such as selenium, sulfur, chloride, and zinc which would reduce to the toxicity of mercury.

Overall, the site-specific data is inadequate to determine reasonable potential in accordance with the process in Figure 1. The lack of observable adverse effects in birds in the Great Salt Lake studies cited in Section 2.1.2 suggest that current mercury concentrations are not adversely affecting birds and impairing the uses but the data is too limited to be definitive. Concentrations of mercury measured in brine shrimp are also below Evers et al. (2004) screening level for low risk. While the existing data do support that uses are being supported in Gilbert Bay, the data to quantify the available assimilative capacity is inadequate. DWQ judges that the relatively small contribution of mercury to Gilbert Bay from the Southwest Groundwater Treatment Plant (0.06-0.38 kg/yr) in comparison to other existing sources (38 kg/yr Naftz et al. 2009) to be unlikely to exceed the assimilative capacity. In the context of the process described in Figure 1, DWQ determined that reasonable potential is unknown for mercury in Gilbert Bay. Therefore, this permit requires Jordan Valley to monitor water, and invertebrates in Gilbert Bay for mercury to collect the data necessary to determine reasonable potential.

3.2 Mercury discharge to the Transitional Waters

3.2.1 Mercury water translator for the Transitional Waters. Even less is known regarding mercury in the Transitional Waters than in Gilbert Bay. This is in part due to the low concentrations of mercury present and the technical challenges of reliably measuring mercury at these concentrations. The conversion of mercury to methylmercury is dependent on site-specific conditions and difficult to predict. Jordan Valley did measure mercury in samples collected from the outfall delta in 2011 (CH2M Hill, 2012) and 2012 when Kennecott was intermittently discharging, not the Southwest Groundwater Treatment Plant. The 2011 and 2012 data collected by Jordan Valley will be useful for comparisons after the Southwest Groundwater Treatment Plant commences discharging, i.e., the 2011 sample results are representative of baseline conditions with only KUC discharging. In the context of the process in Figure 1, DWQ concludes that the data are inadequate to derive water to food, or food to bird translators for the 5E waters.

3.2.2 Mercury reasonable potential for the Transitional Waters. Like Gilbert Bay, the maximum concentration of mercury in the Transitional Waters that would be protective of the uses is uncertain. Mercury concentrations in invertebrates (bird dietary items) from the 2011 *Field and Laboratory Data Great Salt Lake Outfall 001* (CH2MHill, 2012) ranged from 123 to 356 µg/kg and were less than the Evers et al. (2004) low risk mercury screening value of 500 µg/kg. Similar to Gilbert Bay, the applicability of applying Ever's screening values that were based on fish to invertebrates in the Transitional Waters in

uncertain. As previously discussed, the 2011 sampling conducted for the *Joint Discharge Area Transitional Waters Monitoring Program* is without the Southwest Groundwater Treatment Plant discharging. DWQ judges that the available data is inadequate to determine reasonable potential for mercury in the Transitional Waters.

DWQ continues to fill data gaps to support determining a Great Salt Lake-specific acceptable maximum mercury concentration as documented in the Integrated Reports. To address these data gaps specifically for the Southwest Groundwater Treatment Plant discharge in accordance with the process in Figure 1, this permit requires monitoring of mercury in water, sediment, invertebrates, and bird eggs in the affected transition waters to evaluate the feasibility of developing translators and completing a reasonable potential analysis. Given the low concentrations expected, these translators may ultimately be infeasible to determine but aren't critical if the uses remain supported.

3.3 Mercury Summary

Gilbert Bay and Transitional Waters are not currently impaired for mercury. However, the available data is inadequate to conclude that these waters are fully supporting their uses. Great Salt Lake is in Category 3C, Insufficient Data for the Integrated Report. DWQ is actively working to resolve these deficiencies and specific monitoring requirements were added to this permit to address these data gaps as recommended by the USEPA's Methylmercury Implementation Guidance. DWQ's preliminary conclusion is that the Southwest Groundwater Treatment Plant's byproduct is an inconsequential source of mercury to Gilbert Bay compared to other sources of loading. For the Transitional Waters, the low concentrations of mercury in the byproduct are unlikely to adversely affect the uses that will be confirmed by monitoring.

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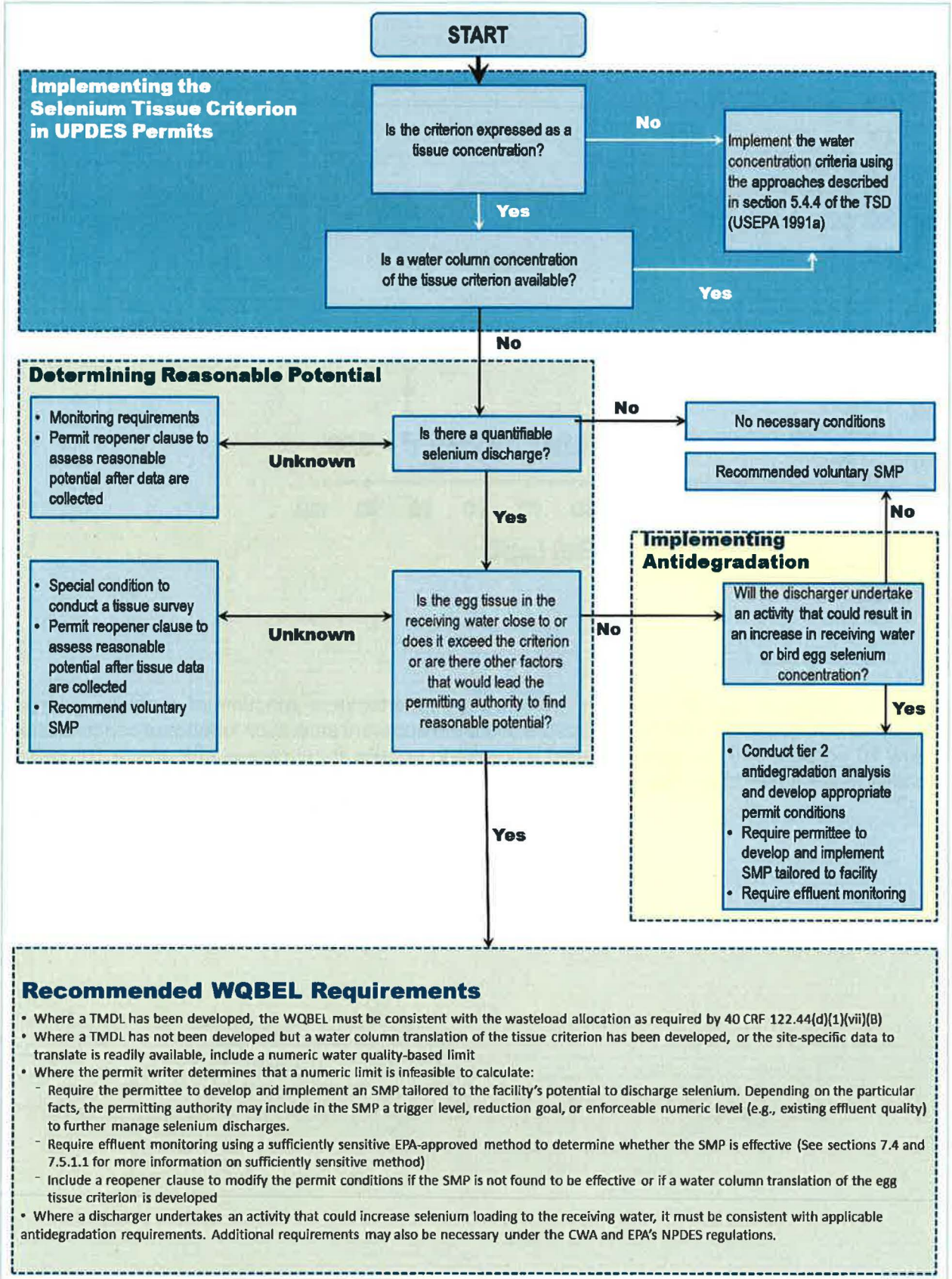


Figure 1. SWGTP permitting approach for selenium egg criterion modified from the USEPA (2010) Methylmercury Implementation Guidance. SMP=Selenium Minimization Plan

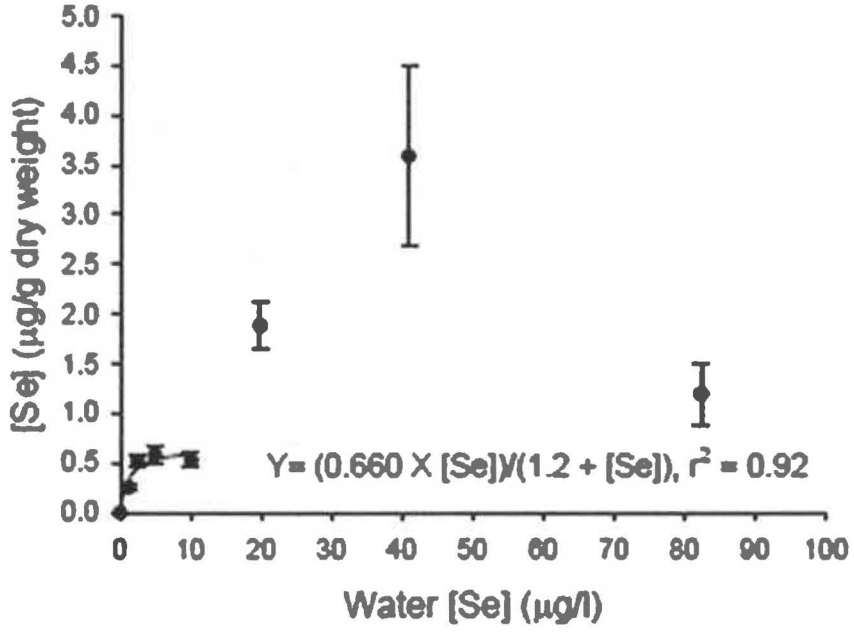


Figure 2. Selenium accumulation in individual adult artemia a function of ambient selenium concentrations following a 24-hour exposure. Note the apparent saturation kinetics at concentrations below 10 µg Se/L and the clear elevated increase in uptake at concentrations above 10 µg Se/L identifying the "knee"to be between 10 and 20µg Se/L.

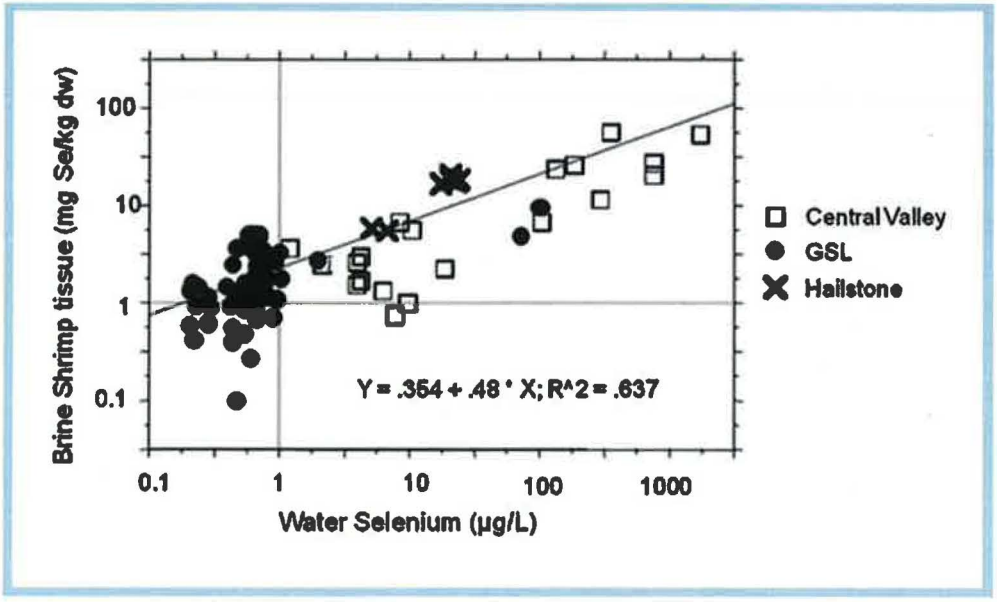
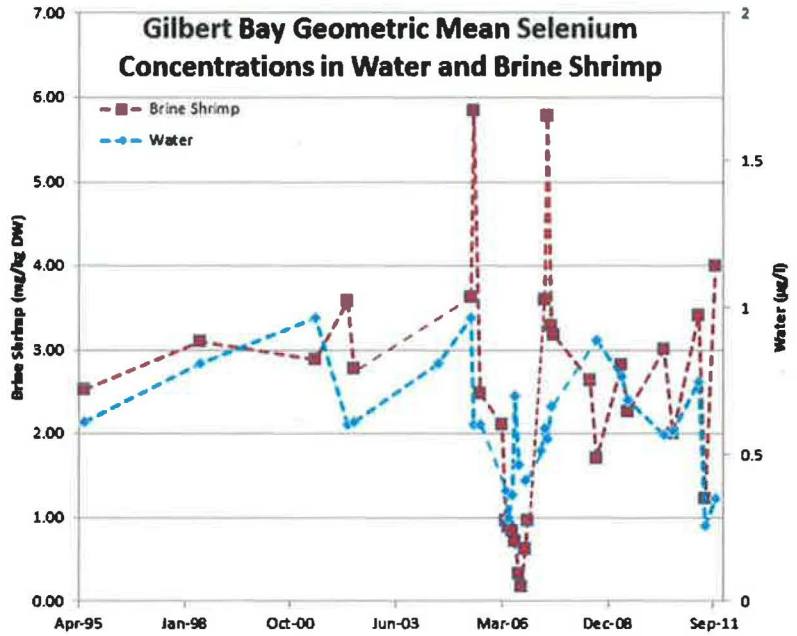


Figure 3. Brine shrimp tissue Se as predicted from total Se in cocollected water samples of the test dataset. The 3 data sources are Central Valley, California, ponds; Great Salt Lake, Utah (GSL); and Hailstone Reservoir, Montana (Byron et al. 2011)



Data Table for Geometric Mean Concentrations of Selenium in Brine Shrimp and Water from Gilbert Bay, Great Salt Lake

Date	Brine Shrimp (mg/kg DW)	n	Water (ug/l)	n	Date	Brine Shrimp (mg/kg DW)	n	Water (ug/l)	n
Jun-95	2.54	43	0.61	7	Nov-06	0.62	12		
Jun-98	3.11	1	0.81	14	Apr-07			0.51	2
Jun-01	2.89	7	0.96	7	May-07	3.60	49	0.59	6
Apr-02	3.58	2	0.60	9	Jun-07	5.79	11	0.55	4
Jun-02	2.78	5	0.60	8	Jul-07	3.29	19	0.66	4
Aug-04			0.38	4	Aug-07	3.17	21		
Jun-05	3.63	7	0.29	4	Jul-08	2.64	7		
Jul-05	5.85	8	0.37	4	Sep-08	1.71	6	0.89	6
Sep-05	2.48	8	0.70	2	May-09	2.83	7	0.77	7
Apr-06	2.11	7			Jul-09	2.27	7	0.69	7
May-06	0.96	23	0.46	5	Jun-10	3.01	6	0.57	6
Jun-06	0.90	9	0.41	8	Sep-10	2.00	5	0.58	5
Jul-06	0.84	12	0.51	2	May-11	3.42	8	0.75	8
Aug-06	0.72	12	0.59	6	Jul-11	1.23	8	0.26	8
Sep-06	0.33	10	0.55	4	Oct-11	3.99	7	0.35	8
Oct-06	0.18	11	0.66	4					

Figure 4 Geometric Mean Concentration of Selenium in Brine Shrimp and Water from Gilbert Bay from USFWS, Kennecott, USGS, and DWQ data

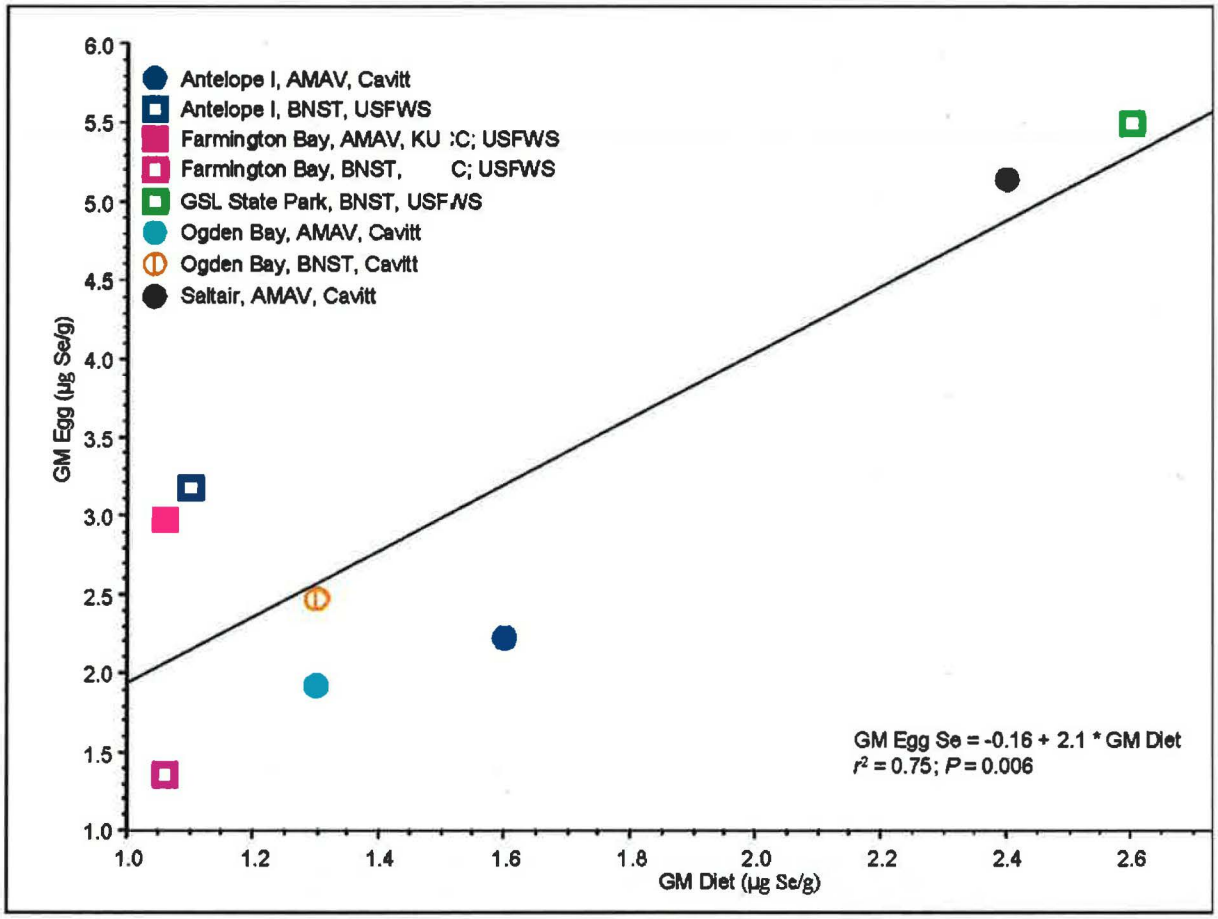
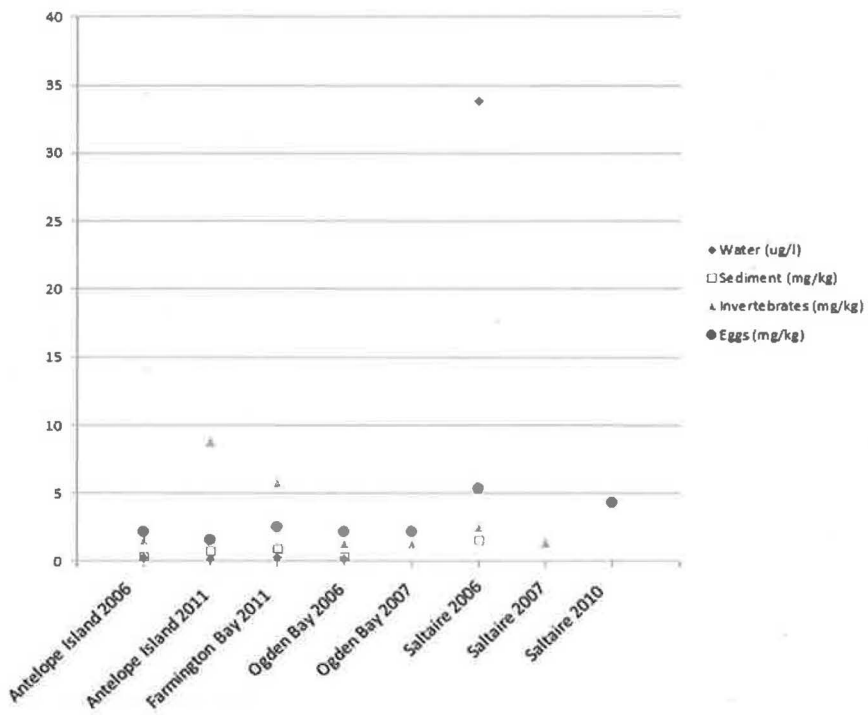


Figure 5. Relationship between shorebird geometric mean diet and egg selenium concentrations at various locations. (Figure 6- 4 DWQ, 2008)



Sample Location	Water Samples	Sediment Samples	Invertebrate Samples	Egg Samples
Antelope Island 2006	3	3	9	21
Antelope Island 2011	2	1*	1	5
Farmington Bay 2011	2	1*	1	5
Ogden Bay 2006	3	3	9	40
Ogden Bay 2007	0	0	2	13
Saltaire 2006	3	3	6	8
Saltaire 2007	0	0	1	0
Saltaire 2010	0	0	0	11

*Composite of 5 aliquots

Figure 6 Geometric mean selenium concentrations in water, sediment, invertebrates, and eggs

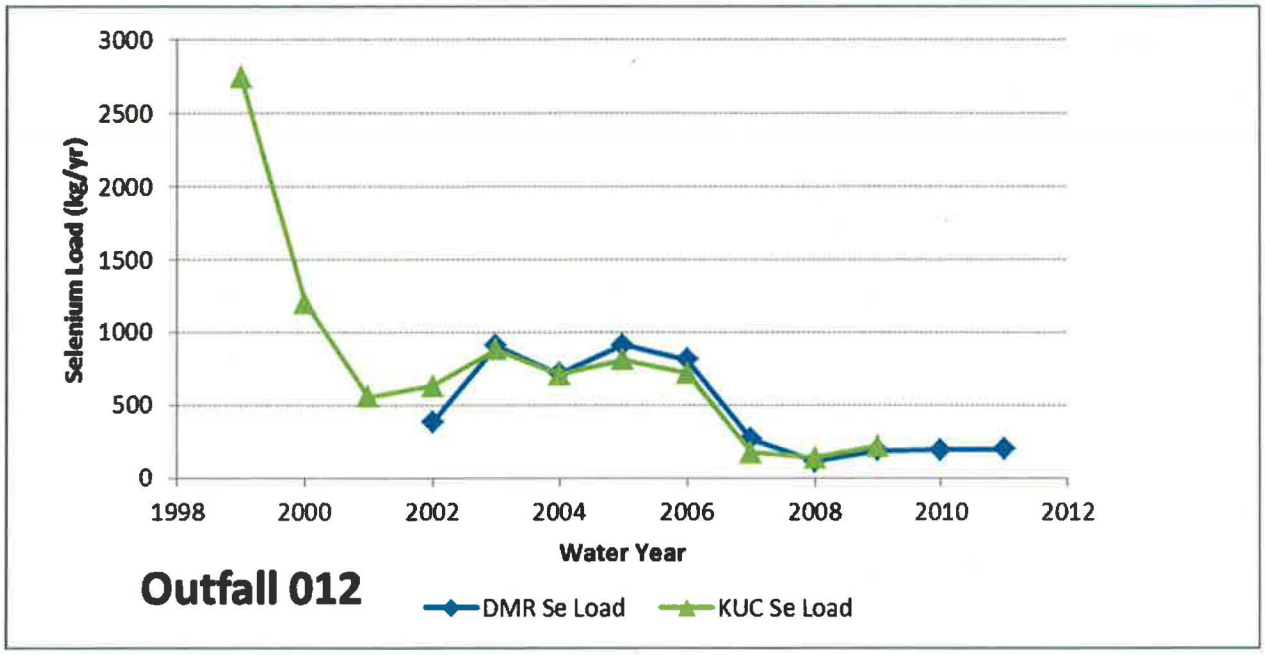


Figure 7. Selenium loads calculated from the DWQ Discharge Monitoring Reporting (DMR) Database and as estimated by Kennecott Utah Copper

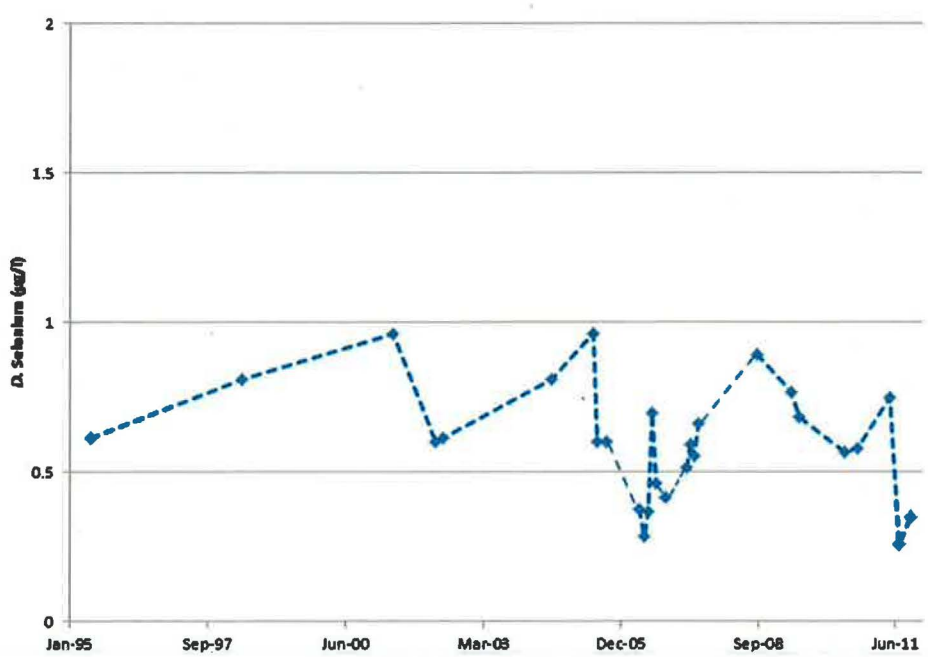


Figure 8. Selenium geometric mean concentrations for Gilbert Bay from USGS, Kennecott, and DWQ data

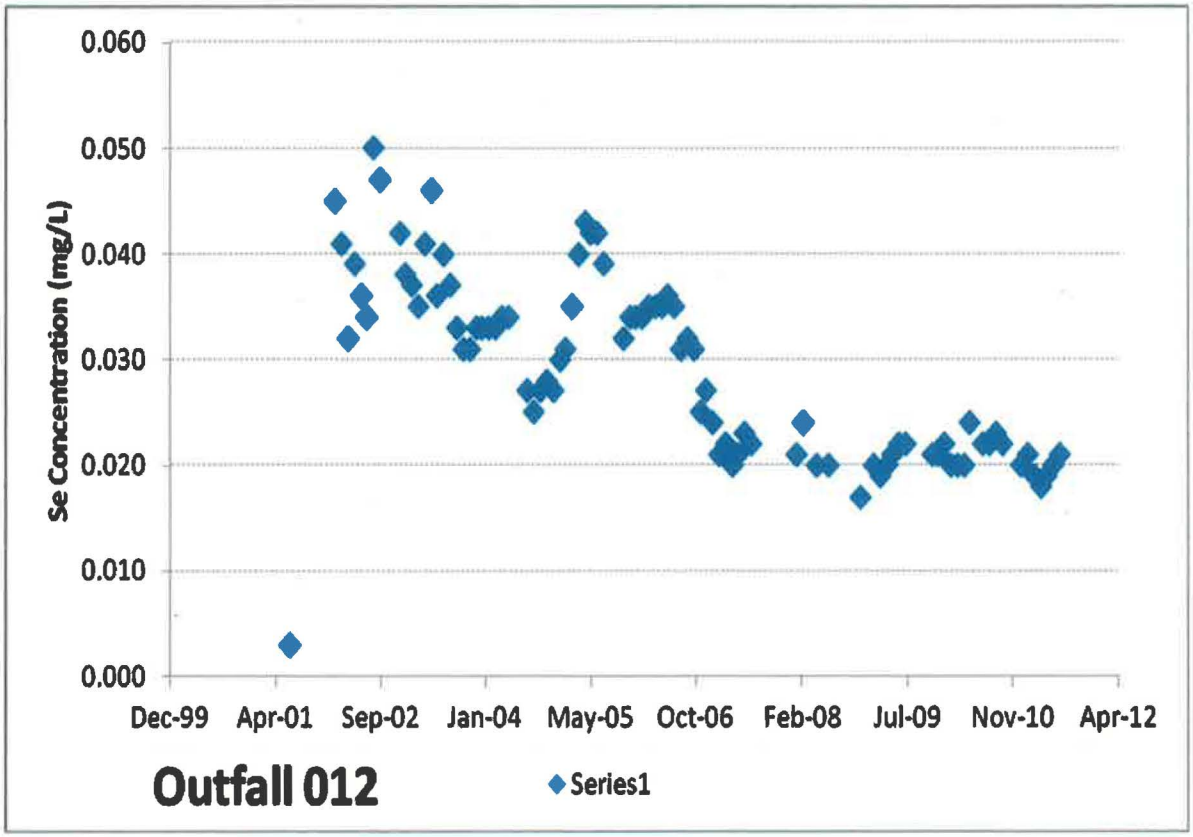


Figure 9. Monthly average selenium concentrations in Kennecott Utah Copper Outfall 012 from Discharge Monitoring Reports

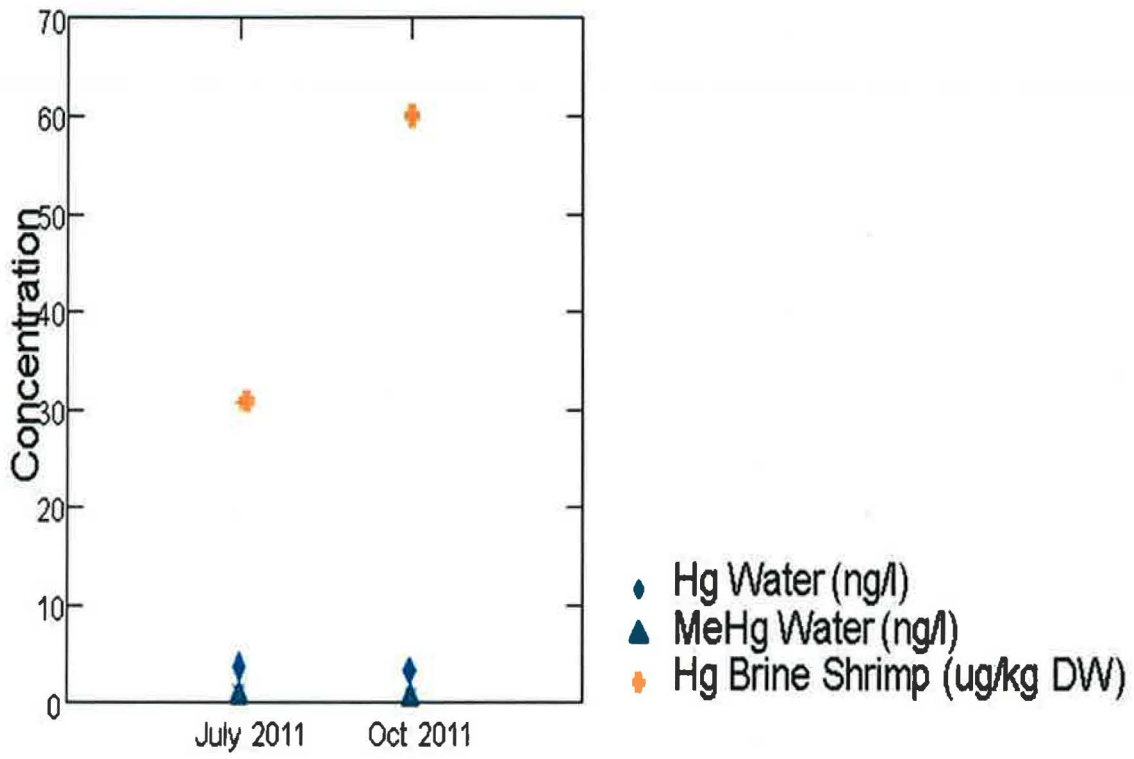


Figure 10 Geometric Mean Concentration of Total Mercury and Methyl Mercury in Gilbert Bay Water and Total Mercury in Brine Shrimp (8 locations). Water geometric mean excludes deep brine layer samples. Samples were collected from 8 locations (DWQ, 2012)

APPENDIX 2

Wasteload Allocations for Outfall 002 to the Jordan River

ALLOWABLE EFFLUENT CONCENTRATION/LOADING
FOR CONSERVATIVE SUBSTANCES

Date of Analysis: 3/27/2013

This Calculates the Allowable Effluent Concentration/Loading for Conservative Substances in a Receiving Water
Assumption: Complete Mixing

Pressure relief discharges from 002

Conservative Substance:	Selenium
Acute or Chronic Standard	Chronic
Discharger:	JVWCD
Receiving Water:	Jordan River
Classification:	2B, 3A, 4
For the Season / Year	All Seasons

Receiving Water Information - Jordan River		
Flow, cfs	70.000	
Flow, cfs (Acute)	35.000	
Selenium, mg/l	0.00330	
Selenium Load, lbs/day	1.25	
Stream Standard		
Selenium, mg/l	0.0046	
Allowable Loading Before Mix:	1.74	lbs/day
Acute / Chronic Standard [Toxics]	Chronic	

Effluent Information [Proposed] JVWCD	
Flow, gal./min.	
Flow, MGD	4.60000
Flow, cfs	7.116
Selenium, mg/l	0.00790
Selenium Load, lbs/day	0.30
Selenium Load, lbs/year	110.60
Selenium Load, tons/day	0.0002
TDS Load, tons/year	0.1
Percent of Receiving Stream = Di	0.09
Dilution Ratio: (to 1.0)	9.84
Percent of Stream Flow Used in C	100%

Combined Effluent/Receiving Water Information		
Flow, cfs	77.116	cfs
Selenium, mg/l	0.00372	mg/l
Concentration Delta Increase, mg/l	0.00042	mg/l [Delta]
Percent Increase:	0.13	%
Selenium Load, lbs/day:	1.55	lbs/day
Allowable Loading After Mix:	1.91	lbs/day
Additional Loading Allowed:	0.36	lbs/day

Current Permit Information	
Flow, MGD (per WLA)	0.0
Effluent Limitation (per WLA)	0.00000
Current Project Loading	0.0000

Permitted Effluent Concentration:	**0.017**	**mg/l**	**17.4 ug/l for : All Seasons**
Permitted Effluent Loading:	**0.66693**	**lbs/day**	**0.1 tons/year**

Effluent Concentration Safety Factor:	0.0095	mg/l
Effluent Loading Safety Factor:	0.3639	lbs/day

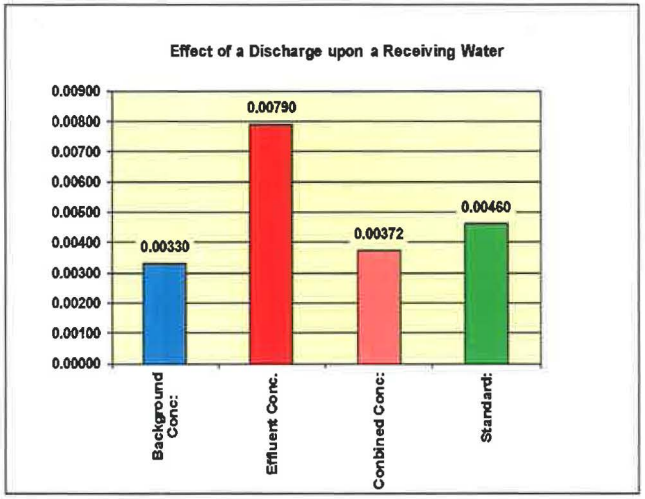
Note: Whole Effluent Toxicity (WET) to be conducted on all toxic substances,.
Note: Waste Load Analysis may indicate unreasonably high allowed concentrations and loadings. Narrative standards, New Source Performance Standards, and BAT also apply.

Background Conc:	0.00330
Effluent Conc.	0.00790
Conbined Conc:	0.00372
Standard:	0.00460
Percent Change	12.9%

Assumptions:
1. Critical low flow is from previous wasteload prepaired by Dr. Moellmer.
2. Selenium concentration of receiving water is based on a 7 year average of data collected at 7800 South, Storet Number 4994170.

Level I Antidegradation Review

Existing Project Loading	None	lbs/day
Proposed Project Loading	0.3030	lbs/day
% Increase in Project Loading	0.0%	
Current Stream Pollutant Load	1.2451	lbs/day
Proposed Stream Pollutant Lo	1.5481	lbs/day
% Increase in Stream Loading	24.3%	
Current Stream Pollutant Conc	0.0033	mg/l
Proposed Stream Pollutant Co	0.0037	mg/l
% Increase in Stream Conc.	12.9%	



ALLOWABLE EFFLUENT CONCENTRATION/LOADING
FOR CONSERVATIVE SUBSTANCES

Date of Analysis: 3/27/2013

This Calculates the Allowable Effluent Concentration/Loading for Conservative Substances in a Receiving Water
Assumption: Complete Mixing

Pressure relief discharges from 002

Conservative Substance:	Selenium
Acute or Chronic Standard	Chronic
Discharger:	JVWCD
Receiving Water:	Jordan River
Classification:	2B, 3A, 4
For the Season / Year	All Seasons

Receiving Water Information - Jordan River		
Flow, cfs	70.000	
Flow, cfs (Acute)	35.000	
Selenium, mg/l	0.00330	
Selenium Load, lbs/day	1.25	
Stream Standard		
Selenium, mg/l	0.0046	
Allowable Loading Before Mix:	1.74	lbs/day
Acute / Chronic Standard [Toxics]	Chronic	

Effluent Information [Proposed] JVWCD	
Flow, gal./min.	
Flow, MGD	1.00000
Flow, cfs	1.547
Selenium, mg/l	0.00790
Selenium Load, lbs/day	0.07
Selenium Load, lbs/year	24.04
Selenium Load, tons/day	0.0000
TDS Load, tons/year	0.0
Percent of Receiving Stream = Di	0.02
Dilution Ratio: (to 1.0)	45.25
Percent of Stream Flow Used in C	100%

Combined Effluent/Receiving Water Information		
Flow, cfs	71.547	cfs
Selenium, mg/l	0.00340	mg/l
Concentration Delta Increase, mg/l	0.00010	mg/l [Delta]
Percent Increase:	0.03	%
Selenium Load, lbs/day:	1.31	lbs/day
Allowable Loading After Mix:	1.77	lbs/day
Additional Loading Allowed:	0.46	lbs/day

Current Permit Information	
Flow, MGD (per WLA)	0.0
Effluent Limitation (per WLA)	0.00000
Current Project Loading	0.0000

Permitted Effluent Concentration:	**0.063**	**mg/l**	**63.4 ug/l for : All Seasons**
Permitted Effluent Loading:	**0.52885**	**lbs/day**	**0.1 tons/year**

Effluent Concentration Safety Factor:	0.0555	mg/l
Effluent Loading Safety Factor:	0.4630	lbs/day

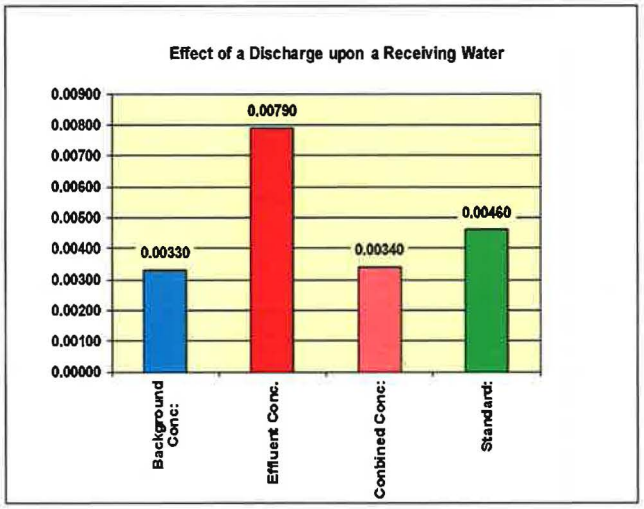
Note: Whole Effluent Toxicity (WET) to be conducted on all toxic substances,.
Note: Waste Load Analysis may indicate unreasonably high allowed concentrations and loadings. Narrative standards, New Source Performance Standards, and BAT also apply.

Background Conc:	0.00330
Effluent Conc.	0.00790
Conbined Conc:	0.00340
Standard:	0.00460
Percent Change	3.0%

Assumptions:
1. Critical low flow is from previous wasteload prepaired by Dr. Moellmer.
2. Selenium concentration of receiving water is based on a 7 year average of data collected at 7800 South, Storet Number 4994170.

Level I Antidegradation Review

Existing Project Loading	None	lbs/day
Proposed Project Loading	0.0659	lbs/day
% Increase in Project Loading	0.0%	
Current Stream Pollutant Load	1.2451	lbs/day
Proposed Stream Pollutant Lo	1.3110	lbs/day
% Increase in Stream Loading	5.3%	
Current Stream Pollutant Conc.	0.0033	mg/l
Proposed Stream Pollutant Co	0.0034	mg/l
% Increase in Stream Conc.	3.0%	



APPENDIX 3

A Tutorial: Utah Pollution Discharge Elimination System (UPDES) Permitting and Water Quality Standards: March 2013

A Tutorial: Utah Pollution Discharge Elimination System (UPDES) Permitting and Water Quality Standards
March 2013

The following is a brief tutorial on the application of water quality standards to permit limits in Utah Pollution Discharge Elimination System permits. The intent of this tutorial is to provide a simplified overview of the process. The overview begins by describing different types of effluent limits that a permit may have and their regulatory bases. Water quality standards and their application to permits are then described.

Permits must consider the impact of discharges on the quality of the receiving water because discharges may not cause an exceedance of water quality standards. Final permit limits are the most restrictive of secondary treatment limits (UAC R317-1-3.2), categorical limits (for instance, R317-8-3.12), or limits necessary to ensure compliance with water quality standards (UAC R317-8-4.2(4)). Effluent limits based on water quality standards are called "water-quality-based effluent limits."

Utah's water quality standards include: designated uses, criteria, and antidegradation and their role in permitting is described in the following paragraphs.

Uses
Designated uses identify the specific activities that the water quality is intended to support. Utah's designated uses include drinking water source, contact recreation such as swimming, aquatic life such as fish and waterfowl, and agriculture (UAC R317-2-6). All waters of the State have designated uses assigned. In addition to designated uses, existing uses[9] must also be protected. Currently, no existing uses have been identified for Utah waters that are not already included as designated uses.

Criteria
Utah's criteria include both numeric criteria (UAC R317-2-14) and Narrative Standards (UAC R317-2-7.2). Numeric criteria are typically expressed as a concentration in water that will protect and support the designated uses. Numeric criteria to protect aquatic life such as waterfowl typically include magnitude (concentration), duration (time period at the concentration commonly set either 1 hour for acute and 4 hours for chronic), and frequency (how often the numeric criteria could be exceeded with no significant effect on the designated use, commonly set to once every 3 years).

The narrative standard is explicitly stated in the permit. The narrative standard is a general prohibition for releasing anything to the water that impairs the designated uses. The Narrative Standards are applied in tandem when numeric criteria are available or alone when numeric criteria are not available.

Determining appropriate effluent limits for permits is relatively straightforward when numeric criteria are available. Through a mathematical modeling process called a waste load allocation, the amount of a pollutant that can be added to the water without exceeding the criterion is calculated. This calculation is based on the concentration of the pollutant that is already present in the receiving water, how much of the receiving water that is available for mixing, and the quantity of effluent that will be discharged. This calculation is done for all pollutants with numeric criteria. The results of the waste load analysis are then compared to the measured or projected effluent concentrations. Pollutants with "reasonable potential", that is, reasonable potential to cause or contribute to an exceedance of the criterion, must have effluent limits in the permit (R317-8-4.2(4)). Pollutants that don't have reasonable potential are not required to have water-quality-based effluent limits but may have monitoring requirements. One reason for monitoring is to provide the data to support a "reasonable potential" determination.

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9 Existing uses are uses actually attained in a water body on or after November 28, 1975, whether or not they UAC R317-8-4.2(4)(a)6.are included in the water quality standards (UAC R317-2-1).

Similar to numeric criteria, pollutants that trigger reasonable potential for the Narrative Standards must have water-quality-based effluent limits in the permit (UAC R317-8-4.2(4)(a)6.). Deriving effluent limits based on the non-numeric Narrative Standards is effluent and facility specific. The rationale for these limits should be documented in the permit Statement of Basis. Permit limits for oil and grease are a common example where the permit includes water-quality-based effluent limits based on the Narrative Standards.

Whole effluent toxicity (WET) testing permit requirements are another tool for evaluating and ensuring compliance with the Narrative Standards. These tests are conducted by exposing standard test organisms to the effluent in a laboratory setting and recording their responses. Whole effluent toxicity is a term used to describe the aggregate toxic effect of the effluent as measured by an organism's response upon exposure to the sample (e.g., lethality, impaired growth or reproduction). These tests replicate the total effect and actual environmental exposure of aquatic life to toxic pollutants in an effluent without requiring the identification of the specific pollutants. Note that WET monitoring and WET limits are not the same thing. A permit may contain WET monitoring requirements and must have WET limits if the results of the WET monitoring trigger reasonable potential (R317-8-4.2(4)a.5.).

Antidegradation

Antidegradation is intended to conserve assimilative capacity[10]. Degradation of water quality is only allowed for important social or economic reasons and the least degrading, feasible treatment option is required (UAC R317-2-3). Note that degradation is defined as in increase in pollutant concentrations in the receiving waters. Pollutant concentrations may be allowed to increase as long as they remain below the numeric criteria and meet the requirements of the Narrative Standards.

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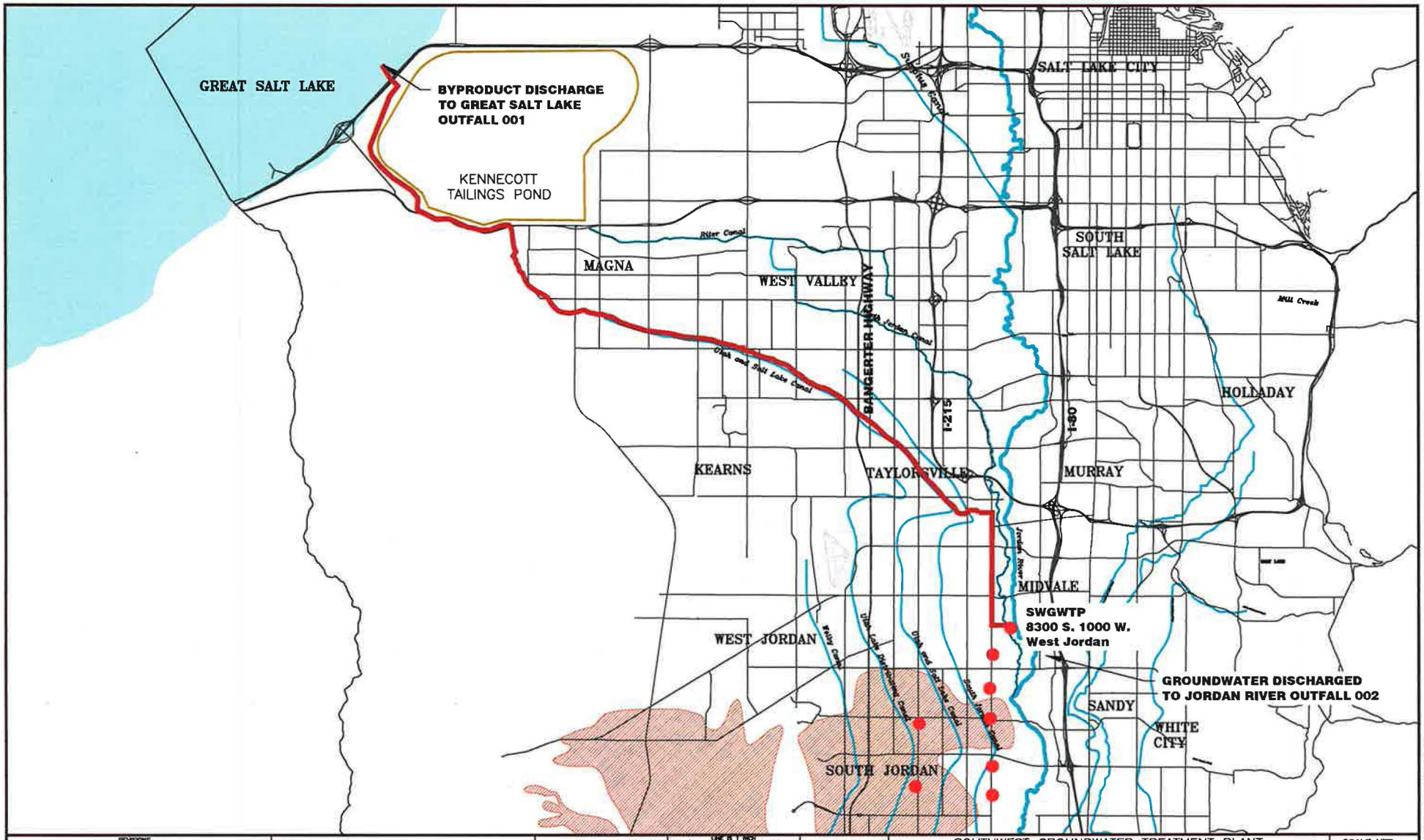
10 "Assimilative Capacity" means the difference between the numeric criteria and the concentration in the waterbody of interest where the concentration is less than the criterion (UAC R317-1-1).

APPENDIX 4

Map of Proposed Discharge Locations and Pipeline Alignment



REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

Jordan Valley Water Conservancy District
8215 SOUTH 1300 WEST
WEST JORDAN, UTAH 84088-0070
PHONE (801) 565-4300

LINE IS 1 INCH AT FULL SIZE (IF NOT 1" -- SCALE ACCORDINGLY)

DESIGN:
DRAWING: TODD M. PETERSON
REVIEW: DAVID R. MCLEAN
APPROVAL:

SOUTHWEST GROUNDWATER TREATMENT PLANT

OVERALL PROJECT VIEW

SCALE: NTS
DATE 3/20/13
PROJECT NUMBER ---
DRAWING NUMBER 1
SHEET NUMBER 1 OF 1

L:\WATER TREATMENT PLANTS\SWGWTP\PERMITS\WEST JORDAN-AMENDED SITE PLAN\SUBMISSION # 1\PIPELINE ALIGNMENT DRAWING 03-20-13.DWG

0.7MI

Appendix C

Agreement with FRIENDS of Great Salt Lake

AGREEMENT

This Agreement is made and entered into as of March 6th, 2014, (the "Effective Date"), by and among the Utah Department of Water Quality (DWQ), FRIENDS of Great Salt Lake (FRIENDS), and Jordan Valley Water Conservancy District (Jordan Valley). The foregoing are sometimes referred to herein as "party" or "parties."

RECITALS

A. DWQ is responsible for implementing the Clean Water Act and the National Pollution Discharge Elimination System Program in the State of Utah. As part of his responsibilities, the Director of DWQ considers and acts upon applications for Utah Pollution Discharge Elimination System Program permits (UPDES permits) for the discharge of pollutants into Utah waters and is responsible for permit enforcement. The Director's staff makes recommendations to him regarding the exercise of these responsibilities.

B. Jordan Valley will receive, on or immediately after the Effective Date, a UDPES permit (Permit No. UT0025836 (the Permit)), which authorizes certain point-source discharges from its Southwest Groundwater Treatment Plant (Southwest Plant). The construction and operation of the Southwest Plant are elements of the resolution agreement that resulted from a Natural Resource Damage Claim against Kennecott Utah Copper filed in 1986 by the State of Utah under the Comprehensive Environmental Response, Compensation, and Liability Act.

C. The treatment process utilized at the Southwest Plant is reverse osmosis, which is designed to remove dissolved salts and other contaminants from the deep groundwater aquifer (also known as Zone B) polluted by Kennecott Utah Copper's historic mining activities. It will also be used to remove dissolved salts from the shallow aquifer, which has not been contaminated by historic mining activities, and to remove any other contaminants that are found in the shallow aquifer as that aquifer is more completely characterized. The dissolved salts and contaminants will be collected in the byproduct waste stream and discharged from Outfall 001 through the Transitional Waters of Great Salt Lake's Gilbert Bay and ultimately into the open waters of Gilbert Bay itself. The Southwest Plant may initially discharge byproduct waste at a maximum rate of 1.5 million gallons per day, and at full operation, may discharge up to 3 million gallons per day.

D. As set forth in the Permit, Jordan Valley is required to conduct sampling and analysis of bird eggs, water, sediment and macroinvertebrates, as well as to undertake bi-weekly bird surveys between April 15 and June 30 each year. The results of this sampling and analysis are referred to in this Agreement as the "Jordan Valley Permit Monitoring Information (Jordan Valley PMI)." The Permit will require Jordan Valley to submit the Jordan Valley PMI to DWQ by February 1 following the end of the calendar year for which the results were obtained.

E. Jordan Valley is authorized and encouraged to share its responsibilities for conducting sampling and analysis with Kennecott Utah Copper, which also has a permit for discharge near the same outfall.

F. The parties wish to resolve any potential disputes among them to the extent provided and upon the terms contained in this Agreement.

AGREEMENT

1. Incorporation of Recitals. The recitals set forth above are incorporated into this Agreement.

2. Review Committee.
   (a) Purpose of Committee: The parties hereby agree to form a committee to undertake an annual review of the Jordan Valley PMI (the Committee). It is the expectation of the parties that this will be a technical review and that Committee members will have the technical expertise to engage in the Committee's purpose of reviewing the Jordan Valley PMI.
   (b) Composition of Committee: The membership of the Committee will consist of one technical representative from each party. The initial technical representatives of the parties will be Christopher Bittner for DWQ, Joe Skorupa for FRIENDS, and Marie Owens for Jordan Valley. If a party's Technical Representative changes during the course of this Agreement, that party will identify a new Technical Representative in a notice sent to the other parties.
   (c) DWQ shall provide a copy of the Jordan Valley PMI to each party's Technical Representative no later than 15 days before any Committee meeting.
   (d) Timing of Review: The Committee will meet to review the Jordan Valley PMI as soon as practicable, but no later than 45 days following receipt of the Jordan Valley PMI by DWQ unless a later date is scheduled by agreement of the parties.
   (e) Public meeting. The meeting will be public.
   (f) Focus of Review: When reviewing the annual results, the Committee will evaluate:
      (1) whether there have been any material, negative changes to the beneficial uses of the Transitional Waters or Gilbert Bay (as the term "beneficial use" is used in Utah Code Ann. § 19-5-107 and Utah Admin. Code R317; see, e.g., R317-2-6 and R317-2-7), including alterations to habitat, water quality, macroinvertibrates and bird use;
      (2) whether any water quality standards have been violated in the Transitional Waters or Gilbert Bay;
      (3) whether, even if beneficial uses have not been impaired and water quality standards have not been violated, the data suggest any negative or positive trends with respect to beneficial uses or water quality standards;
      (4) information regarding the cause(s) of any negative changes under paragraph (1), water quality standard violations under paragraph (2), or trends under paragraph (3);
      (5) based on (1) and (2), whether the Committee as a whole will recommend any permitting actions that the Director should take; and
      (6) based on (1), (2) and (3), whether the Committee as a whole will recommend any adjustments to the sampling and analysis plan.
   (g) Recommendations: The intent of the parties is to reach consensus about interpretation of the data and about the correct course of action, if any, that the DWQ representative should recommend to the DWQ Director.

(h) Dispute Resolution: In the event that there is a disagreement among the technical representatives following the Committee's annual review, that dispute shall be mediated by the Assistant Director, Permits, Compliance and TMDL Branch of DWQ. If the Assistant Director is unable to mediate the dispute, Jordan Valley and Friends may present their positions to the Director of DWQ before the Director makes a final decision. If FRIENDS or Jordan Valley remain in disagreement with the Director's final decision, either party may pursue any legal remedies available to it.

3. DWQ Authorities and Responsibilities. The DWQ Director has statutory authority to make all permitting and enforcement determinations under Title 19, Chapter 5, and nothing in this Agreement shall limit or delegate that authority. Similarly, nothing in this Agreement shall limit or delegate the responsibility of the Director's staff to provide the Director with information and recommendations regarding proposed actions the Director or DWQ staff may take.

4. Covenant Not to Sue and/or Challenge the Permit. Friends hereby covenants and agrees that it shall not challenge or assist any other person or entity in challenging the Permit (including seeking to modify, stay, and/or revoke the Permit). Friends further covenants and agrees that it shall not bring any action or assist any other person or entity in bringing any action against DWQ and/or Jordan Valley under state or federal law, including the Clean Water Act, based on the assertion that the Permit, or any portion thereof, violates the Act or its underlying administrative rules or any state or federal law. This Covenant does not extend:
   (a) to any other UPDES permit; or
   (b) to any revision or reissuance of the Permit if Friends terminates this Agreement in accordance with paragraph 5(b).

5. Term.
   (a) The term of this Agreement shall begin on the Effective Date and it shall end, without further notice or condition, on the expiration of the Permit or on the termination of the Permit, whichever first occurs.
   (b) Notwithstanding any other provision of this Agreement to the contrary, any party may terminate this Agreement upon five (5) business days written notice to the other parties if the Permit is materially revised or if any appeal, action or challenge is commenced against or relating to the Permit.

6. Successors. This Agreement shall be binding upon the parties and their respective successors.

7. Authority and Acknowledgment. Each individual signing this Agreement hereby represents and warrants that she or he has read this entire Agreement, understands all of its terms and provisions, and has authority to enter into this Agreement by and on behalf of the party identified.

8. No Third Party Beneficiary. Except for any express beneficiaries of this Agreement, no third party shall be entitled to enforce any provision of this Agreement, nor may any third party be entitled to rely upon any representation, warranty, covenant, acknowledgment or any other provision hereof.

9. Rules of Construction. Each of the parties has revised, or requested revisions to, this Agreement. Any ambiguities are not to be resolved against any party.

10. Costs, Expenses, and Attorney's Fees. Each party shall bear its own respective costs, expenses, and attorney's fees incurred in connection with the negotiation, preparation, execution, and performance of this Agreement. If any action or motion is brought to enforce or construe the terms of this Agreement, each party shall bear its respective costs, expenses, and attorney's fees incurred in that action or motion.

11. Choice of Law and Mandatory Venue. This Agreement shall be interpreted, construed, and enforced in accordance with and governed by the laws of the State of Utah. Each party hereby submits to the sole and exclusive personal jurisdiction and venue of the state courts situated in Salt Lake County, State of Utah, for the enforcement of this Agreement and any and all claims relating to or arising out of this Agreement.

12. Counterparts. This Agreement may be executed in counterparts, and facsimile or scanned signatures shall be deemed acceptable as if they were original.

WHEREFORE, the parties have executed this Agreement effective as of the Effective Date.

Division of Water Quality, State of Utah

By: _____
Walter Baker
Director

Friends of Great Salt Lake

By: _____
Charles R. Dubuc
Board Chair and Legal Counsel

Jordan Valley Water Conservancy District

By: _____
~~Richard P. Bay~~ GARY C. SWENSON
~~General Manager/CEO~~ BOARD CHAIR

Appendix D

Delineation of Waters of the U.S. for the Jordan Valley Water Conservancy District Groundwater Extraction and Treatment Project.

SWCA®
ENVIRONMENTAL CONSULTANTS
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Delineation of Waters of the U.S. for the Jordan Valley Water Conservancy District Groundwater Extraction and Treatment Project

Prepared for

Jordan Valley Water Conservancy District

Submitted to

U.S. Army Corps of Engineers

Prepared by

SWCA Environmental Consultants

August 2014

DELINEATION OF WATERS OF THE U.S. FOR THE JORDAN VALLEY WATER CONSERVANCY DISTRICT GROUNDWATER EXTRACTION AND TREATMENT PROJECT

Prepared for

Jordan Valley Water Conservancy District
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Submitted to

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August 7, 2014

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INTRODUCTION

This document presents the results of a preliminary delineation of jurisdictional waters of the U.S. for Jordan Valley Water Conservancy District (JVWCD). SWCA Environmental Consultants (SWCA) conducted this delineation as part of the Clean Water Act, Section 404 regulatory process, in preparation for the JVWCD groundwater extraction and treatment project. The study area is in parts of the Great Salt Lake floodplain and adjacent uplands at elevations of approximately 4,212 feet (Figure A1, Appendix A). SWCA delineated potential waters of the U.S. in the study area that meet the three indicator criteria for wetlands or that displayed indicators of ordinary high water marks.

The approximately 10.36-acre study area is adjacent to Great Salt Lake and is the site of the proposed pipeline outfall structure (see Figure A1). It is near the Saltair Beach along the southeastern shoreline of Great Salt Lake (latitude 40.7605 and longitude -112.16991564800 [North American Datum 83]).

REGULATORY SETTING

Jurisdictional waters of the U.S. are defined as

> (1) all waters that are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide; (2) non-navigable tributaries of a traditional navigable water whose water flow is "relatively permanent" (waters that typically, e.g., except due to drought, flow year-round, or waters that have a continuous flow at least seasonally, e.g., typically three months) into a traditional navigable water either directly or indirectly by means of other tributaries; (3) the following types of waters when they have a significant nexus with a traditional navigable water: (a) non-navigable tributaries that are not relatively permanent, (b) wetlands adjacent to non-navigable tributaries that are not relatively permanent, and (c) wetlands adjacent to, but not directly abutting, a relatively permanent tributary (e.g., separated from it by uplands, a berm, dike, or similar feature). (Environmental Protection Agency [EPA] 2007)

Guidance for determining if a waterway has a significant nexus with a traditional navigable water is as follows (relevant to waters under the third definition [3] above):

> Principal considerations when evaluating a significant nexus include the volume, duration, and frequency of the flow of water in the tributary and the proximity of the tributary to a traditional navigable water. In addition to any available hydrologic information (e.g., gauge data, flood predictions, historic records of water flow, statistical data, personal observations/records, etc.), the agencies may reasonably consider certain physical characteristics of the tributary to characterize its flow, and thus help to inform the determination of whether or not a significant nexus is present between the tributary and downstream traditional navigable waters. Physical indicators of flow may include the presence and characteristics of a reliable ordinary high water mark (OHWM) with a channel defined by bed and banks. Other physical indicators of flow may include shelving, wracking, water staining, sediment sorting, and scour. Consideration will also be given to the size of the tributary's watershed, average annual rainfall, average annual winter snowpack, slope, and channel dimensions. (EPA 2007)

Wetlands are a subset of jurisdictional waters of the U.S. The U.S. Army Corps of Engineers (USACE) and the EPA jointly define *wetlands* as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (Environmental Laboratory 1987).

Under Section 404 of the Clean Water Act, dredged and fill material may not be discharged into jurisdictional waters of the U.S., including wetlands, without a permit. Regulated activities include

- fills for development,
- water resource projects (such as dams and levees),
- infrastructure development (such as highways and airports), and
- conversion of wetlands to uplands for farming and forestry.

Therefore, in association with future development, JVWCD would require a USACE Section 404 permit before placing dredged or fill material in jurisdictional wetlands or other waters of the U.S.

METHODOLOGY

Before the delineation, SWCA examined National Wetlands Inventory (NWI) data to obtain an overview of wetlands in the study area. NWI data show two wetland types—lacustrine littoral unconsolidated shore, temporarily flooded (L2USA) and palustrine, emergent, temporarily flooded (PEMA) —in the study area (Table 1; U.S. Fish and Wildlife Service 2014). NWI data are illustrated in Figure A2.

Table 1. National Wetlands Inventory Data for the Study Area

Wetland Type	Acres in Study Area
L2USA	2.74
PEMA	0.03

Natural Resources Conservation Service (NRCS) SSURGO Soil Survey data were also consulted to determine soil types. One soil type, which is listed as hydric on the State of Utah list of hydric soils, was identified in the study area (Table 2). NRCS soil data for the area adjacent to Great Salt Lake are shown in Figure A3.

Table 2. Names and Characteristics of Encountered Soil Types in the Study Area

Soil Series Name	Acres in Study Area	Hydric?
Playas*	4.11	–
Lasil-Goggin complex, 1 to 6 percent slopes	6.25	Yes
Total	**10.36**†	–

* No soil series description is available for non-soil surface types.

† The total acreage of the soil analysis reflects study area boundaries drawn using geographic information system tools and not the legal extent of the lease area.

Water-related land use data from the Utah Division of Water Resources show that the area abutting the study area is considered “Urban” (Figure A4).

Data Collection

During the delineation fieldwork on October 19, 2010, and May 14, 2014, SWCA surveyed upland and wetland sample points in each vegetation community to characterize vegetation, soil, and hydrology. Eight wetland and upland sample points were taken using a Trimble GeoExplorer XT global positioning system (GPS) unit. Proposed wetland boundaries were also delineated using this GPS unit. An overview of wetlands and stream crossings found in the study area is in Figure A5.

SWCA conducted this wetlands delineation according to the *USACE 1987 Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (USACE 2008). Based on these manuals, U.S. jurisdictional wetlands were identified using three criteria:

1. Hydrophytic vegetation
2. Wetlands hydrology
3. Hydric soils

All three criteria must be present for an area to be considered a wetland. An explanation of the three wetlands criteria follows.

Hydrophytic Vegetation

Hydrophytic plants are those plants that are adapted to wet conditions. *The 2014 National Wetland Plant List* (Lichvar et al. 2014) was used to determine the wetlands indicator status of dominant plant species encountered at the sample points.

Most plant species were identified on-site during the wetlands delineation. If a plant species could not be determined in the field, a sample was identified in SWCA's laboratory using a hand lens, ruler, and a dichotomous plant key. Plant species were identified using *A Utah Flora* (Welsh et al. 2003).

Wetlands Hydrology

Wetlands hydrology examines the behavior of water in wetlands. Primary hydrologic indicators include soil saturation, surface water, hydrogen sulfide odor, presence of reduced iron in the soil, and numerous secondary indicators, such as drainage patterns.

Hydric Soils

The NRCS defines *hydric soils* as soils that are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (above 12–20 inches soil depth, depending on soil texture; U.S. Department of Agriculture 2006). Soils were assessed for hydric conditions in the field, using a spade to excavate a pit and Munsell soil color charts to determine the soil color.

RESULTS

Several potential waters of the U.S. were identified in the study area. These consist of an existing pipeline outflow/canal, vegetated playa, mudflat, and emergent marsh.

Hydrophytic Vegetation

The dominant plant species identified at the sample points in the study area are listed in Table 3. Complete vegetation data collected at the sample points can be found in Appendix B.

Table 3. Dominant Plant Species in the Study Area

Scientific Name	Common Name	Wetland Type	Arid West Indicator Status
Bromus tectorum	Cheatgrass	Non-wetland	UPL
Hordeum jubatum	Foxtail barley	L2USA	FAC
Kochia scoparia	Burningbush	Non-wetland	FAC
Salicornia utahensis	Utah swampfire	L2USA	OBL

Notes: Wetland plants are highlighted in gray.

Plant species listed are those found in the sample points only. Other potential dominant species in the study area are not listed here.

PEM = palustrine emergent wetland; L2USA = lacustrine, littoral, unconsolidated shore, temporarily flooded; OBL = obligate wetland; FAC = facultative; UPL = obligate upland.

Wetlands Hydrology

Water sources in the study area consist of precipitation, groundwater, and surface water. The wetland areas identified in the study area all appear to be associated with high groundwater adjacent to Great Salt Lake. The primary indicator of hydrology found in wetland areas in the study area is salt crust (B11), with one wetland point also having hydrogen sulfide odor (C1). Conditions in the study area suggest that wetlands hydrology exists during wetter times of the year and/or during periods of average or above average precipitation. Hydrological data collected at the sample points can be found in Appendix B.

Hydric Soils

Based on the National Hydric Soils Lists for Utah (NRCS 2014, hydric soils are found in the study area. Overall, Munsell soil colors match the soil type descriptions found in official soil series descriptions. The sandy and clay soil textures described in the soil series descriptions were typical of the soil textures found in the study area. Soil series descriptions can be found in Appendix C, as well as a list of all the soil types encountered in the entire study area. The depleted matrix (F3) and redox depressions (F8) hydric soil indicators were found in wetland soils in the study area. The matrix colors of these soils were 2.5Y hues with chromas of 2, 3, and 4, with some redoximorphic features. The presence of concentrations within a depleted matrix was common. Soils data collected at the sample points can be found in Appendix B.

Sample Points and Wetland Boundaries

Four potential jurisdictional waters were identified in the study area during the delineation fieldwork. W01 is a vegetated playa classified as lacustrine littoral unconsolidated shore, temporarily flooded, vegetated (L2USA5). W02 is lacustrine littoral unconsolidated shore, temporarily flooded, mud (L2USA3) and can be characterized as a slope mudflat. W03 is an open ditch or channelize streambed classified as palustrine emergent (PEM). W04 is a palustrine, aquatic bed wetland (PAB) present at an existing outflow structure.

U.S. Geological Survey (2014) data indicate that the highest mean annual Great Salt Lake elevation since October 2007 occurred in 2012 at 4,201 feet above mean sea level. Given the recent historic record of low Great Salt Lake levels, it is likely that any recent surface water occurring on these mudflats is the result of precipitation events. Within this feature, there is an approximately 0.05-acre network of erosion rills. All features are shown in detail in Figure A5.

Three of the eight sample points examined in the study area had wetland characteristics. These are P-02, P-02 (2014), and P-03 (2014). All three meet the three-indicator criteria test for wetlands and are vegetated playa or emergent wetlands. Sample point P-01 lacked vegetation and is considered a mudflat. Three sample points, P-03, P-05, and P-06, contained hydric soils, but did not possess all three wetland criteria. Table 4 summarizes the sample point data. See Appendix B for detailed delineation data forms. Table 5 summarizes the size of the three waters of the U.S. identified in study area. See Appendix D for photographs of the wetlands and other features in the study area.

Table 4. Wetland/Upland Status of Sample Points in the Study Area

Sample Point	Hydrophytes Dominant?	Hydric Soils Present?	Primary Hydrologic Indicator(s) Present?	Sample Point in a Wetland?
P-01	No (No vegetation)	Yes	Yes	No (WOUS mudflat)
P-02	Yes	Yes	Yes	Yes
P-03	No	Yes	No	No
P-05	No	Yes	No	No
P-06	No	Yes	No	No
P-01 (2014)	No	No	No	No
P-02 (2014)	Yes	Yes	Yes	Yes
P-03 (2014)	Yes	Yes	Yes	Yes

Note: Wetland or other potential waters of the U.S. are highlighted in gray.

Table 5. Waters of the U.S. in the Study Area

Wetland Number	Wetland Type	Acres in Study Area
W01	L2USA5	1.08
W02	L2USA3	1.36
W03	PEM	0.60
W04	PAB	0.10
Total	**–**	**3.14**

Notes: PEM = palustrine emergent; L2USA3 = lacustrine littoral unconsolidated shore, temporarily flooded, mud; L2USA5 = lacustrine littoral unconsolidated shore, temporarily flooded, vegetated; PAB = palustrine, aquatic bed wetland.

DISCUSSION

SWCA delineated 2.44 acres of lacustrine littoral unconsolidated shore and 0.70 acre of palustrine wetland associated with a drainage feature and outflow structure (Figure A5). Appendix E contains the jurisdictional determination summary for the wetlands discussed in this report.

INTERSTATE COMMERCE

Great Salt Lake, although contained entirely within the State of Utah, is considered a traditional navigable water. It is a navigable waterbody and supports tourism and a brine shrimp industry with an interstate nexus. The wetlands and other waters of the U.S. (e.g., mudflats) identified in the study area directly abut Great Salt Lake and are therefore regulated under the Clean Water Act.

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Appendix A

Maps

Figure A1. Project location.

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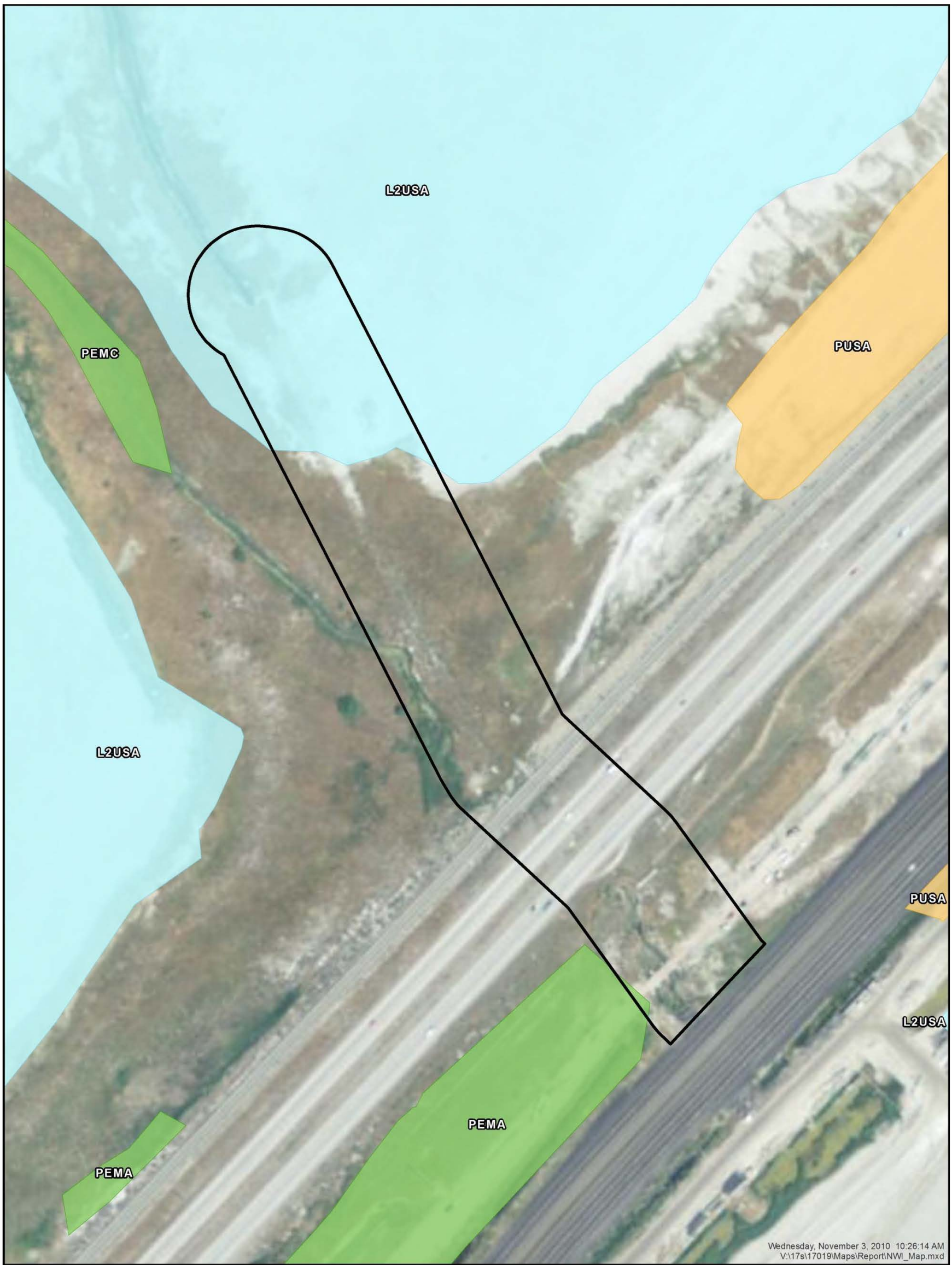

National Wetlands Inventory Data

Study Area

N

SWCA ENVIRONMENTAL CONSULTANTS

National Wetlands Inventory (NWI), U.S. Fish and Wildlife Service, 2001.
Imagery taken from National Agricultural Imagery Program (NAIP)
natural color aerial photography 1-m resolution, 2011.

Contains Privileged Information: Do Not Release

0 100 200 Feet

0 25 50 Meters

Figure A2. National Wetlands Inventory Data.

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Figure A3. Natural Resources Conservation Service Soil Survey data.

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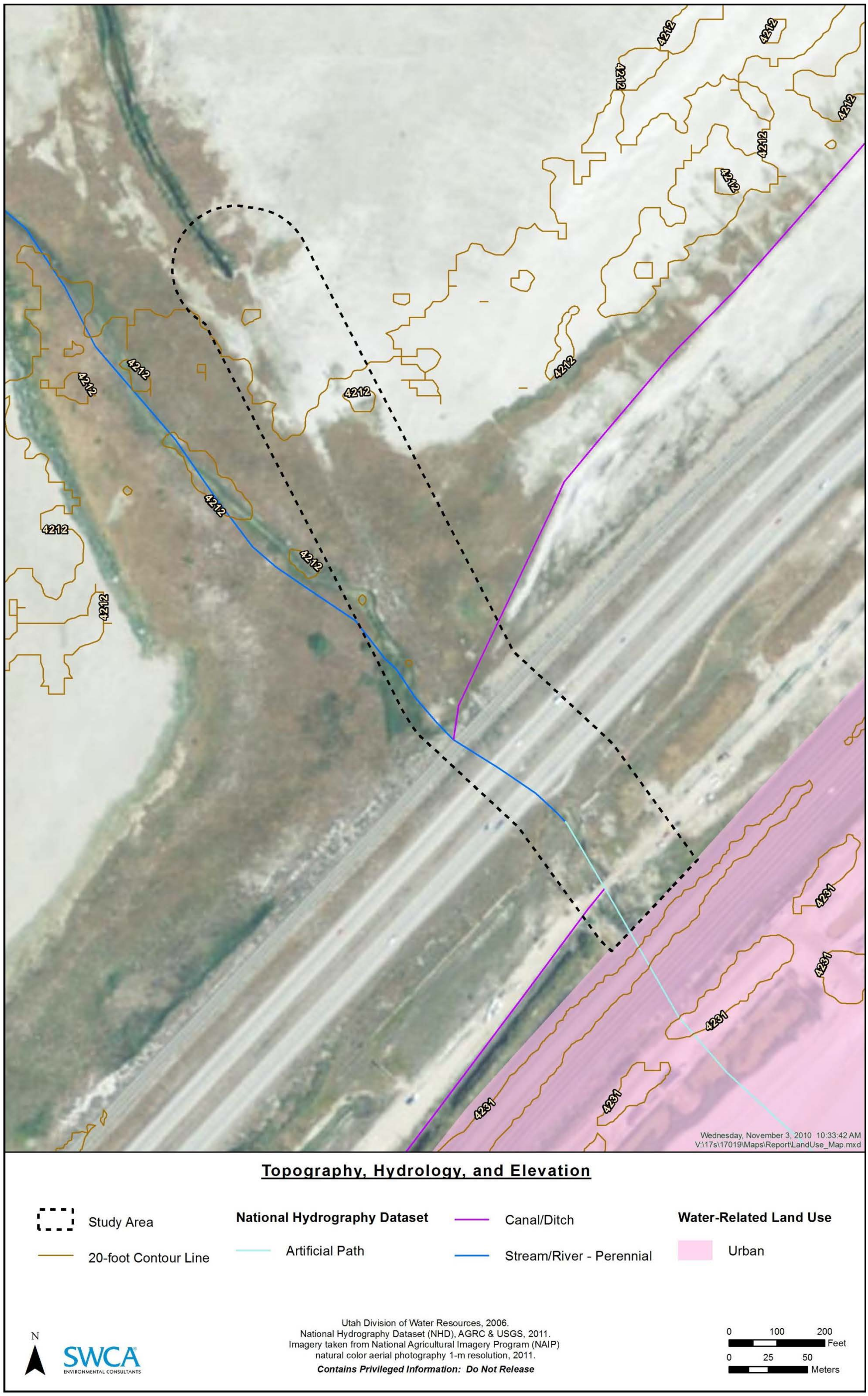

Figure A4. Topography, hydrology, and elevation.

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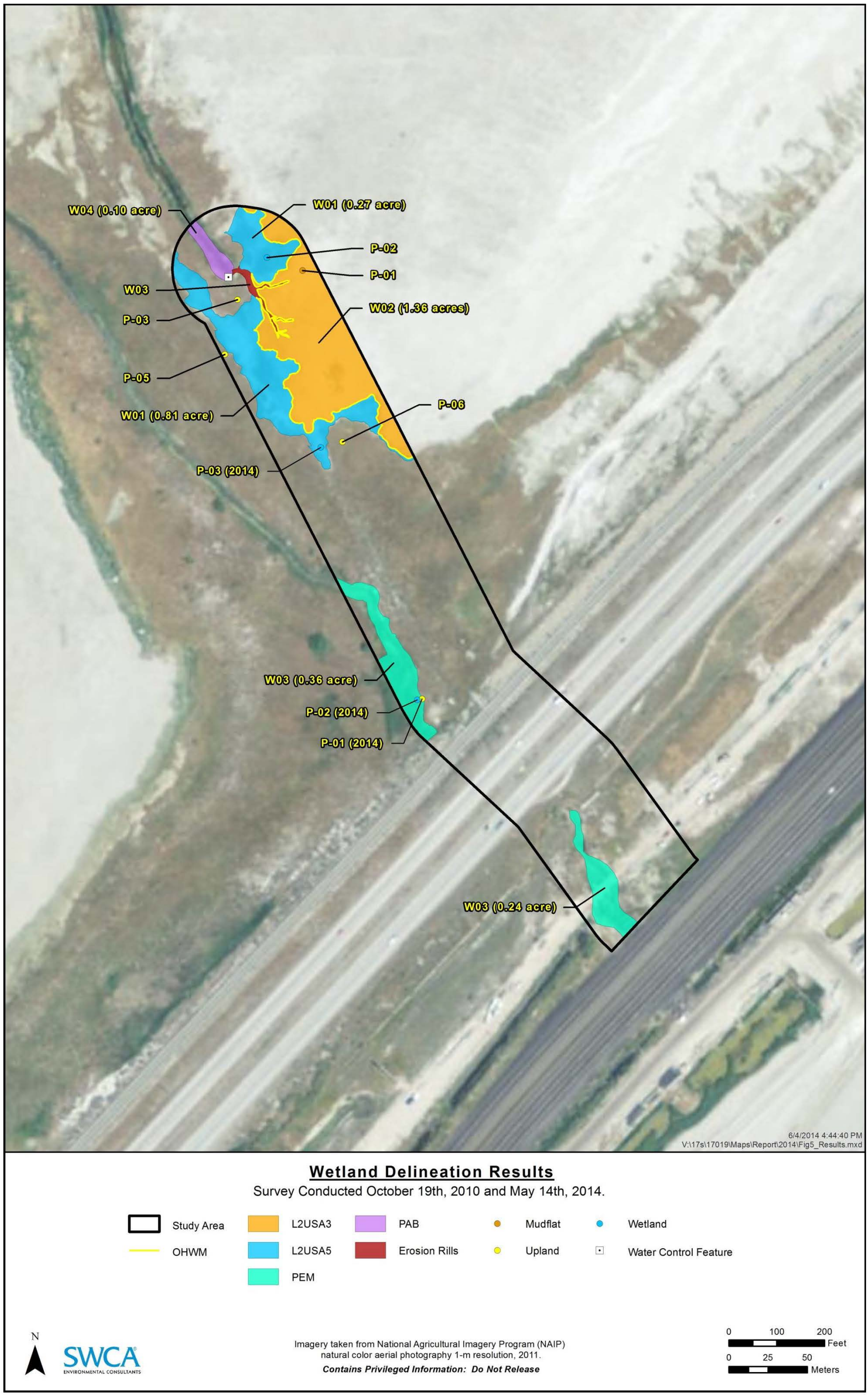

Figure A5. Wetland delineation results.

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Appendix B

Data Forms

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Project/Site: JVWCD City/County: Salt Lake Sampling Date: 10/19/2010

Applicant/Owner: JVWCD State: UT Sampling Point: P01

Investigator(s): BTN and HH Section, Township, Range: No coordinates in GSL

Landform (hillslope, terrace, etc.): GSL Shoreline Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LLR): D Lat: 40.76046200010 Long: -112.16991564800 Datum: NAD 83

Soil Map Unit Name: playa NWI Classification: L2USA

Are climatic / hydrologic conditions on the site typical for this time of year? (If no, explain in Remarks.) Yes ☒ No ☐

Are "Normal Circumstances" present? Yes ☒ No ☐

Are the following significantly disturbed? Vegetation ☐ Soil ☐ Hydrology ☐

Are the following naturally problematic? Vegetation ☐ Soil ☐ Hydrology ☐ (Explain in Remarks if necessary.)

SUMMARY OF FINDINGS (Attach site map showing sampling point locations, transects, features, etc.):

Hydrophytic vegetation present? Yes ☐ No ☒

Hydric soil present? Yes ☒ No ☐

Wetland hydrology present? Yes ☒ No ☐ Is the sampled area within a wetland? Yes ☒ No ☒

Remarks: Mudflat. Due to the lack of an appriorite OHWM form SWCA used an Arid West form to document condtions at this site.

VEGETATION:

	Tree Stratum (scientific name):	Absolute % Cover	Dominant Species?	Indicator
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
	Total Cover:	0		
	Sapling/Shrub Stratum:			
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
5.	-	-	-	-
	Total Cover:	0		
	Herb Stratum:			
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
	Total Cover:	0		
	Woody Vine Stratum:			
1.	-	-	-	-
2.	-	-	-	-
	Total Cover:	0		

% Bare Ground in Herb Stratum: 100 % Cover of Biotic Crust: 0

Dominance Test Worksheet (DS = Dominant Species):

DS that are OBL, FACW, or FAC: - (A)

Total DS across All Strata: - (B)

% DS that are OBL, FACW, or FAC: - (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	-	× 1 =	-
FACW Species	-	× 2 =	-
FAC Species	-	× 3 =	-
FACU Species	-	× 4 =	-
UPL Species	-	× 5 =	-
Column Totals	- (A)		- (B)

Previous Index = B/A = -

Hydrophytic Vegetation Indicators:

- - Dominance test is > 50%.
- - Morphological adaptations**
- - Problematic hydrophytic vegetation**
- - Prevalence Index is ≤ 3.0.

Hydrophytic vegetation present? Yes ☐ No ☒

Remarks:

No vegetative cover

** Indicators of hydric soil and wetland hydrology must be present; give data/explanations in Remarks.

SOIL:

Depth (inch)	MATRIX Color (moist)	MATRIX %	REDOX FEATURES Color (moist)	REDOX FEATURES %	Type[1]	Loc[2]	Texture	Remarks
-3	2.5 Y 4/2	98	10 YR 5/6	2	C	M	Clay	
7	2.5 Y 7/2	100					Sand	Oolitic
9	2.5 Y 7/2	100					Clay	
14	2.5 Y 7/2	95	10 YR 6/6	5	C	M	Sand	Oolitic
24	Gley 1/5 Neutral	100					Sand	Oolitic- H2S odor

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators (Applicable to all LRRs, unless otherwise noted.):

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR C)
- ☐ 1 cm Muck (A9) (LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☒ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Hydric soil present? Yes ☒ No ☐

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive layer if present:
Type: -
Depth: -

Remarks: -

HYDROLOGY:

Wetland Hydrology Indicators, Primary (1 is sufficient):

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, NR (B3)
- ☐ Drift Deposits, NR (B3)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-stained Leaves (B9)
- ☒ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☒ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Wetland Hydrology Indicators, Secondary (2+ required):

- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, R (B2)
- ☐ Drift Deposits, R (B3)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Areal Imagery(C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

NR = Non-riverine; R = Riverine

Surface water present? Yes ☐ No ☒ Depth (inches): -0
Water table present? Yes ☐ No ☒ Depth (inches): -
Saturation present?** Yes ☒ No ☐ Depth (inches): 0-3" Wetland hydrology present? Yes ☒ No ☐
**includes capillary fringe

Describe recorded data, if available (stream gauge, monitoring well, aerial photos, previous inspections):

Remarks: Recent precip ~ 2 weeks ago

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Project/Site: JVWCD City/County: Salt Lake Sampling Date: 10/19/2010

Applicant/Owner: JVWCD State: UT Sampling Point: P02

Investigator(s): BTN and HH Section, Township, Range: No coordinates in GSL

Landform (hillslope, terrace, etc.): GSL Shoreline Local relief (concave, convex, none): slope Slope (%): 0

Subregion (LLR): D Lat: 40.76053329000 Long: -112.17018532100 Datum: NAD 83

Soil Map Unit Name: Playas NWI Classification: L2USA5

Are climatic / hydrologic conditions on the site typical for this time of year? (If no, explain in Remarks.) Yes ☒ No ☐

Are "Normal Circumstances" present? Yes ☒ No ☐

Are the following significantly disturbed? Vegetation ☐ Soil ☐ Hydrology ☐

Are the following naturally problematic? Vegetation ☐ Soil ☐ Hydrology ☐ (Explain in Remarks if necessary.)

SUMMARY OF FINDINGS (Attach site map showing sampling point locations, transects, features, etc.):

Hydrophytic vegetation present? Yes ☒ No ☐

Hydric soil present? Yes ☒ No ☐

Wetland hydrology present? Yes ☒ No ☐ Is the sampled area within a wetland? Yes ☒ No ☐

Remarks:

VEGETATION:

	Tree Stratum (scientific name):	Absolute % Cover	Dominant Species?	Indicator
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
	Total Cover:	0		
	Sapling/Shrub Stratum:			
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
5.	-	-	-	-
	Total Cover:	0		
	Herb Stratum:			
1.	Salicornia utahensis	50	Y	OBL
2.	Hordeum jubatum	30	Y	FAC
3.	Hordeum murinum	10	N	-
4.	Kochia scoparia	5	N	-
	Total Cover:	95		
	Woody Vine Stratum:			
1.	-	-	-	-
2.	-	-	-	-
	Total Cover:	0		

% Bare Ground in Herb Stratum: 5 % Cover of Biotic Crust: 0

Dominance Test Worksheet (DS = Dominant Species):

# DS that are OBL, FACW, or FAC:	2	(A)
Total DS across All Strata:	2	(B)
% DS that are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	50	× 1 =	50
FACW Species	-	× 2 =	-
FAC Species	30	× 3 =	90
FACU Species	-	× 4 =	-
UPL Species	-	× 5 =	-
Column Totals	80 (A)		140 (B)

Previous Index = B/A = 1.75

Hydrophytic Vegetation Indicators:

X	Dominance test is > 50%.
-	Morphological adaptations**
-	Problematic hydrophytic vegetation**
X	Prevalence Index is ≤ 3.0.

Hydrophytic vegetation present? Yes ☒ No ☐

Remarks:

No vegetative cover

** Indicators of hydric soil and wetland hydrology must be present; give data/explanations in Remarks.

SOIL:

Depth (inch)	MATRIX Color (moist)	MATRIX %	REDOX FEATURES Color (moist)	REDOX %	Type[1]	Loc[2]	Texture	Remarks
1	2.5 Y 5/4	100					Sand	Oolitic
6	2.5 Y 4/2	95	10 YR 5/6	5	C	M	Clay	
22	2.5 Y 7/2	95	10 YR 5/6	5	C	M	Sand	Oolitic
24	Gley 1/5 Neutral	100					Sand	Oolitic

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators (Applicable to all LRRs, unless otherwise noted.):

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR C)
- ☐ 1 cm Muck (A9) (LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Hydric soil present? Yes ☒ No ☐

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive layer if present:

Type: -

Depth: -

Remarks: -

HYDROLOGY:

Wetland Hydrology Indicators, Primary (1 is sufficient):

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, NR (B3)
- ☐ Drift Deposits, NR (B3)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-stained Leaves (B9)
- ☒ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Wetland Hydrology Indicators, Secondary (2+ required):

- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, R (B2)
- ☐ Drift Deposits, R (B3)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Areal Imagery(C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

NR = Non-riverine; R = Riverine

Surface water present? Yes ☐ No ☒ Depth (inches): .

Water table present? Yes ☐ No ☒ Depth (inches): -

Saturation present?** Yes ☐ No ☒ Depth (inches): - Wetland hydrology present? Yes ☒ No ☐

**includes capillary fringe

Describe recorded data, if available (stream gauge, monitoring well, aerial photos, previous inspections):

Remarks: Salt crust has the texture of a soft crust- e.g. evaporation of groundwater, but hardened.

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Project/Site: JVWCD City/County: Salt Lake Sampling Date: 10/19/2010

Applicant/Owner: JVWCD State: UT Sampling Point: P03

Investigator(s): BTN and HH Section, Township, Range: Near T01S R03W S03

Landform (hillslope, terrace, etc.): GSL Shoreline Local relief (concave, convex, none): convex Slope (%): 0

Subregion (LLR): D Lat: 40.7603 Long: -112.17040409200 Datum: NAD 83

Soil Map Unit Name: Playas (PU) NWI Classification: L2USA

Are climatic / hydrologic conditions on the site typical for this time of year? (If no, explain in Remarks.) Yes ☒ No ☐

Are "Normal Circumstances" present? Yes ☒ No ☐

Are the following significantly disturbed? Vegetation ☐ Soil ☐ Hydrology ☐

Are the following naturally problematic? Vegetation ☐ Soil ☐ Hydrology ☐ (Explain in Remarks if necessary.)

SUMMARY OF FINDINGS (Attach site map showing sampling point locations, transects, features, etc.):

Hydrophytic vegetation present? Yes ☐ No ☒

Hydric soil present? Yes ☒ No ☐

Wetland hydrology present? Yes ☐ No ☒ Is the sampled area within a wetland? Yes ☐ No ☒

Remarks:

VEGETATION:

	Tree Stratum (scientific name):	Absolute % Cover	Dominant Species?	Indicator
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
	Total Cover:	0		
	Sapling/Shrub Stratum:			
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
5.	-	-	-	-
	Total Cover:	0		
	Herb Stratum:			
1.	Hordeum jubatum	50	Y	FAC
2.	Kochia scoparia	25	Y	FACU
3.	Sissymbrium altissimum	5	N	-
4.	Lepidium perfoliatum	10	N	-
	Total Cover:	90		
	Woody Vine Stratum:			
1.	-	-	-	-
2.	-	-	-	-
	Total Cover:	0		

% Bare Ground in Herb Stratum: 10 % Cover of Biotic Crust: 0

Dominance Test Worksheet (DS = Dominant Species):

# DS that are OBL, FACW, or FAC:	1	(A)
Total DS across All Strata:	2	(B)
% DS that are OBL, FACW, or FAC:	50	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	-	× 1 =	-
FACW Species	-	× 2 =	-
FAC Species	50	× 3 =	150
FACU Species	25	× 4 =	100
UPL Species	-	× 5 =	-
Column Totals	75 (A)		250 (B)

Previous Index = B/A = 3.33

Hydrophytic Vegetation Indicators:

- - Dominance test is > 50%.
- - Morphological adaptations**
- - Problematic hydrophytic vegetation**
- - Prevalence Index is ≤ 3.0.

Hydrophytic vegetation present? Yes ☐ No ☒

Remarks:

** Indicators of hydric soil and wetland hydrology must be present; give data/explanations in Remarks.

SOIL:

Depth (inch)	MATRIX Color (moist)	MATRIX %	REDOX FEATURES Color (moist)	REDOX FEATURES %	REDOX FEATURES Type[1]	REDOX FEATURES Loc[2]	Texture	Remarks
-24	2.5 Y 6/2	100						Uniform silty sandy loam
								oolitic sand
								and animal burrows

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators (Applicable to all LRRs, unless otherwise noted.):

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR C)
- ☐ 1 cm Muck (A9) (LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Hydric soil present? Yes ☒ No ☐

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive layer if present:
Type: -
Depth: -

Remarks: -

HYDROLOGY:

Wetland Hydrology Indicators, Primary (1 is sufficient):

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, NR (B3)
- ☐ Drift Deposits, NR (B3)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Wetland Hydrology Indicators, Secondary (2+ required):

- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, R (B2)
- ☐ Drift Deposits, R (B3)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Areal Imagery(C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

NR = Non-riverine; R = Riverine

Surface water present? Yes ☐ No ☒ Depth (inches): -0
Water table present? Yes ☐ No ☒ Depth (inches): -
Saturation present?** Yes ☐ No ☒ Depth (inches): -- Wetland hydrology present? Yes ☐ No ☒
**includes capillary fringe

Describe recorded data, if available (stream gauge, monitoring well, aerial photos, previous inspections):

Remarks:

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Project/Site: JVWCD City/County: Salt Lake Sampling Date: 10/19/2010

Applicant/Owner: JVWCD State: UT Sampling Point: P06

Investigator(s): BTN and HH Section, Township, Range: Near T01S R03W S03

Landform (hillslope, terrace, etc.): GSL Shoreline Local relief (concave, convex, none): none Slope (%): 0

Subregion (LLR): D Lat: 40.7600 Long: -112.17049329500 Datum: NAD 83

Soil Map Unit Name: Playas (PU) NWI Classification: Non-wetland

Are climatic / hydrologic conditions on the site typical for this time of year? (If no, explain in Remarks.) Yes ☒ No ☐

Are "Normal Circumstances" present? Yes ☒ No ☐

Are the following significantly disturbed? Vegetation ☐ Soil ☐ Hydrology ☐

Are the following naturally problematic? Vegetation ☐ Soil ☐ Hydrology ☐ (Explain in Remarks if necessary.)

SUMMARY OF FINDINGS (Attach site map showing sampling point locations, transects, features, etc.):

Hydrophytic vegetation present? Yes ☐ No ☒

Hydric soil present? Yes ☒ No ☐

Wetland hydrology present? Yes ☐ No ☒ Is the sampled area within a wetland? Yes ☐ No ☒

Remarks:

VEGETATION:

	Tree Stratum (scientific name):	Absolute % Cover	Dominant Species?	Indicator
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
	Total Cover:	0		
	Sapling/Shrub Stratum:			
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
5.	-	-	-	-
	Total Cover:	0		
	Herb Stratum:			
1.	Bromus tectorum	70	Y	UPL
2.	Kochia scoparia	25	Y	FACU
3.	-	-	-	-
4.	-	-	-	-
	Total Cover:	95		
	Woody Vine Stratum:			
1.	-	-	-	-
2.	-	-	-	-
	Total Cover:	0		

% Bare Ground in Herb Stratum: 5 % Cover of Biotic Crust: 0

Dominance Test Worksheet (DS = Dominant Species):

# DS that are OBL, FACW, or FAC:	0	(A)
Total DS across All Strata:	2	(B)
% DS that are OBL, FACW, or FAC:	0	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	-	× 1 =	-
FACW Species	-	× 2 =	-
FAC Species	-	× 3 =	-
FACU Species	25	× 4 =	100
UPL Species	70	× 5 =	350
Column Totals	95 (A)		450 (B)

Previous Index = B/A = 4.74

Hydrophytic Vegetation Indicators:

- - Dominance test is > 50%.
- - Morphological adaptations**
- - Problematic hydrophytic vegetation**
- - Prevalence Index is ≤ 3.0.

Hydrophytic vegetation present? Yes ☐ No ☒

Remarks:

** Indicators of hydric soil and wetland hydrology must be present; give data/explanations in Remarks.

SOIL:

Depth (inch)	MATRIX Color (moist)	MATRIX %	REDOX FEATURES Color (moist)	REDOX FEATURES %	REDOX FEATURES Type[1]	REDOX FEATURES Loc[2]	Texture	Remarks
-6	2.5 Y 6/4	100						
-24	2.5 Y 7/2	98	10 YR 7/6	2	C	M	Sandy	Oolitic

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators (Applicable to all LRRs, unless otherwise noted.):

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR C)
- ☐ 1 cm Muck (A9) (LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☒ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Hydric soil present? Yes ☒ No ☐

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive layer if present:

Type: -

Depth: -

Remarks:

HYDROLOGY:

Wetland Hydrology Indicators, Primary (1 is sufficient):

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, NR (B3)
- ☐ Drift Deposits, NR (B3)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Wetland Hydrology Indicators, Secondary (2+ required):

- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, R (B2)
- ☐ Drift Deposits, R (B3)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Areal Imagery(C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

NR = Non-riverine; R = Riverine

Surface water present? Yes ☐ No ☒ Depth (inches): -0

Water table present? Yes ☐ No ☒ Depth (inches): -

Saturation present?** Yes ☐ No ☒ Depth (inches): - Wetland hydrology present? Yes ☐ No ☒

**includes capillary fringe

Describe recorded data, if available (stream gauge, monitoring well, aerial photos, previous inspections):

Remarks:

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Project/Site: JVWCD City/County: Salt Lake Sampling Date: 10/19/2010

Applicant/Owner: JVWCD State: UT Sampling Point: P05

Investigator(s): BTN and HH Section, Township, Range: Near T01S R03W S03

Landform (hillslope, terrace, etc.): GSL Shoreline Local relief (concave, convex, none): none Slope (%): 0

Subregion (LLR): D Lat: 40.7600 Long: -112.17049329500 Datum: NAD 83

Soil Map Unit Name: Playas (PU) NWI Classification: L2USA

Are climatic / hydrologic conditions on the site typical for this time of year? (If no, explain in Remarks.) Yes ☒ No ☐

Are "Normal Circumstances" present? Yes ☒ No ☐

Are the following significantly disturbed? Vegetation ☐ Soil ☐ Hydrology ☐

Are the following naturally problematic? Vegetation ☐ Soil ☐ Hydrology ☐ (Explain in Remarks if necessary.)

SUMMARY OF FINDINGS (Attach site map showing sampling point locations, transects, features, etc.):

Hydrophytic vegetation present? Yes ☐ No ☒

Hydric soil present? Yes ☒ No ☐

Wetland hydrology present? Yes ☐ No ☒ Is the sampled area within a wetland? Yes ☐ No ☒

Remarks:

VEGETATION:

	Tree Stratum (scientific name):	Absolute % Cover	Dominant Species?	Indicator
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
	Total Cover:	0		
	Sapling/Shrub Stratum:			
1.	-	-	-	-
2.	-	-	-	-
3.	-	-	-	-
4.	-	-	-	-
5.	-	-	-	-
	Total Cover:	0		
	Herb Stratum:			
1.	Bromus tectorum	60	Y	UPL
2.	Kochia scoparia	20	Y	FACU
3.	Sonchus arvensis	10	N	-
4.	Sisumbrium altissimum	tr	N	-
	Total Cover:	90		
	Woody Vine Stratum:			
1.	-	-	-	-
2.	-	-	-	-
	Total Cover:	0		

% Bare Ground in Herb Stratum: 10 % Cover of Biotic Crust: 0

Dominance Test Worksheet (DS = Dominant Species):

# DS that are OBL, FACW, or FAC:	0	(A)
Total DS across All Strata:	2	(B)
% DS that are OBL, FACW, or FAC:	0	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	-	× 1 =	-
FACW Species	-	× 2 =	-
FAC Species	-	× 3 =	-
FACU Species	20	× 4 =	80
UPL Species	60	× 5 =	300
Column Totals	80 (A)		380 (B)

Previous Index = B/A = 4.75

Hydrophytic Vegetation Indicators:

- - Dominance test is > 50%.
- - Morphological adaptations**
- - Problematic hydrophytic vegetation**
- - Prevalence Index is ≤ 3.0.

Hydrophytic vegetation present? Yes ☐ No ☒

Remarks:

** Indicators of hydric soil and wetland hydrology must be present; give data/explanations in Remarks.

SOIL:

Depth (inch)	MATRIX Color (moist)	MATRIX %	REDOX FEATURES Color (moist)	REDOX FEATURES %	Type[1]	Loc[2]	Texture	Remarks
-12	2.5 Y 6/3	98	10 YR 5/6	2	C	M	Sandy	Oolitic
-24	2.5 Y 7/2	98	10 YR 7/6	2	C	M	Sandy	Oolitic

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators (Applicable to all LRRs, unless otherwise noted.):

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR C)
- ☐ 1 cm Muck (A9) (LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☒ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Hydric soil present? Yes ☒ No ☐

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive layer if present:

Type: -

Depth: -

Remarks:

HYDROLOGY:

Wetland Hydrology Indicators, Primary (1 is sufficient):

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, NR (B3)
- ☐ Drift Deposits, NR (B3)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Wetland Hydrology Indicators, Secondary (2+ required):

- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, R (B2)
- ☐ Drift Deposits, R (B3)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Areal Imagery(C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

NR = Non-riverine; R = Riverine

Surface water present? Yes ☐ No ☒ Depth (inches): -0

Water table present? Yes ☐ No ☒ Depth (inches): -

Saturation present?** Yes ☐ No ☒ Depth (inches): - Wetland hydrology present? Yes ☐ No ☒

**includes capillary fringe

Describe recorded data, if available (stream gauge, monitoring well, aerial photos, previous inspections):

Remarks:

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Project/Site: JVWCD City/County: Salt Lake Sampling Date: 5/14/2014

Applicant/Owner: JVWCD State: Utah Sampling Point: P-01 (2014)

Investigator(s): BTN and AM Section, Township, Range: T01S R03W, Sec. 3, Lot 4

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): slope Slope (%): 1

Subregion (LLR): D Lat: 40.75801223990 Long: -112.16897048000 Datum: NAD 83

Soil Map Unit Name: Lasil-Goggin complex, 1 to 6 percent slopes NWI Classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? (If no, explain in Remarks.) Yes ☒ No ☐

Are "Normal Circumstances" present? Yes ☒ No ☐

Are the following significantly disturbed? Vegetation ☐ Soil ☐ Hydrology ☐

Are the following naturally problematic? Vegetation ☐ Soil ☐ Hydrology ☐ (Explain in Remarks if necessary.)

SUMMARY OF FINDINGS (Attach site map showing sampling point locations, transects, features, etc.):

Hydrophytic vegetation present? Yes ☐ No ☒

Hydric soil present? Yes ☐ No ☒

Wetland hydrology present? Yes ☐ No ☒ Is the sampled area within a wetland? Yes ☐ No ☒

Remarks:

VEGETATION:

	Tree Stratum (scientific name):	Absolute % Cover	Dominant Species?	Indicator
1.				
2.				
3.				
4.				
	Total Cover:			
	Sapling/Shrub Stratum:			
1.				
2.				
3.				
4.				
5.				
	Total Cover:			
	Herb Stratum:			
1.	Bromus tectorum	30	Y	UPL
2.	Thinopyrum intermedium	30	Y	UPL
3.	Lepidium latifolium	10	N	FAC
4.				
	Total Cover:	70		
	Woody Vine Stratum:			
1.				
2.				
	Total Cover:			

% Bare Ground in Herb Stratum: 30 % Cover of Biotic Crust:

Dominance Test Worksheet (DS = Dominant Species):

# DS that are OBL, FACW, or FAC:	0	(A)
Total DS across All Strata:	2	(B)
% DS that are OBL, FACW, or FAC:	0	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species		× 1 =	
FACW Species		× 2 =	
FAC Species	10	× 3 =	30
FACU Species		× 4 =	
UPL Species	60	× 5 =	300
Column Totals	70 (A)		330 (B)

Previous Index = B/A = 4.7

Hydrophytic Vegetation Indicators:

- ☐ Dominance test is > 50%.
- ☐ Morphological adaptations**
- ☐ Problematic hydrophytic vegetation**
- ☐ Prevalence Index is ≤ 3.0.

Hydrophytic vegetation present? Yes ☐ No ☒

Remarks:

** Indicators of hydric soil and wetland hydrology must be present; give data/explanations in Remarks.

SOIL:

	MATRIX		REDOX FEATURES					
Depth (inch)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 3/2	100						dry clay loam

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators (Applicable to all LRRs, unless otherwise noted.):

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR C)
- ☐ 1 cm Muck (A9) (LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Hydric soil present? Yes ☐ No ☒

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive layer if present:

Type:

Depth:

Remarks:

HYDROLOGY:

Wetland Hydrology Indicators, Primary (1 is sufficient):

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, NR (B3)
- ☐ Drift Deposits, NR (B3)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Wetland Hydrology Indicators, Secondary (2+ required):

- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, R (B2)
- ☐ Drift Deposits, R (B3)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Areal Imagery(C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

NR = Non-riverine; R = Riverine

Surface water present? Yes ☐ No ☐ Depth (inches): _____

Water table present? Yes ☐ No ☐ Depth (inches): _____

Saturation present?** Yes ☐ No ☐ Depth (inches): _____ Wetland hydrology present? Yes ☐ No ☒

**includes capillary fringe

Describe recorded data, if available (stream gauge, monitoring well, aerial photos, previous inspections):

Remarks: No evidence of surface water or high groundwater.

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Project/Site: JVWCD City/County: Salt Lake Sampling Date: 5/14/2014

Applicant/Owner: JVWCD State: Utah Sampling Point: P-02 (2014)

Investigator(s): BTN and AM Section, Township, Range: T01S R03W, Sec. 3, Lot 4

Landform (hillslope, terrace, etc.): channel Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LLR): D Lat: 40.75800617100 Long: -112.16900560000 Datum: NAD 83

Soil Map Unit Name: Lasil-Goggin complex NWI Classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? (If no, explain in Remarks.) Yes ☒ No ☐

Are "Normal Circumstances" present? Yes ☒ No ☐

Are the following significantly disturbed? Vegetation ☐ Soil ☐ Hydrology ☐

Are the following naturally problematic? Vegetation ☐ Soil ☐ Hydrology ☐ (Explain in Remarks if necessary.)

SUMMARY OF FINDINGS (Attach site map showing sampling point locations, transects, features, etc.):

Hydrophytic vegetation present? Yes ☒ No ☐

Hydric soil present? Yes ☒ No ☐

Wetland hydrology present? Yes ☒ No ☐ Is the sampled area within a wetland? Yes ☒ No ☐

Remarks:

VEGETATION:

Tree Stratum (scientific name):	Absolute % Cover	Dominant Species?	Indicator
1.			
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum:			
1.			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum:			
1. Typha X glauca	40	Y	OBL
2. Phragmites australis	40	Y	FACW
3.			
4.			
Total Cover:			
Woody Vine Stratum:			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum: 20 % Cover of Biotic Crust:

Dominance Test Worksheet (DS = Dominant Species):

# DS that are OBL, FACW, or FAC:	2	(A)
Total DS across All Strata:	2	(B)
% DS that are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	40	× 1 =	40
FACW Species	40	× 2 =	80
FAC Species		× 3 =	
FACU Species		× 4 =	
UPL Species		× 5 =	
Column Totals	80 (A)		120 (B)

Previous Index = B/A = 1.5

Hydrophytic Vegetation Indicators:

X	Dominance test is > 50%.
	Morphological adaptations**
	Problematic hydrophytic vegetation**
X	Prevalence Index is ≤ 3.0.

Hydrophytic vegetation present? Yes ☒ No ☐

Remarks:

** Indicators of hydric soil and wetland hydrology must be present; give data/explanations in Remarks.

SOIL:

	MATRIX		REDOX FEATURES					
Depth (inch)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10 YR 2/1	100						Mucky

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators (Applicable to all LRRs, unless otherwise noted.):

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☒ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR C)
- ☒ 1 cm Muck (A9) (LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Hydric soil present? Yes ☒ No ☐

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive layer if present:

Type:

Depth:

Remarks:

HYDROLOGY:

Wetland Hydrology Indicators, Primary (1 is sufficient):

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, NR (B3)
- ☐ Drift Deposits, NR (B3)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☒ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Wetland Hydrology Indicators, Secondary (2+ required):

- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, R (B2)
- ☐ Drift Deposits, R (B3)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Areal Imagery(C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

NR = Non-riverine; R = Riverine

Surface water present? Yes ☐ No ☒ Depth (inches): _____

Water table present? Yes ☐ No ☒ Depth (inches): _____

Saturation present?** Yes ☒ No ☐ Depth (inches): 0 Wetland hydrology present? Yes ☒ No ☐

**includes capillary fringe

Describe recorded data, if available (stream gauge, monitoring well, aerial photos, previous inspections):

Remarks:

WETLAND DETERMINATION DATA FORM – ARID WEST REGION

Project/Site: JVWCD City/County: Salt Lake Sampling Date: 5/14/2014

Applicant/Owner: JVWCD State: Utah Sampling Point: P-03 (2014)

Investigator(s): BTN and AM Section, Township, Range: No coordinates in GSL

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): slope Slope (%): 1

Subregion (LLR): D Lat: 40.75944788540 Long: -112.16976117200 Datum: NAD 83

Soil Map Unit Name: Playa NWI Classification: L2USA5

Are climatic / hydrologic conditions on the site typical for this time of year? (If no, explain in Remarks.) Yes ☒ No ☐

Are "Normal Circumstances" present? Yes ☒ No ☐

Are the following significantly disturbed? Vegetation ☐ Soil ☐ Hydrology ☐

Are the following naturally problematic? Vegetation ☐ Soil ☐ Hydrology ☐ (Explain in Remarks if necessary.)

SUMMARY OF FINDINGS (Attach site map showing sampling point locations, transects, features, etc.):

Hydrophytic vegetation present? Yes ☒ No ☐

Hydric soil present? Yes ☒ No ☐

Wetland hydrology present? Yes ☒ No ☐ Is the sampled area within a wetland? Yes ☒ No ☐

Remarks:

VEGETATION:

Tree Stratum (scientific name):	Absolute % Cover	Dominant Species?	Indicator
1.			
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum:			
1.			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum:			
1. Salicornia rubra	50	Y	OBL
2. Hordeum pusillum	20	Y	FACU
3.			
4.			
Total Cover:			
Woody Vine Stratum:			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum: 30 % Cover of Biotic Crust:

Dominance Test Worksheet (DS = Dominant Species):

# DS that are OBL, FACW, or FAC:	1	(A)
Total DS across All Strata:	2	(B)
% DS that are OBL, FACW, or FAC:	50	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	50	× 1 =	50
FACW Species		× 2 =	
FAC Species		× 3 =	
FACU Species	20	× 4 =	80
UPL Species		× 5 =	
Column Totals	70 (A)		130 (B)

Previous Index = B/A = 1.85

Hydrophytic Vegetation Indicators:

- ☐ Dominance test is > 50%.
- ☐ Morphological adaptations**
- ☐ Problematic hydrophytic vegetation**
- X Prevalence Index is ≤ 3.0.

Hydrophytic vegetation present? Yes ☒ No ☐

Remarks:

Hordeum could be marinum which is FAC in the Arid West

** Indicators of hydric soil and wetland hydrology must be present; give data/explanations in Remarks.

SOIL:

Depth (inch)	MATRIX Color (moist)	MATRIX %	REDOX FEATURES Color (moist)	REDOX %	Type[1]	Loc[2]	Texture	Remarks
0-2	2.5 Y 4/2	100					sandy	oolitic sand
2-6	2.5 Y 4/2	100					c lay loam	
6-16	7.5 YR 5/1	90	7.5 YR 5/6	10	C	M	clay loam	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators (Applicable to all LRRs, unless otherwise noted.):

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR C)
- ☐ 1 cm Muck (A9) (LRR D)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Hydric soil present? Yes ☒ No ☐

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive layer if present:

Type:

Depth:

Remarks:

HYDROLOGY:

Wetland Hydrology Indicators, Primary (1 is sufficient):

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, NR (B3)
- ☐ Drift Deposits, NR (B3)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-stained Leaves (B9)
- ☒ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Wetland Hydrology Indicators, Secondary (2+ required):

- ☐ Water Marks, NR (B1)
- ☐ Sediment Deposits, R (B2)
- ☐ Drift Deposits, R (B3)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Areal Imagery(C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

NR = Non-riverine; R = Riverine

Surface water present? Yes ☐ No ☐ Depth (inches): _____

Water table present? Yes ☐ No ☐ Depth (inches): _____

Saturation present?** Yes ☐ No ☐ Depth (inches): _____ Wetland hydrology present? Yes ☒ No ☐

**includes capillary fringe

Describe recorded data, if available (stream gauge, monitoring well, aerial photos, previous inspections):

Remarks: No good evidence of high ground water table.

Appendix C

Soil Series Descriptions

These soil series descriptions are taken from the U.S. Department of Agriculture Natural Resources Conservation Service Office Soil Series Descriptions website. Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/home/?cid=nrcs142p2_053587. Accessed on June 5, 2014.

GOGGIN SERIES

The Goggin series consists of very deep, excessively drained soils that formed in beach sand and eolian sands derived mainly from oolites. Goggin soils are on slightly elevated beach ridges and stable dunes. Slopes are 1 to 6 percent. The mean annual precipitation is about 14 inches and the mean annual temperature is about 49 degrees F.

TAXONOMIC CLASS: Carbonatic, mesic Typic Xeropsamments

TYPICAL PEDON: Goggin sand--on an east-facing, undulating, 3 percent slope under Wyoming big sagebrush, rabbitbrush, black greasewood, and Indian ricegrass at an elevation of 4,210 feet--rangeland. (Colors are for dry soil unless otherwise noted.)

A--0 to 3 inches; grayish brown (10YR 5/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; many very fine and fine interstitial pores; violently effervescent; moderately alkaline (pH 8.2); clear smooth boundary. (3 to 5 inches thick)

C1--3 to 20 inches; pale brown (10YR 6/3) sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; violently effervescent; moderately alkaline (pH 8.4); clear wavy boundary. (10 to 20 inches thick)

C2--20 to 30 inches; grayish brown (10YR 5/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine and fine interstitial pores; violently effervescent; strongly alkaline (pH 8.6); clear wavy boundary. (10 to 40 inches thick)

C3--30 to 60 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; single grain; loose, nonsticky and nonplastic; many very fine and fine interstitial pores; violently effervescent; strongly alkaline (pH 8.8); clear wavy boundary.

TYPE LOCATION: Salt Lake County, Utah; about 4 miles north-northwest of Saltair; approximately 2,400 feet west and 600 feet north of the southeast corner of section 12, T. 1 N., R. 3 W.; USGS Antelope Island South 7.5 minute topographic quadrangle; 40 degrees 49 minutes 41 seconds north latitude and 112 degrees 07 minutes 46 seconds west longitude, NAD83; UTM zone 12N 404765E, 4520284N, NAD83.

RANGE IN CHARACTERISTICS:

Soil moisture - Typically moist in winter and spring, dry in summer and fall; the soils are dry in all parts of the moisture control section for more than 60 consecutive days following the summer solstice in normal years; Xeric moisture regime that borders on aridic.

Mean annual soil temperature - 48 to 54 degrees F.

Particle-size control section - Clay content: 0 to 10 percent; Rock fragments: 0 to 15 percent, mainly gravel and small channers.

A horizon - Hue: 10YR or 2.5Y.
Value: 5 or 6 dry, 4 or 5 moist.
Chroma: 2 or 3, dry or moist.
Salinity (EC): 0 to 8 mmhos/cm.
Reaction: Moderately alkaline or strongly alkaline.
Calcium carbonate equivalent: 40 to 90 percent.

C horizon - Hue: 10YR or 2.5Y.
Value: 5 through 7 dry, 4 through 6 moist.
Chroma: 2 or 3, dry or moist.
Salinity (EC): 0 to 8 mmhos/cm.
Reaction: Moderately alkaline or strongly alkaline.
Calcium carbonate equivalent: 40 to 90 percent.
Other features: Some pedons have lithologic discontinuities to clayey or silty lacustrine deposits below a depth of 40 inches.

COMPETING SERIES: There are currently no other series in this family.

GEOGRAPHIC SETTING:

Parent material: Beach sand and eolian sands derived mainly from oolites (ooliths). Oolites are small, rounded, sand-sized accretions formed of concentric layers of calcium carbonate around a sand-sized nucleus of mineral or organic origin and formed in wave-agitated waters. Mineral grains derived from metamorphic and sedimentary rocks are also a component of the soil parent material.

Landform: Slightly elevated beach ridges and stable dunes along the edge of the Great Salt Lake.

Slope: 1 to 6 percent.

Elevation: 4,205 to 4,215 feet.

Mean annual temperature: 46 to 52 degrees F.

Mean annual precipitation: 12 to 16 inches.

Wettest months: October through May.

Driest months: June through September.

Frost-free period: 160 to 180 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Saltair, Lasil, and Jordan soils. Saltair soils are fine-silty, have salic horizons, and occur under pickleweed. Lasil soils are fine-silty, have natric horizon, and occur under black greasewood. Jordan soils are fine textured, have natric and salic horizons, and occur under black greasewood.

DRAINAGE AND PERMEABILITY: Excessively drained; very low surface runoff; rapid or very rapid permeability (high or very high saturated hydraulic conductivity).

USE AND VEGETATION: Goggin soils are used mainly for wildlife habitat. Potential native plants are mainly Wyoming big sagebrush, rubber rabbitbrush, black greasewood, and Indian ricegrass.

DISTRIBUTION AND EXTENT: Northern Utah along the Great Salt Lake. These soils are not extensive. MLRA 28A.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Phoenix, Arizona.

SERIES ESTABLISHED: Salt Lake County, Utah, 2006.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - The zone from the soil surface to 3 inches (A horizon).

Particle-size control section - The zone from 10 to 40 inches (C2 horizon and parts of the C1 and C3 horizons).

LASIL SERIES

The Lasil series consists of very deep, somewhat poorly drained soils that formed in lacustrine deposits derived from mixed rocks. Lasil soils are on low lake terraces and lake plains. Slopes are 0 to 3 percent. The mean annual precipitation is about 15 inches and the mean annual temperature is about 52 degrees F.

TAXONOMIC CLASS: Fine-silty, mixed, superactive, mesic Typic Natrixeralfs

TYPICAL PEDON: Lasil silt loam--rangeland. (Colors are for dry soil unless otherwise noted.)

E--0 to 5 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium platy structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; moderately alkaline (pH 7.9); abrupt smooth boundary. (5 to 13 inches thick)

EB--5 to 9 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; slightly effervescent; 1 percent calcium carbonate equivalent; moderately alkaline (pH 7.9); clear smooth boundary. (0 to 5 inches thick)

Btkn1--9 to 14 inches; light gray (10YR 7/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure; extremely hard, firm, moderately sticky and moderately plastic; few very fine roots; many very fine pores; common faint clay films on faces of peds; violently effervescent; 25 percent calcium carbonate equivalent; secondary carbonates are disseminated; moderately alkaline (pH 8.4); clear smooth boundary. (5 to 12 inches thick)

Btkn2--14 to 19 inches; light gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/3) moist; weak medium platy structure; extremely hard, firm, moderately sticky and moderately plastic; few very fine roots; many

very fine and fine pores; few faint clay films on faces of peds; violently effervescent; 34 percent calcium carbonate equivalent; secondary carbonates are disseminated; strongly alkaline (pH 8.8); clear smooth boundary. (3 to 12 inches thick)

Bk--19 to 29 inches; light gray (5Y 7/2) silty clay loam, olive (5Y 5/3) moist; massive; extremely hard, friable, moderately sticky and moderately plastic; many very fine and fine pores; common fine distinct yellowish brown (10YR 5/4) masses of iron accumulation; violently effervescent; 25 percent calcium carbonate equivalent; secondary carbonates are disseminated; strongly alkaline (pH 8.8); clear smooth boundary. (5 to 10 inches thick)

C--29 to 48 inches; light gray (5Y 7/2) silt loam, olive gray (5Y 5/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and fine pores; common medium dark yellowish brown (10YR 4/4) masses of iron accumulation; violently effervescent; 19 percent calcium carbonate equivalent; strongly alkaline (pH 8.8); clear smooth boundary. (7 to 18 inches thick)

2C--48 to 66 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; common coarse distinct brown (10YR 4/3) masses of iron accumulation; massive; soft, very friable, slightly sticky and nonplastic; interstitial pores; strongly effervescent; 14 percent calcium carbonate equivalent; strongly alkaline (pH 8.6); abrupt smooth boundary. (0 to 18 inches thick)

3C--66 to 78 inches; light gray (2.5Y 7/2) fine sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; few coarse distinct yellowish brown (10YR 5/4) masses of iron accumulation; strongly alkaline (pH 9.0).

TYPE LOCATION: Salt Lake County, Utah; at about 1900 South and 3600 West Street; approximately 1,100 feet south and 175 feet west of the center of section 17, T. 1 S., R. 1 W.; USGS Salt Lake City South 7.5 minute topographic quadrangle; 40 degrees 43 minutes 48 seconds north latitude and 111 degrees 58 minutes 40 seconds west longitude, NAD83; UTM zone 12N 417424E, 4509246N, NAD83.

RANGE IN CHARACTERISTICS:

Soil moisture - Typically moist in winter and spring, dry in summer and fall; the soils are dry in all parts of the moisture control section for more than 60 consecutive days following the summer solstice; Xeric moisture regime that borders on aridic.

Mean annual soil temperature - 49 to 56 degrees F.

Mean summer soil temperature - 65 to 75 degrees F.

Ochric epipedon thickness - 3 to 11 inches.

Particle-size control section - Clay content: 18 to 35 percent.

E and EB horizons - Hue: 10YR or 2.5Y.
Value: 5 or 6 dry, 3 or 4 moist; Moist and dry color values do not occur together as dark as 5 dry and 3 moist.
Chroma: 2 or 3, dry or moist.
Texture: Silt loam or loam.
Effervescence: Noneffervescent to strongly effervescent.

Reaction: Neutral to strongly alkaline.
Salinity (EC): 2 to 32 mmhos/cm.

Btkn horizons - Hue: 10YR or 2.5Y.
Value: 6 or 7 dry, 4 or 5 moist.
Chroma: 2 through 4, dry or moist.
Texture: Silt loam, silty clay loam, or clay loam.
Clay content: 18 to 35 percent.
Structure: Weak to strong prismatic or columnar.
Clay films: Few faint to distinct continuous clay films on faces of peds.
Effervescence: Strongly effervescent or violently effervescent.
Calcium carbonate equivalent: 3 to 40 percent.
Reaction: Moderately alkaline to very strongly alkaline (up to pH 9.6).
Salinity (EC): 2 to 32 mmhos/cm.
Sodicity (SAR): 15 to 40.
Exchangeable sodium: 15 to 60 percent.

Bk and C horizons - Hue: 10YR through 5Y.
Value: 6 through 8 dry, 4 through 6 moist.
Chroma: 2 or 3, dry or moist.
Texture: Silty clay loam, silt loam, loam, sandy clay loam, and sandy loam; some pedons have texture of fine sand or sand below 40 inches.
Calcium carbonate equivalent: 10 to 40 percent.
Reaction: Moderately alkaline to very strongly alkaline (up to pH 11.0).
Salinity (EC): 4 to 32 mmhos/cm.
Sodicity (SAR): 15 to 40.
Exchangeable sodium: 40 to 90 percent.
Other features: Some pedons have discontinuous weak cementation.

COMPETING SERIES: There are currently no other series in this family.

GEOGRAPHIC SETTING: Lasil soils are on smooth to channeled low lake terraces and lake plains. They formed in calcareous lacustrine deposits derived from mixed sedimentary and igneous rocks. Slopes are 0 to 3 percent. Elevations range from 4,200 to 4,500 feet. The climate is dry subhumid. The mean annual precipitation is 12 to 16 inches. The mean annual temperature is 47 to 54 degrees F. and the mean summer temperature is 65 to 75 degrees F. The frost-free period is 120 to 190 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Decker, Saltair, and Jordan soils. Decker soils lack natric horizons and have control sections that have more than 15 percent coarser than very fine sand. Saltair soils have salic horizons and lack natric horizons. Jordan soils have salic horizons.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; medium surface runoff; slow permeability (moderately low or moderately high saturated hydraulic conductivity). Endosaturation is present with an apparent seasonal high water table between 2.5 and 4.0 feet (moderately deep or deep free water occurrence classes) between April and September. Cumulative annual duration class is Common. Drained phases occur in areas reclaimed for cropland.

USE AND VEGETATION: Lasil soils are used for rangeland and wildlife habitat, except for small areas that are reclaimed and used for irrigated cropland. The native vegetation is black greasewood, pickleweed, inland saltgrass, and rubber rabbitbrush.

DISTRIBUTION AND EXTENT: Northwestern Utah. These soils are moderately extensive. MLRA 28A.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Phoenix, Arizona.

SERIES ESTABLISHED: Salt Lake Area, Utah, 1965.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - The zone from the soil surface to 9 inches (E and EB horizons).

Albic horizon - The zone from the soil surface to 9 inches (E and EB horizons).

Natric horizon - The zone from 9 to 19 inches (Btkn1 and Btkn2 horizons).

Calcic horizon - The zone from 9 to 29 inches (Btkn1, Btkn2, and Bk horizons).

Endosaturation feature - The condition of ground water with an upper boundary between 30 and 50 inches at certain times during normal years (parts of the C horizons).

Particle-size control section - The zone from 9 to 19 inches (Btkn1 and Btkn2 horizons).

The revision of April 2005 updated the taxonomic class from Fine-silty, mixed, superactive, mesic Typic Natrustalfs based on the assumed moisture regime being xeric instead of ustic.

The Lasil series is currently mapped in three soil survey areas in Utah. There are some phases which have the average depth to the seasonal high saturation within 30 inches of the soil surface. Such phases should classify in the subgroup of Aquic Natrixeralfs. Future study is needed to determine whether a new series concept should be developed for these wetter phases of Lasil or whether they should be correlated to the Arave series.

The superactive cation exchange activity class was added in 03/2003 to the taxonomic classification by the National Soil Survey Center on request of the Reno MLRA office, without review of the soil series property data.

ADDITIONAL DATA: The typical pedon at the series type location has partial characterization data by the Soils Laboratory from Utah State University (USU) Logan, UT and is published on pages 122-123, Table 7 of the Soil Survey of Salt Lake Area, Utah. The pH values in the typical pedon are from saturated paste.

Appendix D

Photographs

Photograph D1. W02 looking north in 2010.

Photograph D2. Uplands looking north to drainage canal in 2010.

Photograph D3. Erosion rills in 2014.

Photograph D4. Drainage canal in 2014 looking north.

Photograph D5. W01 and W02 looking north in 2014.

Photograph D6. W03 looking south in 2014.

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Appendix E

Jurisdictional Determination Table

Table E1. Jurisdictional Determination Table

Waters Name	Cowardin Code	HGM Code	Acres	Waters Type Code	Latitude	Longitude	Local Waterway
W01	L2USA5	SLOPE	1.02	TNWW	40.7598890	-112.1701400	Great Salt Lake
W02	L2USA3	MINSOILFLT	1.49	DELINEATE	40.7600520	-112.1698020	Great Salt Lake
W03	PEM	SLOPE	0.60	NRPW	40.7575880	-112.1683880	Great Salt Lake
W04	PAB	SLOPE	0.10	NRPW	40.7602906	-112.1704040	Great Salt Lake

Notes: PEM = palustrine emergent; L2USA3 = lacustrine littoral unconsolidated shore, temporarily flooded, mud; L2USA5 = lacustrine littoral unconsolidated shore, temporarily flooded, vegetated; PAB = palustrine, aquatic bed wetland; TNWW = wetlands adjacent to traditional navigable waters (wetlands, not streams); NRPW = Non-relatively permanent waters that flow directly or indirectly into traditional navigable waters (streams, not wetlands)

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Appendix E

SHPO Concurrence Letter

State of Utah

GARY R. HERBERT
Governor

GREG BELL
Lieutenant Governor

DEPARTMENT OF TRANSPORTATION

JOHN R. NJORD, P.E.
Executive Director

CARLOS M. BRACERAS, P.E.
Deputy Director

10-0461

April 13, 2010

Wilson Martin, State Historic Preservation Officer
Division of State History
300 Rio Grande
Salt Lake City, Utah 84101-1182

RE: Utah Antiquities Project U-05-ST-0011p,s. Cultural Resources Survey of the Jordan Valley Water Conservancy District Wells EA Project

Determination of Eligibility and Finding of No Adverse Effect.

Dear Mr. Martin,

The Utah Department of Transportation (UDOT) is conducting an environmental review of a proposal to construct wells, pipelines and a water treatment plant for the Jordan Valley Water Conservancy District. The project is located on in Salt Lake County, Utah, and comprises a linear corridor extending approximately 29 miles in the cities of South Jordan, West Jordan, Kearns and West Valley City, Utah, as well as 10 block inventory areas for seven deep wells, two pump stations and one reverse osmosis treatment plant.

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, 16 U.S.C. §470 et seq., and Utah Code Annotated (U.C.A.) §9-8-404, the Utah Department of Transportation, is taking into account the effects of this undertaking on historic properties, and will afford the Advisory Council on Historic Preservation (Council) and the USHPO an opportunity to comment on the undertaking. Please review this letter and, providing you agree with the finding contained herein, sign and date the signature line at the end of this letter.

SWCA Environmental Consultants (SWCA) conducted a pedestrian and windshield survey of the project area in January and February of 2009. The survey totaled 177.21 acres. The survey resulted in updating site forms for 7 previously recorded sites still extant in the APE (42SL267, 42SL291, 42SL295, 42SL306, 42SL335, 42SL342, and 42SL387), 8 which have been destroyed where they would have crossed the APE (42SL54, 42SL333, 42SL337, 42SL344, 42SL351, 42SL385, 42SL510 and 42SL541),

Received
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USHPO

one with no remnants visible in the APE (42SL297) the documentation of two new historic sites, as well as two isolated occurrences and five isolated features.

Of the previously documented sites which were not found in the APE, one (42SL54, the California National Historic Trail) is a historic trail, one (42SL297 the Beckstead ditch) is a historic canal, five (42SL300/344-Utah Southern/Union Pacific, 42SL333-Denver & Rio Grande Western Garfield Branch, 42SL337-Western Pacific, 42SL385-Bingham and Garfield Railway, and 42SL510-Salt Lake and Utah) are historic railroads, and two (42SL351-Lincoln Highway and 42SL541-Victory Highway) are historic highways. These sites were not evaluated for eligibility.

The previously documented sites which were found to exist in the APE include four historic canals (42SL267-C-7 Canal, 42SL291-South Jordan Canal, 42SL295-Utah and Salt Lake Canal and 42SL342-North Jordan Canal), two historic railroads (42SL306-Salt Lake, Garfield and Western and 42SL335-Historic Bingham Branch of the D&RGW), and one historic transmission line (42SL387-Terminal to Garfield Transmission Line). Of these sites, 42SL267 is recommended **not eligible** for the National Register of Historic Places. 42SL291, 42SL295, 42SL335, and 42SL342 have been previously determined to be **eligible** fort he National Register. 42SL306 is recommended **eligible** under criteria A,B and C, and 42SL387 is recommended **eligible** under criterion A.

Two previously unrecorded sites were discovered during the survey. 42SL631 is a historic farm structure, possibly a silo. 42SL630 is a historic road alignment associated with 42SL631. Both sites are recommended **not eligible** for the National Register.

The overall effect of the undertaking upon historic properties is **no adverse effect**. The project will not seriously impact any significant portion of any of these lengthy linear sites. The small area (less than fifty feet in any linear location) required for the project will not impact the historic integrity or overall eligibility of any of the sites located in the project area. The only site with more than this impact is 42SL295, the Utah and Salt Lake Canal. The pipeline will be installed in the berm which carries a maintenance road beside the canal. This historic canal is still in use, and the berm undergoes regular maintenance. Therefore, I do not believe that the berm retains historic integrity, and should not be considered a contributing feature to the historic nature of the canal.

Please do not hesitate to call me at (801) 887-3410 or email at psteele@utah.gov if you have any questions or need additional information.

Sincerely,

Peter Steele
Regional NEPA/NHPA Specialist

Enclosures

I concur with the overall finding of **No Adverse Effect** for UDOT Project No. F-LC43(25) Summit County Historic Union Pacific Rail Trail Paving Project – Phase 1, Summit County, Utah; and that the UDOT has taken into account effects of the undertaking upon historic and archaeological resources in accordance with Section 106 and U.C.A. 9-8-404.

4·21·2010

Wilson Martin, State Historic Preservation Officer

Date