Official Draft Public Notice Version, May 15, 2013
The findings, determinations and assertions contained in the document are not final and subject to change following the public comment period.

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:
Ended:
Public Noticed in the Salt Lake Tribune and Desert News.

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.

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APPENDIX 1

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

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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

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

translators between each compartment may identify the food web link with the highest variability and focus research efforts.

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.

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.

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 beyond the models predictive interval 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.

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 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

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

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

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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.

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 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 a trigger based on concentrations of selenium measured in bird eggs. This trigger requires specific actions to prevent the uses from being impaired if selenium concentrations are observed to increase in bird eggs. 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.

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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.

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 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 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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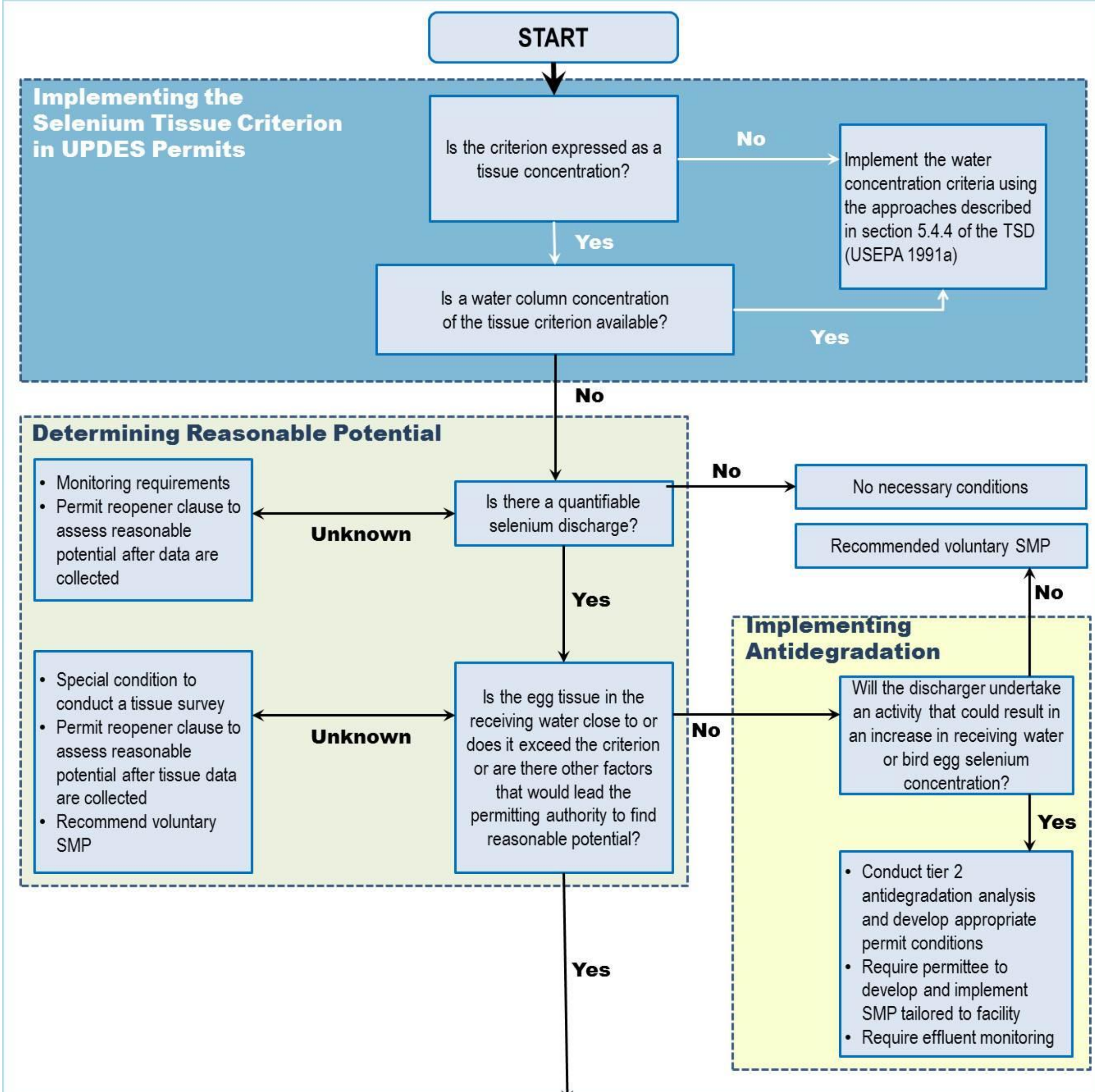


Recommended WQBEL Requirements

- Where a TMDL has been developed, the WQBEL must be consistent with the wasteload allocation as required by 40 CFR 122.44(d)(1)(vii)(B)
- Where a TMDL has not been developed but a water column translation of the tissue criterion has been developed, or the site-specific data to translate is readily available, include a numeric water quality-based limit
- Where the permit writer determines that a numeric limit is infeasible to calculate:
  - Require the permittee to develop and implement an SMP tailored to the facility's potential to discharge selenium. Depending on the particular facts, the permitting authority may include in the SMP a trigger level, reduction goal, or enforceable numeric level (e.g., existing effluent quality) to further manage selenium discharges.
  - Require effluent monitoring using a sufficiently sensitive EPA-approved method to determine whether the SMP is effective (See sections 7.4 and 7.5.1.1 for more information on sufficiently sensitive method)
  - Include a reopener clause to modify the permit conditions if the SMP is not found to be effective or if a water column translation of the egg tissue criterion is developed
- Where a discharger undertakes an activity that could increase selenium loading to the receiving water, it must be consistent with applicable antidegradation requirements. Additional requirements may also be necessary under the CWA and EPA's NPDES regulations.

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

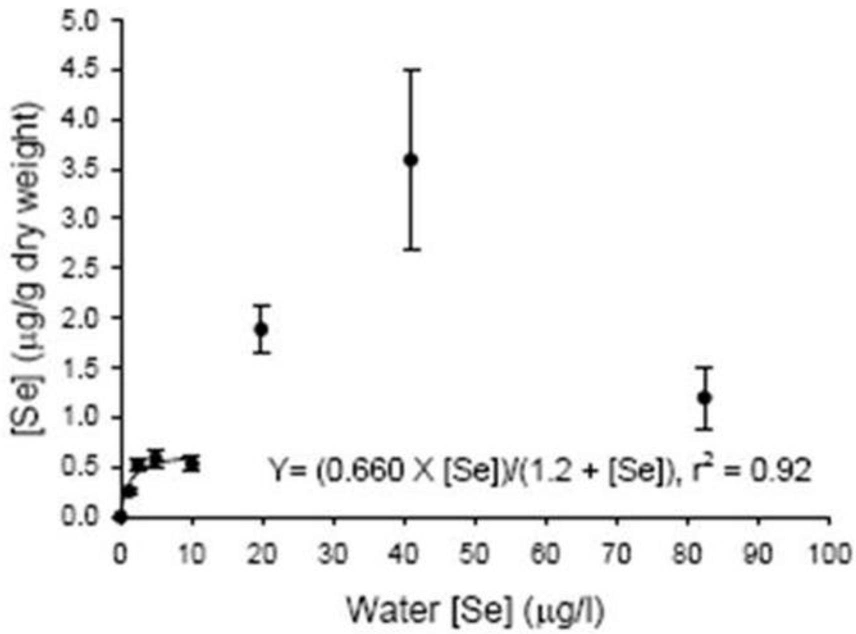
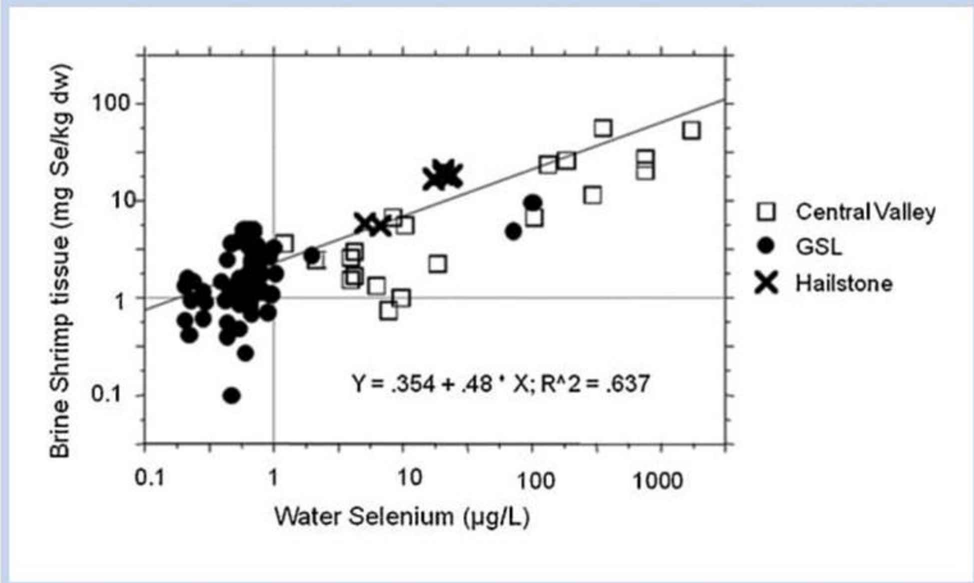


Figure 3. Brine shrimp tissue Se as predicted from total Se in cocollected water samples of the test dataset. The 3 data sources are Central Valley, California, ponds; Great Salt Lake, Utah (GSL); and Hailstone Reservoir, Montana (Byron et al. 2011)



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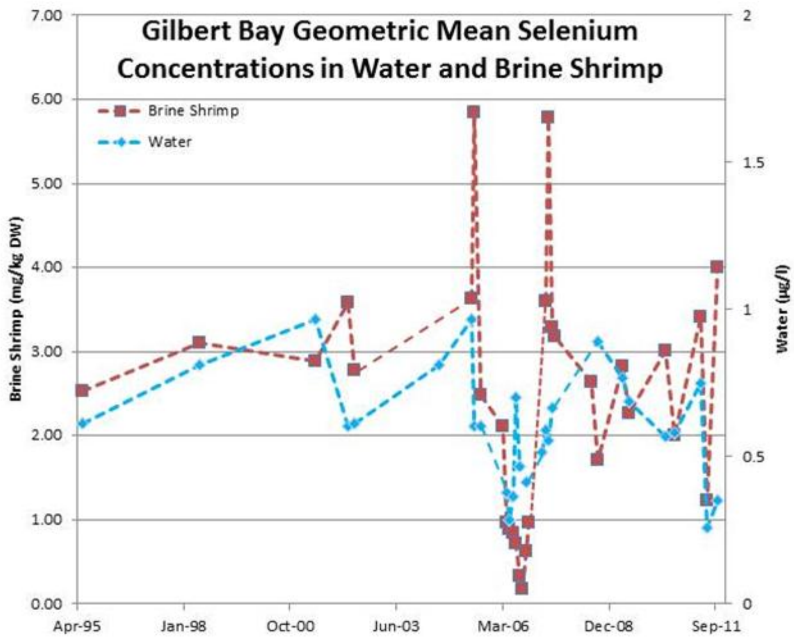


Data Table for Geometric Mean Concentrations of Selenium in Brine Shrimp and Water from Gilbert Bay, Great Salt Lake									
Date	**Brine Shrimp (mg/kg DW)**	**n**	**Water (ug/l)**	**n**	**Date**	**Brine Shrimp (mg/kg DW)**	**n**	**Water (ug/l)**	**n**
Jun-95	2.54	43	0.61	7	Nov-06	0.62	12		
Jun-98	3.11	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

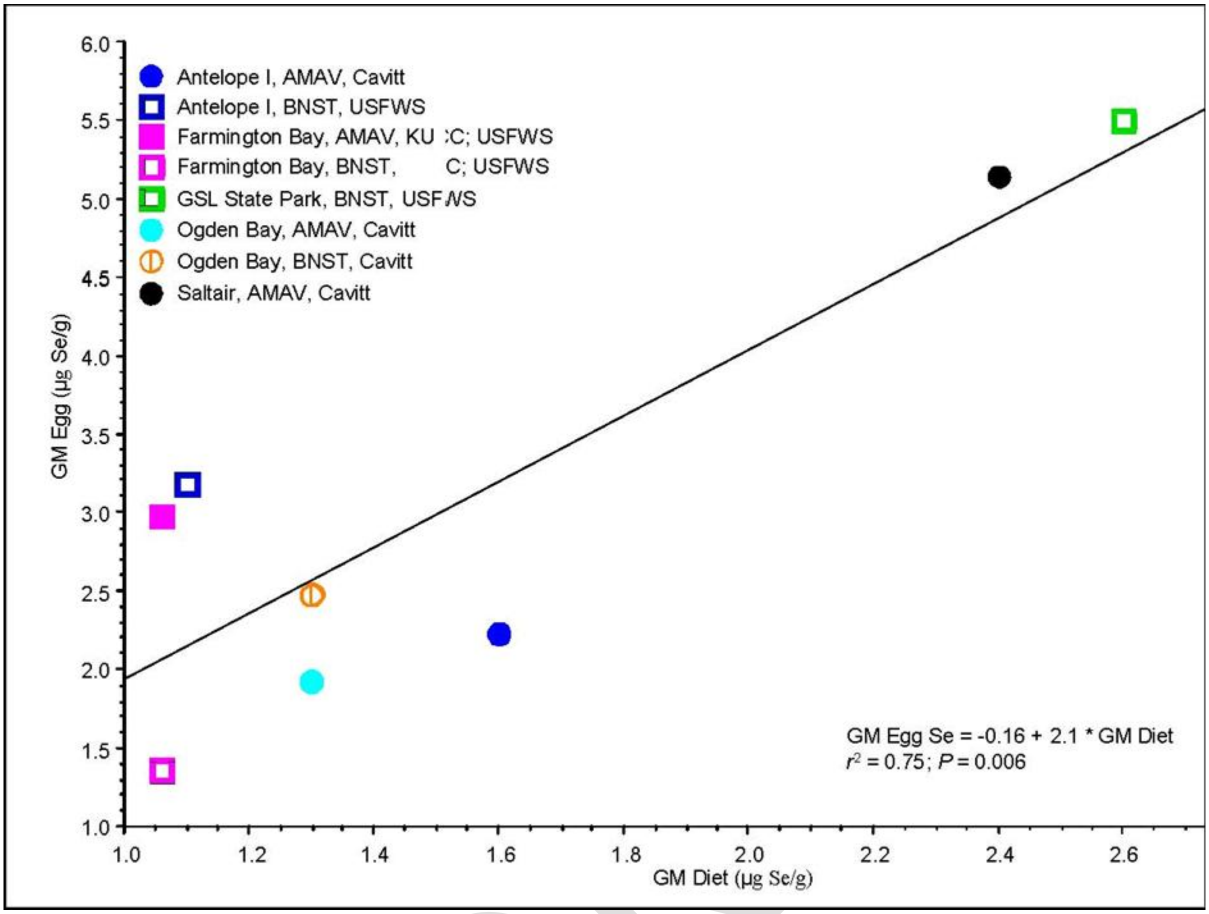
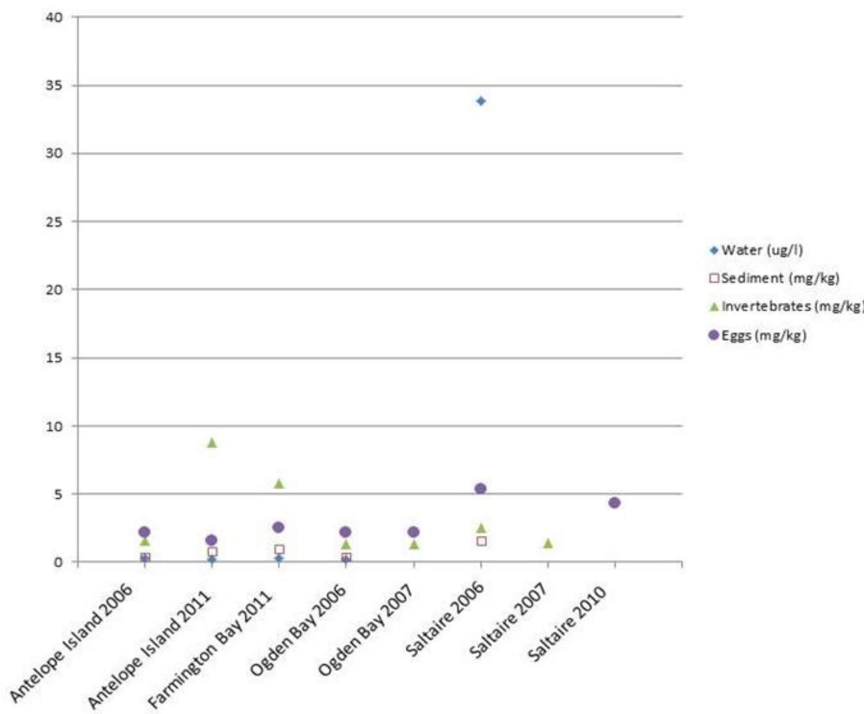


Figure 5. Relationship between shorebird geometric mean diet and egg selenium concentrations at various locations. (Figure 6- 4 DWQ, 2008)



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

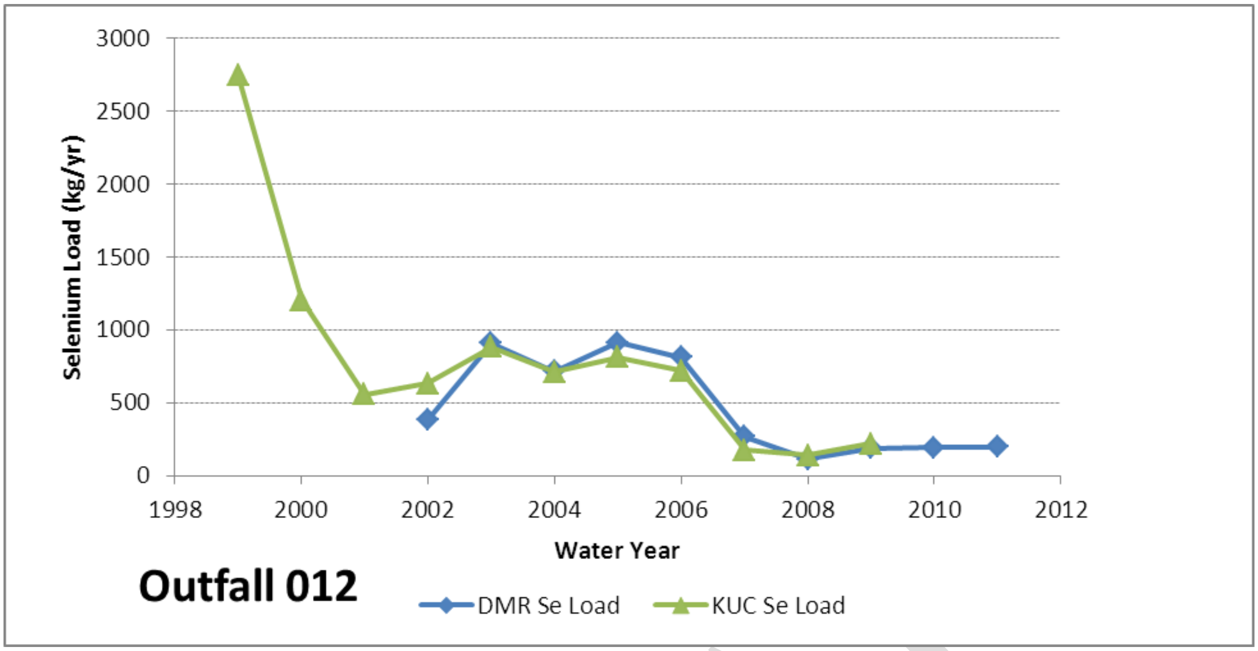


Figure 7. Selenium loads calculated from the DWQ Discharge Monitoring Reporting (DMR) Database and as estimated by Kennecott Utah Copper

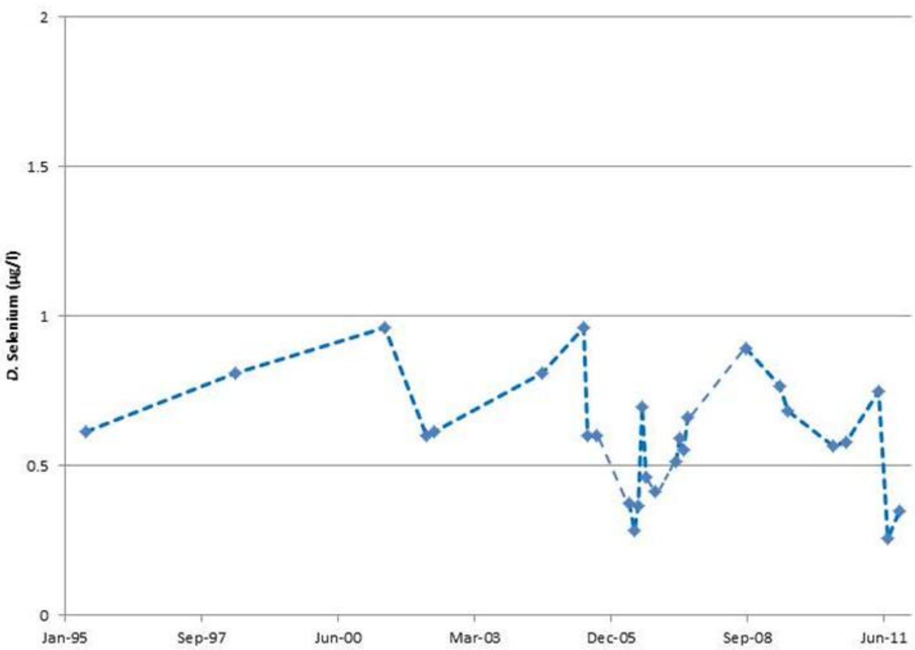


Figure 8. Selenium geometric mean concentrations for Gilbert Bay from USGS, Kennecott, and DWQ data

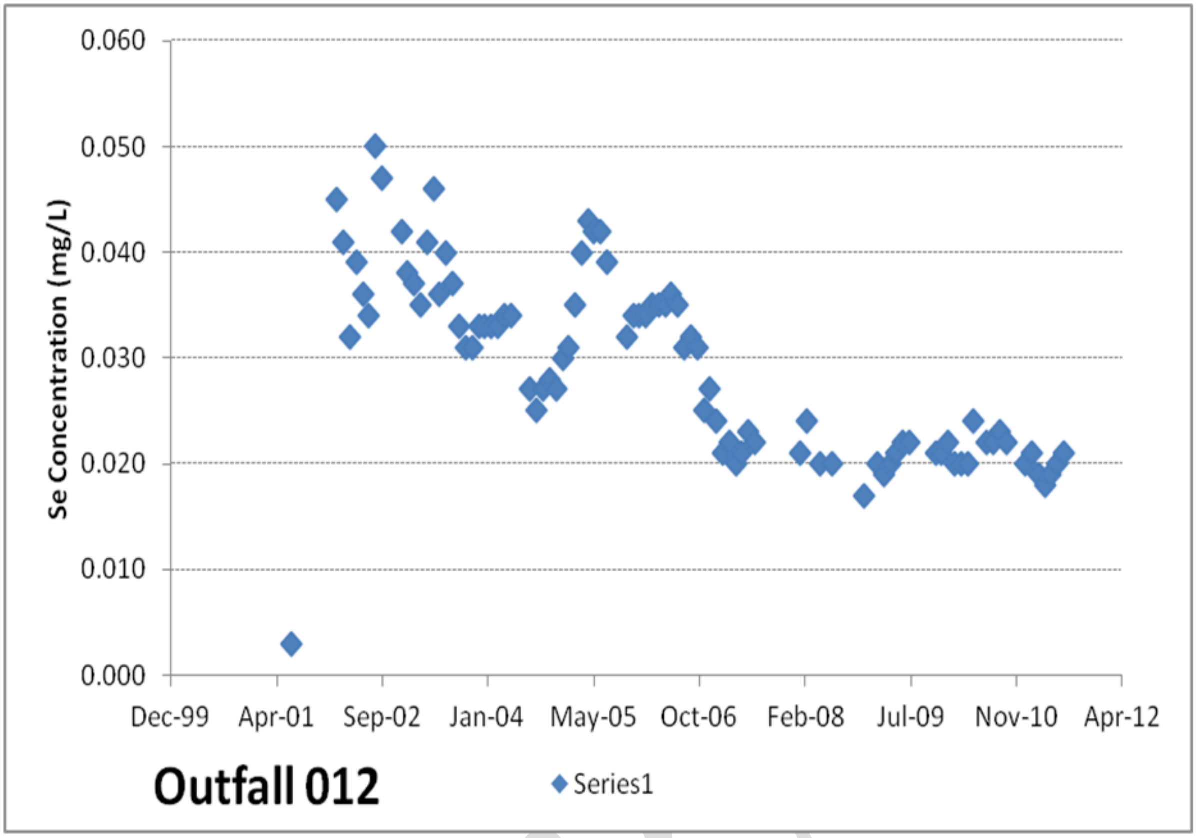


Figure 9. Monthly average selenium concentrations in Kennecott Utah Copper Outfall 012 from Discharge Monitoring Reports

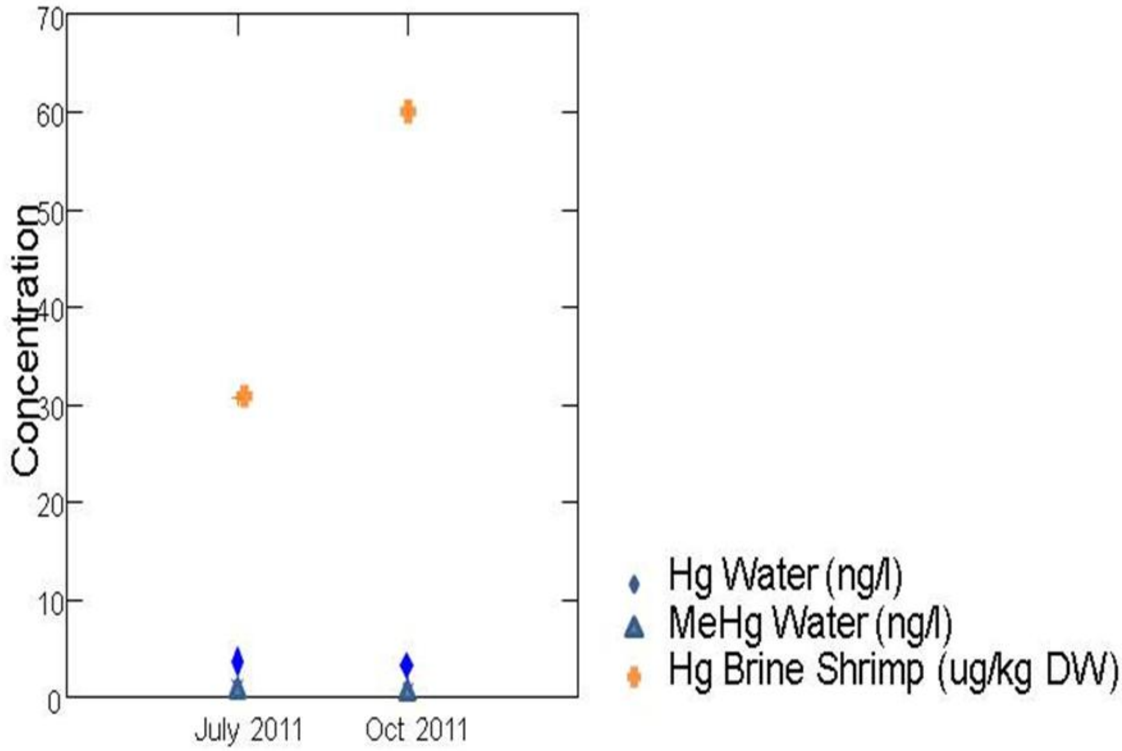


Figure 10 Geometric Mean Concentration of Total Mercury and Methyl Mercury in Gilbert Bay Water and Total Mercury in Brine Shrimp (8 locations). Water geometric mean excludes deep brine layer samples. Samples were collected from 8 locations (DWQ, 2012)

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

<u>Pressure relief discharges from 002</u>

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

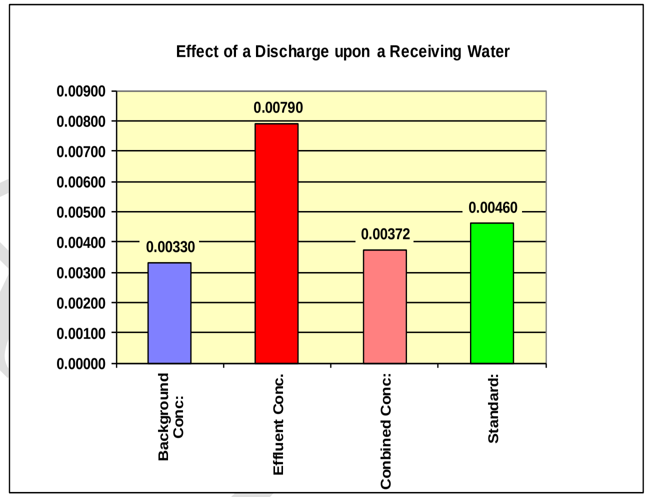
Note: Whole Effluent Toxicity (WET) to be conducted on all toxic substances,.
Note: Waste Load Analysis may indicate unreasonably high allowed concentrations and loadings. Narrative standards, New Source Performance Standards, and BAT also apply.

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 Loadi	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 Pressure relief discharges from 002
Conservative Substances in a Receiving Water
Assumption: Complete Mixing

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

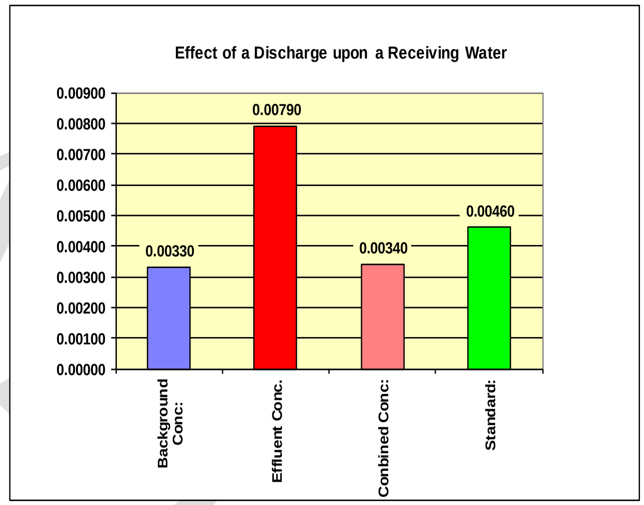
Note: Whole Effluent Toxicity (WET) to be conducted on all toxic substances,.
Note: Waste Load Analysis may indicate unreasonably high allowed concentrations and loadings. Narrative standards, New Source Performance Standards, and BAT also apply.

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 Loadi	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.

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